Ministry of Economy and Poverty Reduction
of the Republic of Uzbekistan

switchasia

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SUSTAINABLE CONSUMPTION AND PRODUCTION ACTION PLAN

REPUBLIC OF UZBEKISTAN

FULL EDITION

Acknowledgement

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Author: Russell C. Frost

Supervision and Coordination: Zinaida Fadeeva and Zulfira Zikrina, SWITCH-Asia SCP Facility

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LIST OF ACRONYMS

AQM	Air Quality Management
AQP	Air Quality Pollutants
BAT	Best Available Techniques
BAT-AEL	BAT-Associated Emission Level/s
BAT-AEPL	BAT-Associated Environmental Performance Level/s
Blue Hydrogen	Hydrogen gas produced by the steam reformation of methane (natural gas), the CO_2 (carbon dioxide) by-product of this process being separated from the hydrogen and either put to beneficial use or immobilised using CCS technology.
Bt	Bacterium *Bacillus thuringiensis* (Bt) - it produces a chemical harmful to a small fraction of insects, most notably the larvae of moths and butterflies, beetles, and flies. The responsible gene is used to produce genetically modified cotton plants.
CCS	Carbon Capture and Storage
CE	Circular Economy
CH_4	Methane
CHP	Combined Heat and Power
CIS	Commonwealth of (Newly) Independent States
CLRTAP	Convention on Long Range Transport of Air Pollutants
CMS	Chemicals Management System
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2-eq	Carbon Dioxide Equivalent of a gas concerning its Global Warming Potential (GWP) relative to that of carbon dioxide.
COD	Chemical Oxygen Demand – a measure (mg oxygen/litre) of the oxidisable strength of a wastewater or other water stream
DEFRA	UK Government Ministry: Department for Environment, Food and Rural Affairs
EC	European Commission
EE	Energy Efficiency
EEBPP	Formerly the Energy Efficiency Best Practice Programme of the United Kingdom
EGD	European Green Deal
ELP	End of Life Product or Products
EMS	Environmental Management System e.g. one certified as compliant with ISO14001
EN	European Standards (European Norm) - technical standards drafted and maintained by CEN (European Committee for Standardization) and others
EPA	Environmental Protection Agency of the USA
EPCA	Enhanced Partnership and Cooperation Agreement between Uzbekistan and the EU
EPR	Extended Producer Responsibility
ETS	Emissions Trading System
ETSU	Formerly the Energy Technology Support Unit of the United Kingdom
EU	European Union
FOLU	Forestry and Other Land Use
GDP	Gross Domestic Product
GE	Green Economy
GHG	Greenhouse Gas

GM	Genetically Modified
Green Hydrogen	'Green Hydrogen' is hydrogen produced by the electrolysis of water using electricity generated from renewable energy sources.
H_2O_2	Hydrogen Peroxide
Ha	Hectare
HSE	Health, Safety and Environment
INCD	Intended Nationally Determined Contribution to reducing GHG emissions under the Paris Agreement
IPCC	Intergovernmental Panel for Climate Change
IPM	Integrated Pest Management
ISO	International Organization for Standards
LCA	Lifecycle Assessment
MEDPR	Ministry of Economic Development and Poverty Reduction
MHCS	Ministry of Housing and Communal Services
MHSSE	Ministry of Higher and Secondary Special Education
MoA	Ministry of Agriculture
MoC	Ministry of Construction
MoE	Ministry of Energy
MoT	Ministry of Transport
MPE	Ministry of Public Education
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MWR	Ministry of Water Resources
MWth	MegaWatt Thermal
NaOH	Sodium Hydroxide also known as Caustic Soda
NAP	National Action Plan/s
NAPCP	National Air Pollution Control Programme
NGO	Non-governmental Organisation
NMVOC	Non-Methane Volatile Organic Carbon Compound/s
N_2O	Nitrous oxide
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
PCA	Partnership and Cooperation Agreement between Uzbekistan and the EU – see EPCA
PM	Airborne Particulate Matter. PM_{10} is the concentration in air of all PM whose aero-dynamic diameter is equal to or less than 10μm. Hence it includes the finer PM fraction, $PM_{2.5}$, whose aerodynamic diameter is equal to or less than 2.5μm.
PRC	Peoples' Republic of China
R&D	Research and Development
RES	Renewable Energy Source
SCEE	State Committee of Ecology and Environmental Protection
SCAP	Sustainable Clothing Action Plan
SCP	Sustainable Consumption and Production
SDG	Sustainable Development Goal
SO_2	Sulphur Dioxide

STRUGE	Strategy for the Transition of the Republic of Uzbekistan to a Green Economy, 2019-2030
TA	Technical Assistance
TI	Tracking Indicator and Indicators
TI	Tracking Indicator
TPP	Thermal Power Plant
UK	United Kingdom
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
USA	United States of America
VAT	Value Added Tax
WCP	Whole Chain Plans, e.g. for food waste reduction
WEEE	Waste Electric and Electronic Equipment
WHO	World Health Organization
WRAP	Waste & Resources Action Programme
WWTP	Waste water Treatment Plant

Executive Summary

Uzbekistan has signed up to the United Nations Sustainable Development Goals (SDG), which include Goal 12 to 'ensure sustainable consumption and production (SCP) patterns' and meet its 11 subsidiary targets – mostly by 2030. Consequently the SWITCH-Asia SCP Facility, the National Focal Point and the EU Delegation to Uzbekistan organised a Multi-Stakeholders Dialogue (MSD) with line Ministries and key Stakeholders to identify main priorities for supportive Technical Assistance activity. The MSD was held on 3 March 2020, and two priority areas were identified for support, including the Preparation of an SCP Action Plan. An official demand letter was received from the Government on 19 May 2020, including an objective 'To promote SCP and CE in support to Uzbekistan's Green Economy Strategy through the development of the SCP Action Plan, and the identification of priority thematic policies and actions'.

The SCP Action Plan is structured as follows:

Chapter 1 introduces SCP, its relationship to higher-level environmental and other policies and goals, and to many of the SCP tools and measures that can help identify practical measures for improving resource efficiency, reducing waste, substituting more benign resources for those that are potentially harmful, and for the reuse and recycling of end-of-life products. A major consideration in applying SCP is the mapping of sectoral 'value chains', which comprise all the stages in production, product use (consumption) and the management and disposal of products that have reached the end of their useful life.

Chapter 2 provides a principled rationale for the scope of the national SCP Action Plan. Three major value chains are identified: (i) agriculture and agri-products; (ii) textiles and textile products; and (iii) the extraction, processing and use of fossil fuels (gas, oil and coal). Four cross-sectoral themes are discussed: (a) water conservation and efficiency; (b) resources recovery (materials and/or energy) recovery from municipal solid waste (MSW); (c) reducing national GHG emissions in response to climate change – requiring action on energy efficiency (resource efficiency cornerstone), adoption of renewable energy sources (substitution cornerstone), and shifting towards a decarbonised energy system in the longer term; and (d) ambient air quality.

Chapter 3 details the scope of the agriculture and agri-product value chain. It breaks down the value chain into major stages and their subsidiary steps, describing major resource consumption and emission issues (to air, water, soil and wastes) for each – including the predominant role of crop growing in the abstraction and consumption of freshwater. The chapter identifies SCP tools and measures that may be appropriate in each step of the value chain to improve resource efficiency and reduce ecological impacts.

Chapter 4 breaks down the textiles value chain into major stages and their subsidiary steps, describing major resource consumption and emission issues, and identifies potentially applicable SCP tools and measures. It concludes with a section on the role that Textile Clusters may play in leading SCP uptake in the sector.

Chapter 5 follows a similar approach regarding the energy value chain. Emphasis is placed on the adoption of Best Available Techniques (BAT) in the extraction and processing stages, and in large-scale combustion plants, where the numerous multi-sector uses of energy constitute a primary source of GHG emissions and air pollutants. However, other sectors also make significant contributions to pollution, so dealing with this issue warrants the adoption of a cross-sectoral approach – see below (Chapters 6 and 7).

Chapter 6 starts with a consideration of the overlaps that may occur between value-chain and cross-sectoral action. It then introduces the scope for SCP action in four cross-sectoral areas: (i) water saving and efficiency; (ii) recovering resources – materials and energy – from municipal solid waste (MSW); (iii) climate change – mitigating GHG emissions through energy efficiency and using renewable energy; and (iv) ambient air quality.

Chapter 7 introduces the elements of an SCP enabling environment that may be applied to actions in all value chains and cross-sectoral areas. The relative significance of these elements in action plans varies, depending on the value-chain and cross-sectoral characteristics, but all are relevant, especially in the cross-sectoral area of resource recovery from MSW. Hence the concept is developed through its application to this area.

Chapter 8 introduces the need for a mechanism to promote and stimulate SCP uptake in priority areas. Because much SCP action is voluntary, attitudinal and behavioural change is critical to its widespread uptake. A promotional mechanism is needed, therefore, targeting the stimulation of behavioural change as a major goal. The chapter identifies the underlying principles for such a mechanism, and provides international experience illustrating how such a mechanism may evolve over time as experience is gained, in an accompanying Annex (Annex D).

Chapter 9 presents the SCP Action Plan to 2030, derived from the analysis presented in the preceding chapters and the reviews of national and EU policy presented in the Annexes.

Annex A: provides a summary of major national legislation, concepts and projects related to achieving a green economy;

Annex B summarises the European Union's Green Deal, including the goal of Net Zero GHG emissions by 2050, a toxic-free environment and achieving a circular economy. It concludes with a comparative analysis of Uzbekistan's Concept to Transition to a Green Economy (to 2030) and the EU's Green Deal (EGD), and notes the opportunities to introduce EGD ideas into the SCP Action Plan for Uzbekistan.

Annex C identifies the United Nations' Sustainable Development Goals (SDGs) relevant to SCP implementation, important drivers for Green Economy policy implementation.

Annex D illustrates the evolution of SCP Support Mechanisms in an OECD country and identifies indicative Terms of Reference and a staff complement for one possible institutional measure to promote SCP.

Annex E summarises recent developments in Uzbekistan's Development Strategy regarding the Textiles Industry.

Annex F notes the European Commission's interim BAT Conclusions for the Textiles Industry.

Annex G summarises recent developments in Uzbekistan's reformation of the gas and oil industry.

Annex H notes the infrastructure needed to recover resources from municipal solid wastes in two scenarios.

1. SUSTAINABLE CONSUMPTION AND PRODUCTION (SCP)

1.1 The Three Cornerstones of SCP

The concept of sustainable consumption and production (SCP) has evolved and been defined in a number of ways. For instance, the Oslo Symposium in 1994 proposed a working definition of SCP as '*the use of services and related products which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic materials as well as the emission of waste and pollutants over the life cycle of the service or product so as not to jeopardise the needs of future generations*'.[1]

The United Nations Environment Program (UNEP) in 2011 defined SCP more simply as '*a holistic approach to minimising the negative environmental impacts from consumption and production systems while promoting quality of life for all*'.[2]

Regardless of the definition of SCP, four underlying SCP principles apply:

1. Improving the quality of life without increasing environmental degradation and without compromising the resource needs of future generations
2. Decoupling economic growth from environmental degradation by:
    - Reducing material/energy intensity of current economic activities and reducing emissions and waste from extraction, production, consumption and disposal
    - Promoting a shift of consumption patterns towards groups of goods and services with lower energy and material intensity without compromising quality of life
3. Applying life-cycle thinking which considers the impacts from all life-cycle stages of the production and consumption process
4. Guarding against the re-bound effect, where efficiency gains are cancelled out by resulting increases in consumption

Three fundamental concepts may be extracted from the above definitions and principles: **resource efficiency, substitution,** and **circularity**. Drawing on these concepts, SCP may be seen as a delivery agent for a national Green Economy (GE); see Figure 1.

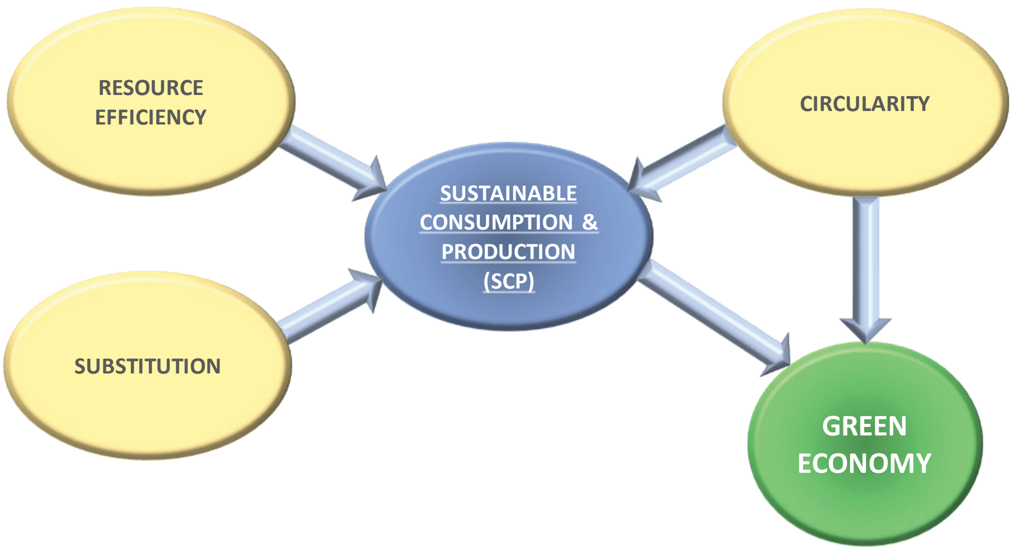


Figure 1 SCP, together with Circularity, contributes to delivering a Green Economy

1 Oslo Symposium, 1994: https://enb.iisd.org/consume/oslo004.html

2 UNEP, 2011, Sustainable Consumption and Production: A Handbook for Policymakers, Global Edition, p. 10. The online PDF be freely downloaded from Research Gate: https://www.researchgate.net/publication/324583885_Sustainable_Consumption_and_Production_A_Handbook_for_Policy_Makers

Understanding each of these concepts helps us develop our appreciation for and recognition of the systematic, deep-seated changes in behaviour and practice that SCP strives to achieve. It represents a profound shift away from ‘business as usual’. A further feature of SCP is that it recognises and places an emphasis on the role not only of producers but of consumers, and this latter group includes governments, institutions, members of the public, and businesses. Each of the three concepts is described below and Section 1.2 introduces the roles of governments, producers and consumers.

Resource Efficiency (Use Less): reduce the consumption of energy, water and materials in production; and design, buy and use fewer resource-intensive products. Some examples:

- Increase the energy efficiency of buildings by improving their insulation
- Adopt water saving techniques to reduce the net freshwater consumption of agricultural and industrial production
- Optimise product design and production operations so that fewer resources are consumed in making and using consumer products
- Consumers purchase resource efficient products (incentivised by eco-labelling and communication messaging, for example)

Substitution **(Use Better):** use harmless or less harmful resources to produce goods and services:

- Produce, buy, and use paints that contain fewer, or are free of, organic solvents
- Generate electricity using renewable energy sources instead of fossil fuels

Circularity (‘From Cradle to Cradle’): in a minimalist sense, this method involves saving resources by recycling or reusing a product or waste stream or product. A fuller interpretation, as exemplified by the Circular Economy approach being adopted by the EU, represents a strategic transformation from a linear to a more sustainable economy that decouples economic growth from resource use (see Section 1.3). It thus affects product design, production, end-of-life product management and consumer behaviour, and includes wastes recycling (solid, liquid, gaseous), as for example:

- Recovery and recycling of waste streams (solid, liquid and gaseous) at production sites and from consumers, and, where this is not possible, in off-site facilities, etc.
- Designing products for low resource consumption while in use, and for durability, repairability, and ease of end-of-life disassembly (i.e. ‘circularity’)
- Applying a value-chain approach in key sectors, including measures to reduce all forms of waste systematically, and reusing or recycling whatever waste is produced
- Adopting necessary systems and infrastructure to enable the recovery and reuse/recycling of constituent components and materials from products that have reached the end of their lives

1.2 Roles of Government, Producers and Consumers in SCP

The three main stakeholder groups noted in the foregoing section are introduced below.

Government

In addition to setting appropriate goals and policies, the government has the responsibility to ensure that those policies are implemented effectively and that the outcomes of implementation are recorded and fed back into the policy-review process. And it has the primary responsibility, through its agencies, to monitor and inspect entities in the productive, supply and waste management sectors to enforce legislative requirements.

As prime mover in the policy decision to adopt SCP as a key part of its green agenda, **government must also ensure there exists a sustained enabling environment**. Key elements of an enabling environment for SCP include the following:

- Applicable policy documents are clear and unambiguous and that the policy requirements are enforceable

- SCP tools and associated information are made available for producers and suppliers to use
- Entities in the productive and supply sectors have the capacity to apply SCP tools and, where their capacity is limited, receive capacity-building training and advisory support
- Those entities in the sectors of the economy lying within identified national key value-added chains (see Section 1.5) undertake coordinated SCP action in pursuit of a circular economy agenda
- The policy goals, the policies themselves, and the practical steps - including the use of SCP tools – that help to identify and implement measures are communicated effectively to producers and suppliers
- Similarly, policy and what it implies for consumers – households and others – is communicated effectively to consumers
- Consumers are motivated to buy green products, and producers and suppliers are motivated to produce and supply them
- Government ministries and departments purchase goods and services in accordance with the government's Green Economy agenda, consistent with SCP principles and concepts
- Financial resources are available to catalyse all of the above, and economically disadvantaged members of society are treated fairly

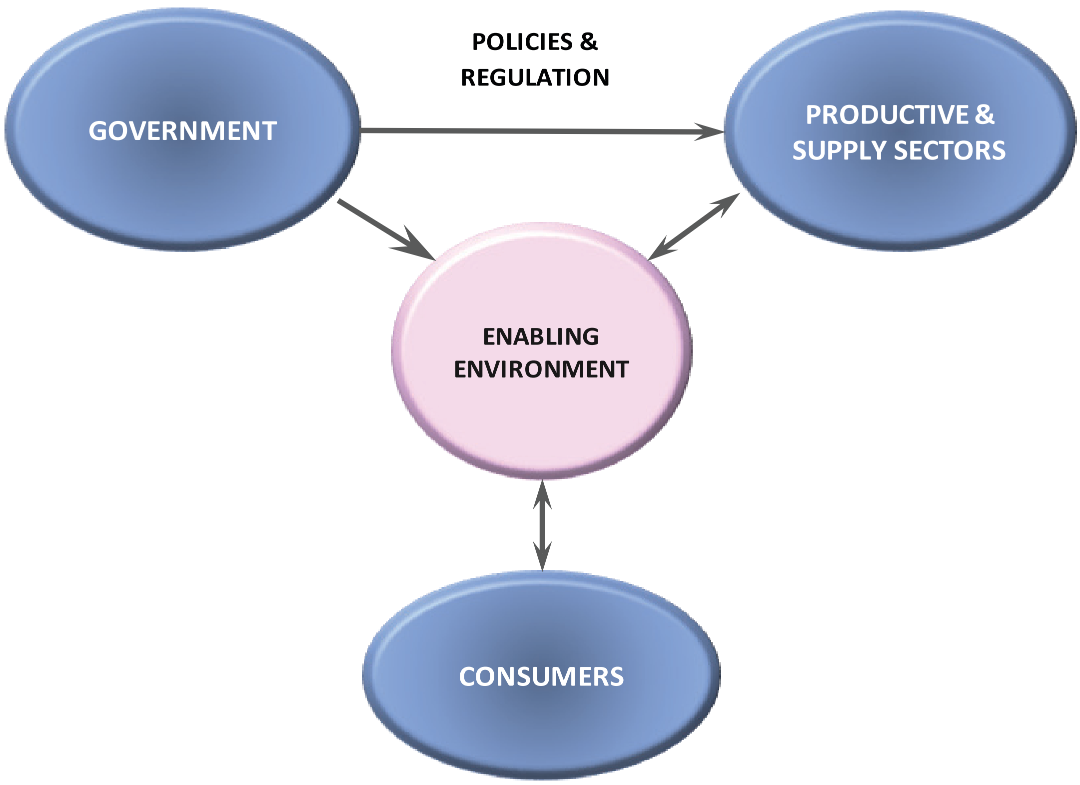


Figure 2 Schematic illustration of the need for an enabling environment to interface with government, producers and suppliers, and consumers

Producers and Suppliers

It is the responsibility of producers and suppliers to apply appropriate SCP tools to identify, and then implement, the specific measures that will contribute to achieving the national Green Economy vision. In particular, for those entities in key value-added chains, the measures include taking coordinated action to respond to the national Green Economy agenda. Consumers, as purchasers of intermediate goods and services, are also implicated in these measures.

Consumers

Consumers can be private, business or government, for whom different instruments and approaches are available to facilitate action. The roles of consumers include:

- Responding positively to communications regarding the green agenda
- Buying and boosting the demand for green products, communicating their desires to suppliers
- Using products responsibly, avoiding waste where possible, and avoiding excessive use of water and energy, etc.
- Complying responsibly with requirements to, for instance, separate solid wastes at the source before their collection, and disposing of defined end-of-life products defined in accordance with regulatory requirements and making use of available facilities

1.3 How Linear and Circular Economies Differ

Creating a greener economy requires the transformation of the consuming and productive sectors of the economy – primary, secondary and tertiary – to shift from a predominantly linear model to one that is more circular. What distinguishes these two models? The differences are illustrated schematically in Figure 3 and elaborated below.

Linear Economy

Put simply, a linear economy is one in which little or no emphasis is placed on minimising resource consumption, and material recycling, energy and water efficiency measures are not practised. *In extremis*, a linear economy may be characterised as ***Take-Make-Use-Dispose***. At present, despite the energy substitution, resource efficiency, recycling, and (solid, liquid and gaseous) wastes management measures that have been adopted, the Republic of Uzbekistan's economy bears an uncomfortably close resemblance to the linear model.

Circular Economy

In contrast, as indicated in Figures 3 and 4, a circular economy involves substantial feedback loops, in which efforts are made at the design and subsequent stages to eliminate or, if this is not possible, to minimise waste generation throughout a product's life-cycle – starting with its production, through to its use and until the end of its useful life. It involves all sectors of the economy, for instance:

- Primary sectors: agriculture, forestry, fisheries, water abstraction, mining for coal and ores, quarrying for stone, oil and gas extraction
- Secondary sectors: processing of primary raw materials and foodstuffs, treatment of freshwater for the purpose of supply, oil and gas refining and petrochemicals production, energy transformation processes including the generation of electricity and heat from the combustion of fossil fuels, and coke production, and the manufacture and production of all manner of goods and packaging materials for sale
- Tertiary sectors: distribution and supply of goods and services, public transport, municipal sewerage and wastewater treatment services, municipal solid waste management facilities, retail outlets, health and educational services offices, and the supply of all manner of services including government at national and lower-level tiers
- Consumers: government and institutions, households, hospitality, private transport, all sectoral users of goods and services irrespective of their being produced in-country or imported, and all external users of goods and services exported from Uzbekistan

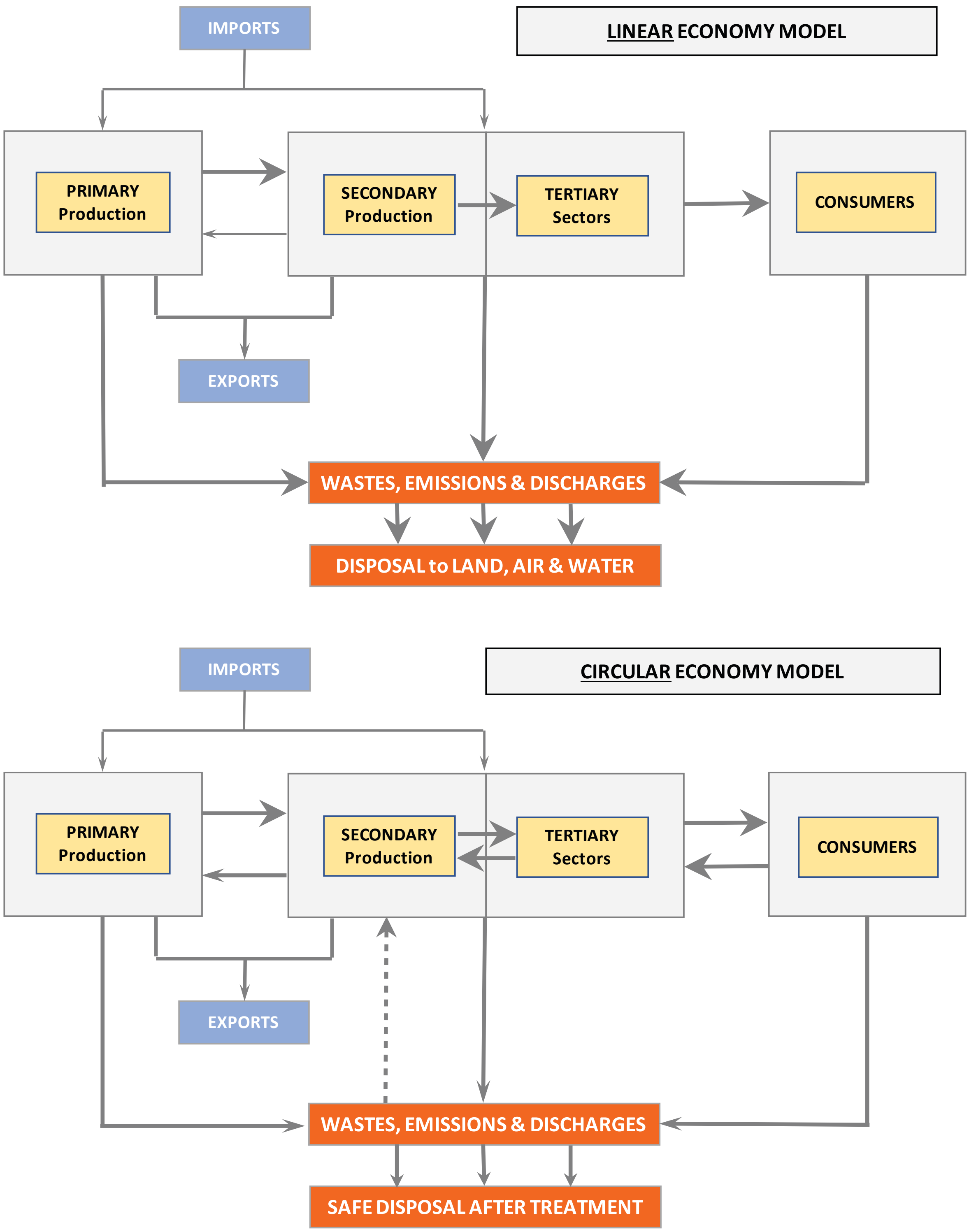


Figure 3 Simplified, schematic illustration of the differences between linear and circular economies

A circular economy (CE) is one which successfully **decouples economic growth from resource consumption and Greenhouse Gas (GHG) emissions** and achieves or approaches a state of **sustainability**: it is the antithesis of the linear 'Take-Make-Use-Dispose' model and **applies the Waste Management Hierarchy** in full – a key concept within the EU's Green Deal (see below and in Annex B). **Adoption of SCP concepts and tools is key to delivering a CE.** Qualitatively, **SCP tools may be applied in policy areas that include**:

- Reducing national energy demand through applying energy efficiency policies and measures in all sectors
- Minimising greenhouse gas (GHG) emissions through using renewable energy resources (RES) to the full, thereby eliminating or reducing the need to extract and burn fossil fuels. Improved ambient air quality and public health is a co-benefit

- Gasifying an energy system, since the combustion of natural gas instead of coal releases fewer GHGs, although it does not eliminate them. Hence this policy should be seen as representing an intermediate stage of development towards a CE
- Minimising freshwater demand within river basins and catchments through applying water efficiency policies and measures in all sectors including industry, energy, institutions, offices and households – but especially in agriculture. Co-benefits include the safeguarding of water resources, freshwater and wetland habitats along with their biodiversity
- Adapting agricultural practices to minimise, where elimination is not feasible, the use of inorganic nitrogenous and phosphate fertilisers, pesticides and other chemicals; to minimise emissions to air from arable cultivation, animal manures management, and crop residues management; and to minimise, reusing or recycling agricultural solid wastes
- Minimising all food wastes downstream of agricultural production and, where feasible, recovering and recycling them. This concerns all segments of the agri-food production, distribution, shops, hospitality, institutional and household sectors – and includes treating food wastes and municipal wastewater sludge solids in such a manner as to enable their use as organic fertiliser in agriculture
- Designing all material products and packaging through applying the principles of sustainable production as embodied in the examples of 'Circularity' noted in section 1.1 and Annex B.1, along with motivating consumers to base their product purchasing and disposal decisions on those principles – catalysed in part through communication measures. Special provisions may be needed to deal with the management of end-of-life products that have been imported and are not manufactured to a significant extent within Uzbekistan

Figure 4 shows an alternative visualisation of the Circular Economy, commonly referred to as a 'Butterfly Diagram', developed by the Ellen MacArthur Foundation.[3] It portrays the flow of materials in an economy as two main cycles: one biological (renewables, left-hand side of the diagram), and one technical (finite materials, right-hand side of the diagram). As explained on the Ellen MacArthur Foundation website, in a circular economy, waste and pollution are eliminated, products and materials are circulated, and nature is regenerated. The circular economy system diagram (butterfly diagram) illustrates the continuous flow of materials in the economy. In the biological cycle, the nutrients from biodegradable materials are returned to the Earth, through processes like composting or anaerobic digestion. This allows the land to regenerate so the cycle can continue. In the technical cycle, products are kept in circulation in the economy through reuse, repair, remanufacture and recycling. In this way, materials are kept in use and never become waste.[4]

Biological and material resource leakage occurs when 'goods' – intermediate and final products – are produced and consumed. Leakage takes the form of miscellaneous solid waste, emissions to air, and wastewater discharges. Viewed from a sustainable use of resources perspective, the closer the subsidiary cycles or 'loops' (keeping resources in circulation) are to the points of leakage, the better.

3 https://ellenmacarthurfoundation.org/circular-economy-diagram
4 https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview

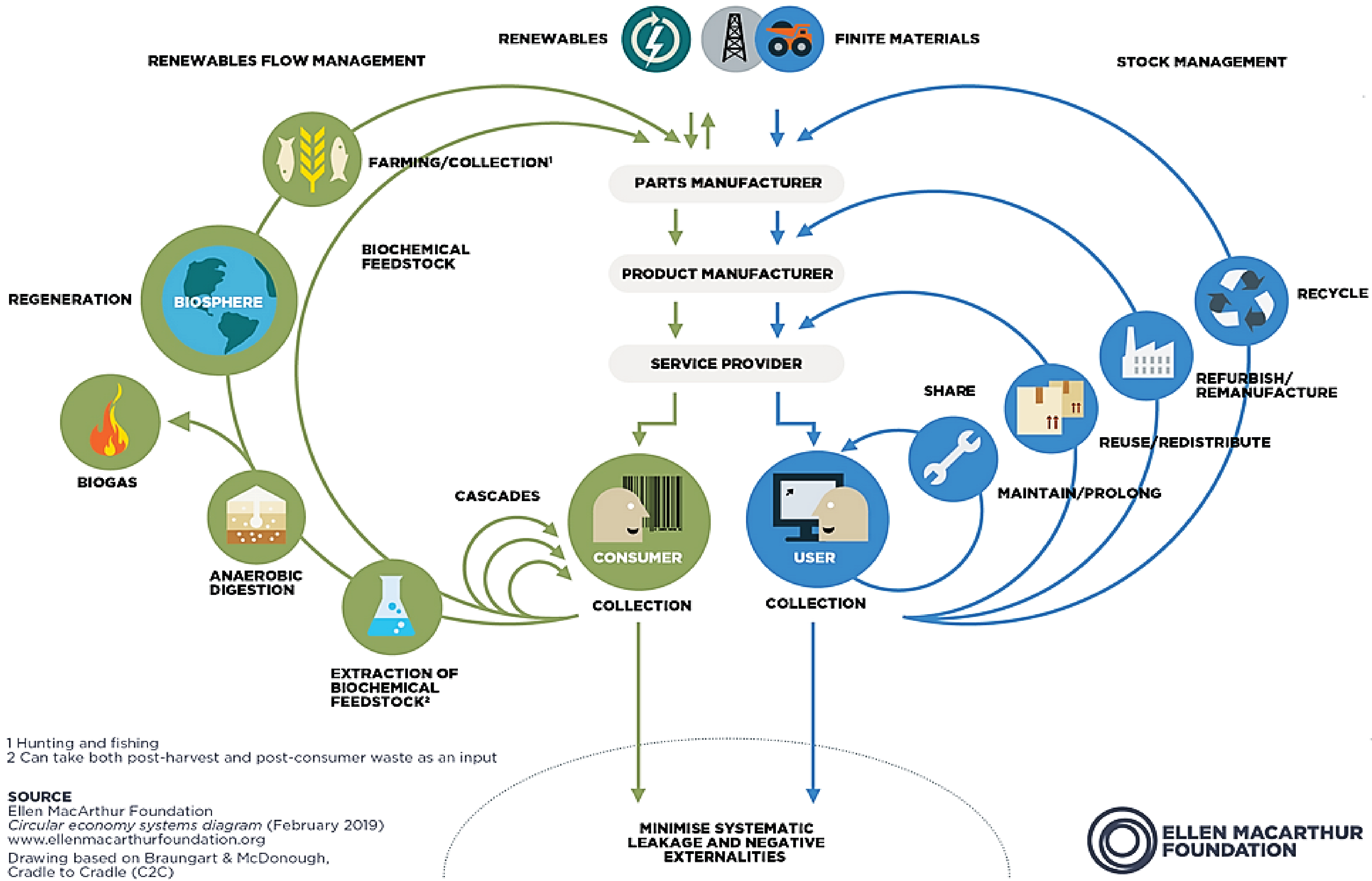


Figure 4 Butterfly Diagram' Visualisation of a Circular Economy

Waste Management Hierarchy

The waste hierarchy lays down a priority order of, in principle, the best overall environmental and sustainable options in waste management. In a circular economy, every effort is made to adopt options that lie at the pyramid's pinnacle. In reality, departures from applying the hierarchy in practice may be justified for specific waste streams on the grounds of technical feasibility and economic viability.

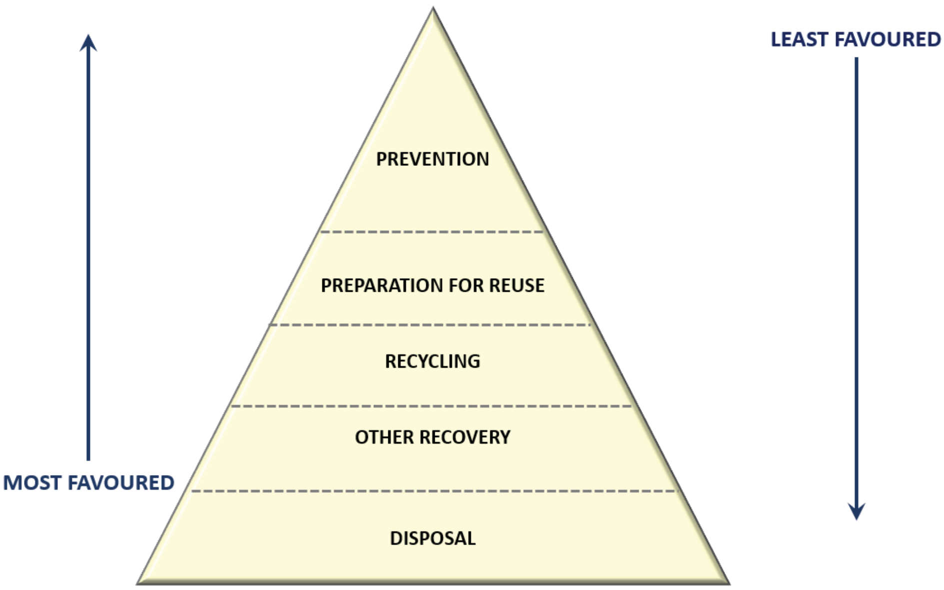


Figure 5 Waste Management Hierarchy

Figure 5 represents the waste management hierarchy as defined in Articles 3 and 4 of the EC Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, and in particular, Article 4:

The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy:

a. *Prevention:* measures taken before a substance, material or product has become waste, that reduce:
   - the quantity of waste, including through the re-use of products or the extension of the life span of products;
   - the adverse impacts of the generated waste on the environment and human health; or
   - the content of harmful substances in materials and products;

b. *Preparing for re-use:* 'preparing' means checking, cleaning, repairing or recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing; 're-use' means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived;

c. *Recycling:* means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations;

d. *Other Recovery, e.g. energy recovery:* means any operation, the principal result of which is that waste serves a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste prepared to fulfil that function, in the plant or in the wider economy. Annex II of the Directive sets out a non-exhaustive list of recovery operations; and

e. *Disposal*: means any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Annex I of Directive 2008/98/EC sets out a non-exhaustive list of disposal operations.[5]

5 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098

1.4 Environmental Goals, Policies and Indicators

Goals and Policies

In moving towards a Green Economy there must be a vision as to what this means in substance. This vision may be expressed as achieving a number of environmental, economic and social goals. They will be nationally specific. A **major role of SCP and of SCP tools is their application to help identify measures whose implementation may help meet Green Economy goals**. Table 1 provides an illustrative set of potentially relevant environmental goals – based on but not necessarily the same as those of the EU's Green Deal; see Annex B. In addition, it provides a set of policies whose implementation could contribute to achieving one or more goals.

Table 1 Illustrative Green Economy Goals and Potentially Appropriate Policies

Example of Goal	Examples of Contributing Policies
The link between national economic growth and resource consumption/waste generation is broken	Broaden the national Green Economy Strategy to embrace the EU's 'Sustainable Product Policy Framework', a major component of the EU's CE Action Plan (CEAP), to include: – Promotion and coordination of activity in national 'Key Product Value Chains' – Introduction of 'Sustainable Consumption and Production' concept and 'Sustainability Principles' into the GEC – Applying Sustainability Principles to regulated economic activities – Placing 'Extended Producer Responsibility' requirements on producers and importers of defined categories of goods – Prohibiting, form a defined future date, the placement on the market of energy-related and other consumer products that lie within the scope of the current/strengthened Ecodesign Directive and Ecolabel scheme – Setting a mandatory requirement that public sector bodies adopt minimum 'Green Public Procurement' criteria – Introducing CE practices in best available techniques (BAT) reference documents.
	Broaden the national Green Economy Strategy to embrace the 'Less Waste, More Value' component of the EU's CEAP, to include: – Creating a well-functioning market for secondary raw materials, including the export of high-grade recovered/recycled materials to product-producing countries – Mandatory separation at-source and collection of household and other municipal solid wastes, in support of such markets – Strengthening the provisions for managing end-of-life vehicles, electronic equipment, and batteries – Strengthening the provisions for the prevention and minimisation of packaging wastes, including setting waste reduction targets for selected streams – Commitment to explore pricing and financial instruments as a means to change the patterns of waste generation and disposal, with the aim of minimising disposal quantities.
	Broaden the national Green Economy Strategy to embrace the principles of the 'Farm to Fork' strategy for reducing food waste in the Agriculture-Agrifoods-Consumption Value Chain.
	Establish an appropriate set of stage-based Target Indicators to track progress, and systems to collect the necessary data, their analysis, reporting and time-bound review.

<table>
<tr><th>Example of Goal</th><th>Examples of Contributing Policies</th></tr>
<tr><td rowspan="2">The link between national economic growth and GHG emissions is broken, Net-Zero emissions to be achieved by 2050/2060</td><td>Broaden the national Green Economy Strategy to embrace the EU’s ‘European Green Deal’ (EGD) proposals concerning Net-Zero emissions, to include:
– Ratification of the protocols to the UNECE Convention on Long-Range Transport of Air Pollutants (CLRTAP), requiring progressive reductions in national emissions
– Requiring that biennial national GHG emission projections to 2050/2060 are prepared and published
– Setting national targets for energy efficiency improvements in key sectors, and publicising progress in achieving these targets
– Setting national targets for renewable energy use as a share of the total energy consumption, and publicising progress in achieving these targets
– Committing to gasification to replace coal as the source of energy for electricity generation and residential heating, while recognising that this is only an interim policy measure
– Committing to explore pricing and financial instruments as a means to change the patterns and intensity of energy use in order that fewer GHG emissions are generated.</td></tr>
<tr><td>Establish an appropriate set of stage-based Target Indicators to track progress, and systems to collect the necessary data, their analysis, reporting and time-bound review</td></tr>
<tr><td rowspan="2">Urban ambient air quality to satisfy World Health Organization (WHO) recommended limit values by 2050</td><td>Broaden the national Green Economy Strategy to embrace an unambiguous commitment to achieve non-toxic ambient air quality and to reduce the emissions of air quality pollutants (AQPs) accordingly, to include:
– Ratification of the protocols to the UNECE Convention on Long-Range Transport of Air Pollutants (CLRTAP), requiring progressive reductions in national air quality management (AQP) emissions
– Committing to the preparation of a National Air Pollution Control Plan (NAPCP) in line with the EU Directive (EU) 2016/2284 and to a cycle of periodic review and updating (every four years)
– Set ambitious national targets for renewable energy use as a share of the total energy consumption, and publicise progress in achieving these targets
– Prohibiting, from a defined future date, the placement on the market of energy-related and other consumer products that lie within the scope of the current/strengthened Ecodesign Directive and Ecolabel scheme
– Prohibiting the import of pre-EURO 4 diesel-powered road vehicles from a defined date (and restricting imports prior to that date)</td></tr>
<tr><td>Establish an appropriate set of stage-based Target Indicators to track progress, and systems to collect the necessary data, their analysis, reporting and time-bound review</td></tr>
<tr><td rowspan="2">The water demands of the general public and of the nation’s productive sectors are met while at the same time freshwater abstraction rates are minimised, surface and groundwater resources are used sustainably, freshwater and wetland habitats are conserved, and biodiversity is safeguarded</td><td>Introduce specific policy commitments into the National Green Economy Strategy, to include:
– Sustainable, quantitative limits are set on the maximum annual volumes of freshwater abstracted from each defined water basin
– Development of a national strategy to develop, adapt and introduce water conservation and water efficiency techniques in major water using sectors – principally agriculture – and implementing the strategy, tailored where appropriate, in each water basin
– Committing to explore pricing and financial instruments as a means to reduce nett freshwater demand as a component of these national and basin strategies</td></tr>
<tr><td>Establish an appropriate set of staged Target Indicators to track progress, and systems to collect the necessary data, their analysis, reporting and time-bound review.</td></tr>
</table>

Policy Implementation Indicators

Implementation of policy measures to achieve national goals is always challenging – both in terms of implementation being timely and being applied to the full technical extent envisaged in policy. Financial and institutional capacity constraints often apply, while unforeseen regulatory ambiguities and enforcement weaknesses can also be an issue. To assist the high-level monitoring of implementation progress, it is always useful to adopt a robust, targeted set of indicators whose values may be determined using basic statistical data that are, or could be, collated nationally. Data collection should be conducted in a strategic manner as this process requires resources, and maximum use should always be made of existing data collection systems.

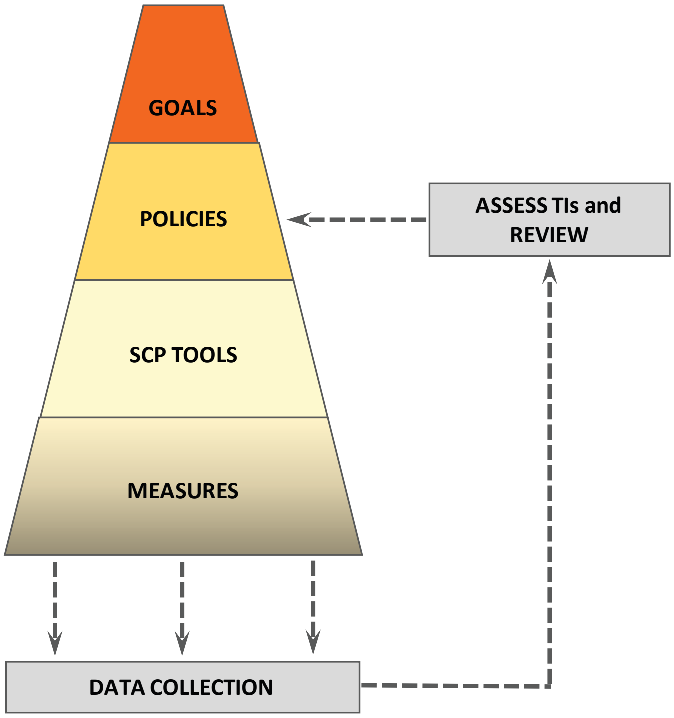


Figure 6 Hierarchy of goals, policies, tools and measures, and monitoring outcomes via Tracking Indicators

The use of tracking indicators (TIs) can help government and other stakeholders track progress in the achievement of policy goals. Interim, time-bound targets for the tracking indicators (TIs) enable government to review overall progress at stages and, where laggard progress is evident, and to step in to instigate remedial actions that might include policy adjustments. Figure 6 illustrates the hierarchal concept, while Table 2 provides non-exhaustive examples. Setting goals drives policy development, and SCP tools aid the identification of appropriate measures. The effects of implemented measures are determined through monitoring and data analysis, and the results of reviewing progress on meeting the TIs feedbacks into policy revision (if needed).

Establishing an appropriate set of country-specific TIs – which may also help assess the degree and extent of SCP tools and measures use – depends on the precise nature of the national goals.

Table 2 Illustration of the hierarchal relationship between a goal and subsidiary policies, SCP tools, and measures

Example	GOAL: Net Zero GHG Emissions by 2060		
Policies	Prohibit the disposal of biodegradable waste in landfill sites	Decarbonise the energy supply	Minimise GHG emissions from the agriculture value chain
Tools	Inventories of waste arisings and fishbone analysis Guidance and awareness-raising activities targeting households and other stakeholders	GHG emissions inventory and projections policy to tool Benchmarking (external and internal) of energy use in processes & operations Energy efficiency audits	Life-cycle analysis of emissions from the value chain Walk-through audits & fishbone analysis at food-processing plants Awareness-raising and guidance activity targeting specific stakeholders
Measures	Separate wastes at the source and separate collection Install and operate anaerobic digestion and composting plants to process bio-wastes Put the processed bio-waste to beneficial use	All energy efficiency measures Incentivise the generation of renewable energy and its use Production of 'blue' hydrogen from gas Carbon Capture and Storage technology	Adopt best practices to match fertiliser use to crop type and nutrient needs Anaerobic digestion of animal manures, with energy recovery Changes in consumption behaviour that minimises food waste

The application of SCP Tools and implementation of measures to deliver policy goals involves many stakeholders, each group having distinctive roles – see Section 1.2. But all stakeholder groups act also as consumers, because the consumer category is not limited to households.

1.5 Key Value-Added Chains

Key value-added chains are those which offer multiple opportunities to apply SCP in adopting a Circular Economy approach and are significant for the national economy. Three are explored in Chapters 3, 4 and 5 for the agriculture, textiles, and energy sectors, respectively.

Resources are consumed, and one or several waste streams are generated, at each stage of a value chain. **SCP actions apply to each stage** on these value chain maps. Wherever appropriate and possible, stakeholders should undertake action – coordinated where necessary – to maximise the application of the three SCP cornerstones. Such actions increase resource efficiency, minimise resource consumption and waste, and reduce environmental harm.

1.6 Glossary of SCP Tools, Measures and Terminology

Developed and proven internationally, an array of SCP tools is available – see Table 3. Their application helps to identify measures whose implementation contributes to putting Green Economy policies into effect.[6] In practice, many SCP tools may be used at several stages in the product life cycle and may apply to one, two or all three cornerstone principles; and they may be policy focused, application focused, or applicable in both roles.

6 The practical measures identified through using SCP tools are sector-specific and too varied to mention here, but some that may be relevant in the agricultural and downstream production sectors and consumption are noted in Table 2.

Table 3 SCP Tools and Measures and their Application of Cornerstone Principles

SCP Tool / Measure	Resource Efficiency	Substitution	Circularity
Policy Focused			
BAT Reference/Conclusions	✓	✓	
Benchmarking - external	✓	✓	
Carbon Pricing/Taxes	✓	✓	✓
Communication	✓	✓	✓
Consumer Awareness, Interest, Motivation & Behaviour	✓	✓	✓
Consumption and Procurement	✓	✓	✓
Eco-Design Product Standards	✓		✓
Education	✓	✓	✓
Emission Projection			✓
Financial Incentives	✓	✓	✓
Forestry Stewardship			✓
Green Purchasing Criteria/Code	✓	✓	✓
Mapping the Sectoral Value Chain	✓	✓	✓
Pricing of Publicly Delivered Goods	✓	✓	✓
Producer Responsibility			✓
SCP Support Unit	✓	✓	✓
Waste Management Hierarchy	✓	✓	✓
Application Focused			
Baseline Assessment	✓		
Benchmarking - internal	✓	✓	
Carbon Footprinting	✓	✓	✓
Champions	✓	✓	✓
Cleaner Design	✓	✓	✓
Communication	✓	✓	✓
Counter-current washing/heat-exchange	✓		
Dematerialisation	✓	✓	✓
Energy Audits	✓	✓	✓
Environmental Management System	✓	✓	
Fishbone Analysis	✓	✓	
Good Practice Guides and Case Studies	✓	✓	✓
Green Purchasing Criteria/Code	✓	✓	✓
Heat Exchanger Network	✓		
Innovation			✓
Life-Cycle-Analysis		✓	✓
Mapping the Sectoral Value Chain	✓	✓	✓
Mass and Energy Balances	✓		
Metering, Monitoring and Sampling	✓	✓	✓
Product-as-a-Service			✓
Reformulation		✓	
Resource Efficiency & Waste Minimisation Club	✓		
Separation of Wastes at Source	✓		✓
Walk-through Audit	✓		

The glossary below provides a brief introduction to the tools and measures listed above.

Baseline Assessment: an initial identification and quantitative assessment of the resources consumed by an entity (institutions, buildings, processes and operations). In order that a 'fresh pair of eyes' is brought to bear, the assessment is best led and undertaken by personnel without direct experience of the entity's daily operations. This technique may utilise a number of the others mentioned below, and any other available, relevant information. Its use helps the identification of priority areas, where action should be focused to minimise resource use in the short-medium term and deploy more radical measures longer-term.

BAT Reference Documentation: Published by the European Commission (EC), these documents on Best Available Techniques (BAT) definitively identify those technologies and operational practices that provide the best protection for the environment and human health. Moreover, the economic costs are taken into consideration as well. Prepared for given production sectors, they are updated periodically, and are mandatory for those sectors. Governments of countries that are not Member States (MS) of the EU may adapt these documents to suit their national circumstances. They provide an authoritative source of guidance on potential measures.

Benchmarking – external: comparing the efficiency of resource use (electricity, coal, gas, steam, water, materials, etc.) with that of comparable institutions, buildings, processes and operations. This method requires metering of the resources being consumed. Typically, comparisons are made with average, or ranges of, resource consumption values – e.g. kWh/t product, m^3 water/m^3 milk processed – in the public domain or published by accredited institutions guaranteeing respondent confidentiality. Use of this broad-brush technique can provide a 'wake-up call' to stimulate a search for efficiency measures and can be useful at a policy level.

Benchmarking – internal: A powerful technique that may be used by any institution, office, or enterprise to monitor and analyse resource use in a process or operation, inform the search for measures to achieve efficiency gains, and determine the savings once measures have been implemented – providing valuable information feed-back. Similarly, it may also be used to analyse material wastage rates. The technique is often referred to as '**monitoring and targeting**'. As with external benchmarking, its use requires the metering of resource consumption and material wastage in parallel with a measurement of production over the same time. In essence, the measured resource consumption of a defined operation, over a defined interval of time - typically per month, or per batch, depending on the nature of the production process - is plotted against a relevant measure of production over the same period of time. The graphs may be easily prepared using a simple spreadsheet program, and will yield quantitative information which can be used to help drive the search for efficiency measures and determine the resource savings made once efficiency measures have been implemented.

Carbon Footprinting: A tool or methodology to calculate the total greenhouse gas (GHG) emissions caused by an individual, event, organisation, service, place or product, expressed as carbon dioxide equivalent (abbreviated as CO_2-eq). Carbon footprinting is related to carbon accounting and life-cycle analysis. Greenhouse gases, including the carbon-containing gases carbon dioxide and methane, can be emitted through the burning of fossil fuels, land clearance and the production and consumption of food, manufactured goods, materials (including cement and steel, etc.), wood, roads, buildings, transportation and other services. Carbon footprint may be calculated as a CO_2-eq using the relevant 100-year global warming potential. Once the carbon footprint of a specific organisation, activity or product has been identified, it may be compared with that of other entities, activities and products so that actions may be devised to reduce the footprint.

Carbon Pricing/Taxes: Assigning a price for the (input and intrinsic) carbon content of energy and other products is a mechanism whereby carbon-rich products will, all else being the same, be more expensive than alternative products, leading to less of the former and more of the latter being bought and consumed. It is a tool available for governments to use, either by setting a carbon price, or by issuing a limited number of carbon quotas, leaving it to 'carbon market' forces to determine the carbon price. Effectively designed, this mechanism may be used to help implement a national GHG emissions reduction strategy. Its effects range from the short-term, rising prices affecting immediate consumer choices, to the longer term, sending firm signals on future price changes to producers and consumers.

Champions: A member of an enterprise's staff appointed as a 'champion' to stimulate broad-based interest and to push through measures to use resources efficiently and stimulate product redesign. Enterprises have found that appointing such a champion – someone who is genuinely interested and motivated – helps to motivate others in the enterprise and to sustain initial pushes for improvement.

Cleaner Design: A technique in which a critical examination is conducted into how a product is made, its resource consumption when in use, its durability and ease of repair, and the ease of its dismantling at the end of its working life. The objective of this examination is to identify and implement production changes that (i) minimise the number of components, quantity of materials, and, where possible, the hazardous nature of the materials used to produce a product, and (ii) enable the recovery of materials and components from end-of-life products to be maximised. Forming part of a Cleaner Design exercise, **Life-Cycle-Analysis** may be undertaken in parallel.

Communication: Effective communication is an indispensable tool to raise awareness and understanding among all stakeholder interests of the need to take action, and to stimulate their interest in, and component. Stakeholder groups on which targeted communication activities should focus include the production sectors – primary through to tertiary – and, just as important, all consumer groups. The latter range from households, governmental and non-governmental institutions, through to all manner of enterprises purchasing intermediate products. Effective consumer-oriented communication is important since motivated consumers will form a major driver of demand for greener products – placing pressure on producers and suppliers to meet this demand. All manner of media and other techniques – including educational programmes – may be used to achieve effective communication.

Consumer Awareness, Interest, Motivation and Behaviour: The behaviour of households and other consumers whose awareness is raised, and that have become interested and motivated, will be changed in many ways. For instance, they will demand and search out greener products, will be less tolerant of waste and more likely to separate at-source and recycle the wastes they do generate. They may drive less aggressively on the roads, consider vehicles that are more fuel-efficient when changing their cars, and they may seek out opportunities to reduce household energy consumption. Achieving such changes in consumer behaviour requires sustained communications efforts, targeting both the young and the more mature members of society.

Consumption and Procurement: See Green Purchasing Criteria/Codes

Counter-Current Washing/Heat Exchange: where possible, washing or heating/cooling an intermediate or final product in counter-current mode as opposed to batch mode. This ensures a more efficient use of the washing medium, whether the washing or solvent medium (or heat exchange fluid) is water or some other substance.

Dematerialisation: Substitution of a digital service for a physical product. Examples include the availability of music and films on demand via the internet, as opposed to buying CDs and DVDs, the availability of e-books, and the submission of forms, letters and invoices electronically instead of by paper via the mail service.

Eco-design Product Standards: a requirement that appliances such as electrical, electronic and heating equipment placed on the commercial market must meet minimum energy efficiency limits.

Education: Closely linked to and forming part of a long-term communication strategy, curricula for specific age groups, from elementary school through to university undergraduate study, may be adapted to include SCP and Green Economy concepts. This tool provides a long-term, bottom-up approach to mainstreaming SCP in society.

Emission Projections – GHGs and Air Quality Pollutants (AQP): In places where policies are in place requiring quantitative reductions in emissions to air by specified dates, emission projection tools are indispensable aids to policy makers. Whether GHGs or AQPs are the subject of the policy, they enable decision takers to examine the potential impacts of implementing alternative or complementary policy options and measures. Projection tools are ineluctably linked to historic emission inventories and their quality. Both inventories and projections need to reflect adequately the influences of alternative technologies and their (expected) uptake on activity levels and emission factors. AQPs commonly included in inventories and projections are SO_2, NOx, NMVOCs, NH_3, $PM_{2.5}$ and PM_{10}. See also **Carbon footprinting**.

Energy Audits: the collection, processing and analysis of data on using energy resources for the purpose of assessing the possibility and potential for energy saving and the preparation of a conclusion.

Environmental Management System (EMS): An EMS, such as ISO14001, is a set of processes and practices that enable an organisation to reduce its environmental impacts and increase its operating efficiency. It is applicable for large and most small businesses, institutions and government departments and agencies.

Financial Incentives: They represent the ‘pull’ mechanism in contrast to the ‘push’ provided by the **Pricing** tools concerning Carbon and Publicly Delivered Goods. Financial incentives to encourage greener consumption and production come in various guises. They can include (time-limited) subsidies on greener consumable goods, investment grants, low-interest loans for green investments, favourable tax allowances for innovative research or investments, etc.

Fishbone Analysis: Also known as root cause analysis, an aid to determining the root causes of resource inefficiencies. The results of such an analysis may be represented diagrammatically in the form of a skeletal fish – hence its name. The technique questions why a given source of resource inefficiency prevails and may deploy 'brain-storming' sessions to help identify the deeper causes and find solutions.

Forestry Stewardship: A certification system for the sustainable management of forests and woodland in order to ensure that timber extraction is not exploitive and is compatible with maintaining biodiversity.

Good Practice Guides and Case Studies: Guides provide practical information on how to get started and use many of the other SCP tools, while Case Studies summarise the real-life experience of entities in identifying opportunities and implementing identified measures. Complementary to reports on external benchmarks, Good Practice documents may be cross-sectoral or have a sectoral focus.

Green Purchasing Criteria/Codes[7]: Requiring that all products purchased by an entity meet minimum environmental criteria is a tool whose widespread adoption encourages increased procurement of green goods and services while discouraging the supply of goods and services that fail to meet such criteria. Entities that may employ such Purchase Codes include governmental and non-governmental institutions, and enterprises in multiple sectors including retail outlets.

Heat Exchanger Networks: Utilising the heat content of liquid or heat exchange fluid output from one production unit to provide the heat needed by a second production unit.

Innovation: Research and innovation as a tool can lead to improvements in existing processes, production and supply of goods and services, and the design and development of new, greener technologies and techniques. Sectoral-specific innovation and its application in practice is perhaps most relevant to **Mapping** and driving improvements in Key **Value Chains**.

Life-Cycle-Analysis: An analytical process in which all the resources consumed during the production, use and post-working life management of a product are estimated along with the atmospheric emissions, wastewater, and solid wastes that are generated. This far-reaching analysis may include, for instance, estimating the energy consumed (and emissions generated) in producing the materials that compose the product. The outcome of this analysis may be presented as a map or process flow chart, which helps to identify the most resource-intensive stages of a product's life. Undertaken as part of a **Cleaner Design** process, it informs radical thinking on how to transform products and reduce their carbon and environmental footprints.

Mapping the Sectoral Value Chain: A technique to help visualise the major stages involved from a product's production through to its final consumption and end of life. It also helps in identifying the cross-links to other sectoral activities. It may be used to help focus concerted action to minimise waste throughout the value-chain and to stimulate a search for ways in which minimised waste streams may be recovered and reused in other sectors.

Mass and Energy Balances: A standard technique which relies on the principles of conservation of mass and conservation of energy. Its use can help to identify previously unrecognised waste streams and energy losses.

Metering, Monitoring and Sampling: The means by which quantitative data are obtained, enabling the use of most of the other SCP tools noted here. The systems adopted for data collection and capture should be systemic and proportionate to goals.

Prevention of Waste: See **Waste Management Hierarchy**.

Pricing of Publicly Delivered Goods: Electricity and water are examples of publicly delivered goods and services. If priced at or below the costs of provision, or of the value of the benefits conferred, users – including large-scale production installations – may be encouraged to use more of the resource than is strictly necessary, and their incentive to minimise its use may be minimal. On the other hand, progressively raising the prices for such public goods increases the incentives to reduce their consumption. Also, establishing a framework for future increases in price sends advance signals to users, providing them with time to take resource efficiency action.

7 Also known as Green Procurement [codes/criteria].

Producer Responsibility: Policy requirement placed on the producers of certain products whose end-of-life disposal represents a significant waste of material resources and is environmentally damaging. In present and former EU Member States producers have the responsibility to recover materials from and recycle end-of-life products that include goods such as road vehicles, batteries, electronic goods, and packaging. Although it predates the EU's Circular Economy (CE) approach, the Producer Responsibility principle lies at the heart of the CE and its focus on identified product value chains.

Product-as-a-Service: Producers or suppliers retain ownership of a product, leasing it out to customers as a service, and are responsible for managing its end-of-life dismantling, material recovery, recycling and disposal. Examples include electronic goods and vehicles.

Recovery and Recycling: See **Waste Management Hierarchy**.

Reformulation: Reformulation of a product to substitute harmless for harmful components to the maximum extent possible while maintaining product quality. A prime example is the reformulation of paints to minimise their organic solvent content, replacing them with water, thereby reducing the emissions to air of non-methane volatile organic compounds (NMVOC) when paint is applied.

Resource Efficiency & Waste Minimisation Club (Informal Associations): Representatives of enterprises or entities in a given area meeting informally to share experience on searching for resource efficiency and waste minimisation opportunities, and their implementation of measures. Experience shows that such associations, providing the opportunity to learn from the efforts of others, can be helpful in stimulating ideas for change. This holds even when the entities involved lie in different sectors, since their reticence due to competition fears are lessened.

Reuse: See **Waste Management Hierarchy**.

SCP Support Mechanism: An institutional tool that Governments may use to catalyse SCP activity at local level across the country. The United Kingdom (UK) government, for instance, funded several multi-year programmes[8] that operated at arms-length from the Government in the energy sector (*Energy Technology Support Unit, ETSU*) and business waste minimisation (*Envirowise*), developing benchmarking reports, good practice guides and case studies, market reports, and actively marketing them via comprehensive communication campaigns, and periodically evaluating the impacts of the communication programmes. Superseding these programmes in the UK, the Waste and Resources Action Programme (WRAP) provides, among other things, market intelligence reports on secondary materials. Action on food waste has been a major focus of its activities. SCP Support Mechanisms can play a vital role in helping to secure an enabling environment for the practice of SCP to flourish.

Separation of Wastes at Source: Whether applied to solid waste, wastewater or gaseous streams it is a basic principle of waste recovery and recycling that, wherever possible, concentrated should not be mixed with dilute streams and dissimilar streams should not be mixed. Failure to do so is liable to (i) increase the costs of resource recovery and recycling above what they could be and (ii) contaminate the recovered resource or recyclate. Both factors may jeopardise the practicality and viability of waste recovery and recycling. This principle is enshrined also in the management of end-of-life products subject to **Extended Producer Responsibility**.

Walk-through Audit: Inspection of the conduct of normal (and abnormal) operations to visually identify sources of waste, whether of materials, water, or energy. Undertaken as part of a **Baseline Assessment**, a 'fresh pair of eyes' is best brought to bear, the walk-through-audit undertaken by personnel without direct experience of the entity's daily operations. Having identified the sources of waste, the root causes may be identified using **Fishbone Analysis** involving plant personnel. Solutions may then be found, and measures implemented.

Waste Management Hierarchy: This hierarchy expresses schematically the favoured forms of waste management options from an environmental and sustainability perspective. It ranks options by priority order, taking into consideration prevention, preparation for reuse, recycling, other recovery, and disposal. See the closing part of Section 1.3 for an explanation of the concept and definitions of the ranked options.

To illustrate the relevance of various available SCP Tools and measures at different stages of a product life-cycle, Table 4 presents a sample of the SCP tools and measures applicable in the agricultural product chain; it is provided as an example only.

8 For example: the Energy Technology Support Unit (ETSU) in the energy sector and Envirowise for business waste minimisation.

Table 4 Example to show some of the SCP Tools and Measures that may be Applied in a Product's Life Cycle: Agriculture - Considering only Crop and Animal Product Chains

Cornerstone	Sub-branch	Primary Production	Processing	Wholesale & Retail	Consumption	End of Life Management
Resource Efficiency	Crops	Apply good practice guidance regarding: Water-efficient crop watering techniques; Timing N&P fertiliser application - to improve efficiency of use & reduce consumption.	Baseline assessment including walk-through audit. Set improvement targets & monitor performance using benchmarking tools. Champions to drive the identification of measures and their implementation.	As for processing - to reduce resource inputs, food waste	Communication to alert consumers to the effects of food waste. Apply good practice and change habits to reduce food waste in households and hospitality sector.	Separate food waste at source for collection and treatment & utilisation as biogas, fertiliser, and compost.
	Animals	Optimise feeding regimes of non-range animals to minimise N emissions in urine and faeces.	As above	As for processing to reduce waste and resource inputs	As above	As above
Substitution	Crops	Grow crop varieties that need less water. Substitute treated bio-wastes for inorganic fertiliser. Substitute less-harmful for hazardous pesticides.	Use renewable energy as a substitute for fossil fuel derived energy where possible.	As for processing. Substitute compostable for plastic packaging.	Communication to alert consumers of the benefits of adopting a more vegetarian diet & eating less meat.	As above
	Animals	Minimise antibiotic use.	As above.	As above.	As above	As above.
Circularity	Crops	Apply good practice guidance regarding the management of crop residues, including their incorporation in soil.	Apply life cycle analysis and cleaner design to minimise food waste and packaging waste.	As for processing.	Communication of the need to minimise food waste and to separate it at source for separate disposal & collection.	Apply treated sewage sludge and animal manures to land, as partial replacements for inorganic fertilisers.
	Animals	Rear animals according to organic farming principles.	As above and to minimise leather waste.	As for processing	As above.	-

2. RATIONALE FOR THE SCOPE OF THE ACTION PLAN

2.1 Underlying Principles

Eight principles underlie the rationale for the scope of the SCP action plan in Republic of Uzbekistan:

1. First is to align its duration to that of the Concept for Transition to a Green Economy (STRUGE, 2019–2030), and the commitment to meet Sustainable Development Goal SDG12 and other SDG Goals, i.e. to the year 2030. As shown in Annexes A and C, respectively, STRUGE and the SDG commitments are key drivers for a green and circular economy in Uzbekistan. Hence it makes sense to align the SCP Action Plan with them in terms of timescale. Towards the end of the decade the Action Plan could be revised and updated.

2. However, the preparation of STRUGE was not able to fully embrace the SCP philosophy. Hence, the introduction of SCP into a STRUGE Action Plan, as a contributory means of STRUGE delivery, is recommended in the SCP Action Plan.

3. Third, the mainstreaming of SCP philosophy into practice requires the existence of an enabling environment, which can be considered as a framework of interrelated elements, each of which act to promote, support and enable SCP implementation. Six elements are identified in this Action Plan: a consistent legislative and regulatory framework, institutional capacity and capability, operational infrastructure, sustainable finance, a culture of compliance, and efficient and supportive markets/ outlets. Their relative significance depends on the characteristics of the economic sector in which SCP is to be mainstreamed.

4. While the legislative and regulatory framework has undergone significant development over time, there is always room for improvement and refinement. Policy areas where further Government consideration and action might support the promotion and uptake of SCP are therefore identified in this Action Plan. They derive from a consideration of the potential constraints on SCP adoption in the identified value chains and cross-sectoral themes.

5. Fifth, much of the application of SCP in practice depends on stakeholders and actors taking voluntary action – whether national and regional government branches, households, institutions, farmers, miners, and enterprises in many industrial, energy and service sectors. It is recognised, therefore, that actors need first to be ***motivated and have practical tools and guidance tailored to their specific needs***. A mechanism to stimulate actors to take voluntary SCP action and provide appropriate tools and guidance should therefore be regarded as an essential element of any SCP action plan. Its implementation will contribute significantly to strengthening the institutional capacity and capability within an enabling environment; its role is complementary to, but distinct from, that of legislation and regulation.

   To aid the Government to determine an appropriate mechanism and its institutional 'home', the underlying principles for such a mechanism are provided in Chapter 8.

6. While the scope for SCP action is significant in most economic sectors, an attempt to stimulate strong SCP action in all sectors at the same time will likely fail owing to an initially limited capability and an overstretching of capacity. Therefore, the national SCP Action Plan adopts a ***strategic focus***, concentrating initially on key sectoral value chains and significant cross-sectoral themes that have the Government's attention. Efforts may then be built-up over time and phased in so as to allow capability and capacity to develop and be strengthened sustainably. Securing appropriate international Technical Assistance as a first step would help promote the swift development of capability and capacity.

7. ***Key value chains*** for SCP action are selected based on several factors: (i) their identification in STRUGE – see Annex A, (ii) their significance in the national economy as measured by GDP – see section 2.2, (iii) the extent of their reach in the primary through to the tertiary branches of the economy, (iv) the significance of their relative consumption and/or overconsumption of major resources, and (v) their significant release of emissions to air, wastewater and pollutants to water, and/or solid wastes. With these criteria in mind, three sectoral value chains are included in the Action Plan:

- ***Agriculture and Agri-Products***: essential to food security and the livelihoods of poorer members of society; responsible for about 80% of national freshwater demand, and significant GHG emissions from both crop-growing and animal rearing; a user of herbicides and pesticides, hazardous chemicals that can be harmful to human health; the value chain involving a long and complex supply chain starting with primary production, through a myriad of food and beverage processing operations, food storage, distribution and supply to consumers via many retail outlets, and consumption in households, institutions and multiple hospitality venues – all stages collectively generating huge amounts of food waste, which is mostly disposed of to landfill, and significant amounts of packaging waste.
- ***Textiles***: a value chain that is economically significant and an important vehicle for developing national manufacturing capacity, exports, employment, and poverty relief. Raw cotton, wool and silk production may be viewed as part of the primary agricultural sector, but the secondary production of textiles (yarn and fabric) involve significant energy, water and chemicals consumption.
- ***Energy (Oil, Gas, Coal) – Mining, Refining, Energy Transformation, and Combustion***: a value chain that is the principal source of both national wealth and GHG emissions – both carbon dioxide and methane. And, through the combustion of prepared coal, refined natural gas, and petroleum fuels in various settings along the value chain, a significant primary source of the ambient air pollutants ($PM_{2.5}$, NOx, SO_2, NMVOCs) that may contribute to the poor air quality experienced in some cities and urban areas.

8. Even where a specific value chain is a major contributor to significant resource use, ecological and human health issues, the role played by activities in diverse other sectors may also be substantial. Resolving issues such as freshwater resource availability, material and energy resources recovery from solid wastes, GHG emissions reduction in response to climate change, and ambient air quality, requires a ***cross-sectoral approach*** as well, in which SCP can play a big role. The above four cross-sectoral themes are included in the SCP Action Plan, in line with the GEC Concept and national SDG commitments. They also reflects some of the EU Green Deal's priorities – see Annex B.

2.2 Structural Composition of the Economy

Drawing on internationally comparable economic data presented by the World Bank[9], Figure 7 indicates the broad structural composition of Uzbekistan's economy, in terms of Gross Domestic Product (GDP). The methodology adopted for preparing the national statistical data incorporates the International Statistical Industrial Classification (ISIC) of economic activities.[10]

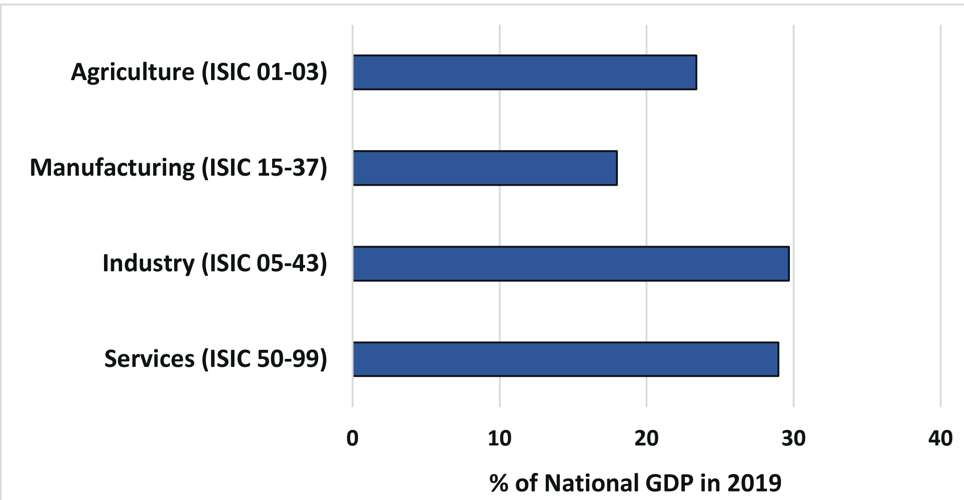


Figure 7 Broad-based Structure of the Economy in 2019 – Contributors to National GDP **(source: World Bank data)**

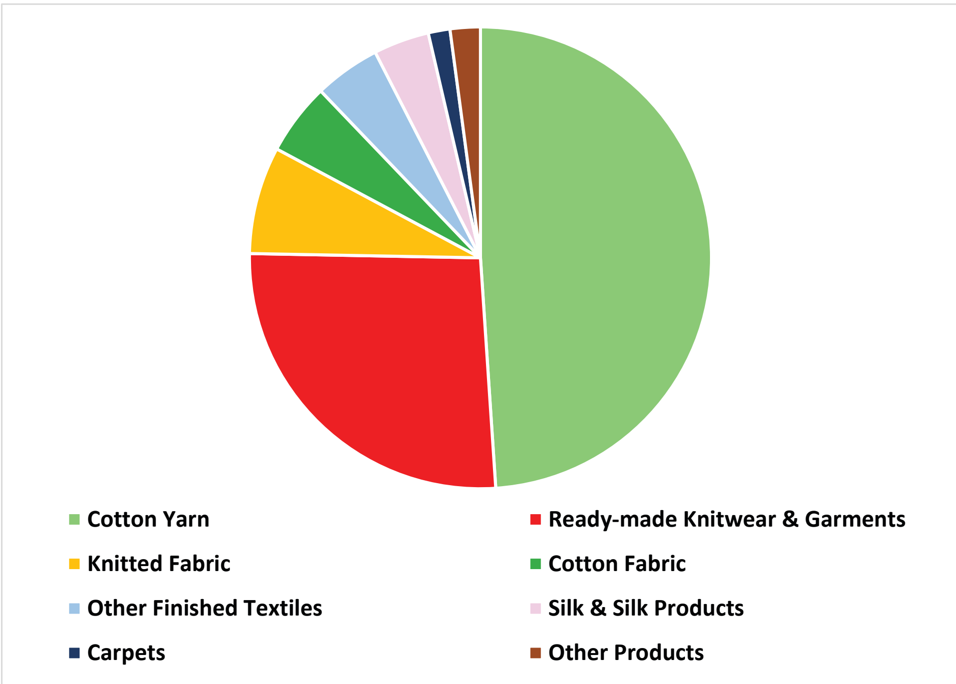
9 World Bank, World Development Indicators: Structure of Output http://wdi.worldbank.org/table/4.2
10 International Standard Industrial Classification of All Economic Activities (ISIC), https://ilostat.ilo.org/resources/concepts-and-definitions/classification-economic-activities/

Within this structural composition:

- Agriculture refers to the cultivation of food crops for human and animal consumption; the cultivation of cotton and the production of other raw textile materials such as wool and silk; livestock production; forestry; hunting; and fishing.
- Manufacturing comprises a diverse range of activities including the manufacture of leather, wood, and paper products; furniture; and other products. The category includes the manufacture of motor vehicles, aerospace equipment, machinery, and electronic equipment. While some of the latter products are manufactured in Uzbekistan, high quality, high-value items are mostly imported to Uzbekistan.
- Industry refers to mining and quarrying (including oil, gas, coal, and mineral ores); some manufacturing activities (ISIC divisions 10-33) that include those involved in making food, beverage and textile products, refining oil and gas, coking of coal, and production of basic metals; utilities – electricity, heat, water, gas, and waste management; construction; and other activities.
- Services refer to wholesale and retail trade (including tourism, hospitality, hotels and restaurants); transport; government, financial and professional services; education and health care; real estate and a range of other services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling.

The data shown in Figure 7 indicates a balanced economy, with no sector predominating to a significant extent, although future economic growth is expected to occur in the development of industrial sectors. In the textiles value chain, this will be achieved by moving up the value chain to the production of intermediate and finished products as elaborated in Annex E. In 2020, textile product exports (valued at USD 1,922.2 billion) comprised 12.7% of Uzbekistan's exports by value. Figure 8a indicates that cotton yarn (48.9%) and ready-made knitwear and garments (26.4%) contributed the most to export value in that year.

(a) Percentage Structure of Textile Exports by Product (valued at USD 1,922.2 billion)



(b) Percentage Structure of Textile Exports by Market (valued at USD 1,922.2 billion)

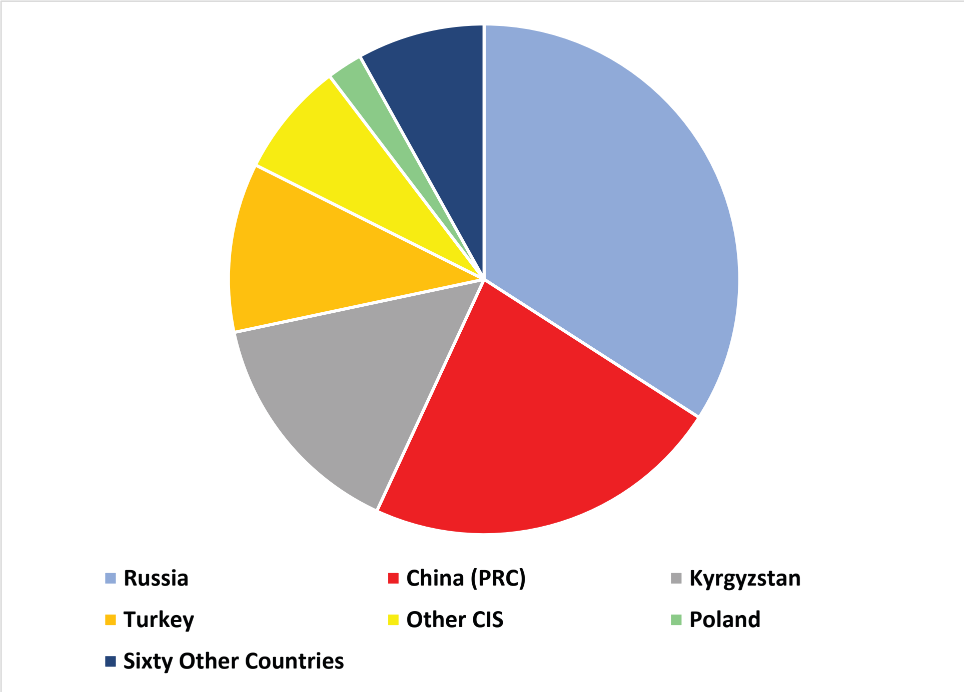


Figure 8 Structure of Textile Exports by Value (USD) in 2020

Figure 8b shows that the principal export markets were Russia (34.1%), China (22.8%) and other CIS States (22.0%), principally Kyrgyzstan but also Kazakhstan, Tajikistan, Ukraine, Belarus and Azerbaijan. In contrast, the export of raw cotton is now minimal, and any exports that do occur are thought to be made in fulfilment of existing long-term contracts.

3. SCP AND THE AGRICULTURE VALUE CHAIN

3.1 Scope of the Agriculture Value Chain

The agriculture value chain is comprehensive and links to several significant cross-sectoral themes, in particular to water resources, wastes management, energy and air quality. Figure 9 illustrates the sector's range and complexity and shows the many discrete steps in the value chain. Neither fishing nor forestry are shown in the value chain, since the significance of these activities is local rather than national, even though the principles outlined below apply to both. Broadly speaking, each step in the value chain can be considered to lie in one or other of the following economic stages:

- **Primary production sector**: cereals, vegetables, fruit, milk, eggs, wool, meat and animal hides
- **Secondary processing and production sector**: including cereal milling, bakeries, multiple food processing operations, dairies, meat processing, brewing, wine making, etc., the tanning of animal hides to produce leather, and the manufacture of shoes and other leather products
- **Tertiary or services sector**: covering the storage of raw and part-finished goods, their distribution, and the sale of finished goods through retail outlets ranging from large supermarkets in urban areas down to small shops in villages and towns
- **Final consumption**: of foodstuffs in domestic households, institutional canteens (work-place, educational, prison eating halls, etc.), and in the hospitality sector – hotels, restaurants, cafés, etc.; and the wearing of shoes and other products made from leather

Resources are used in each step, and various solid wastes, liquids and gaseous emissions are generated. In a green economy, actions are taken at each step to:

- Minimise resource consumption, waste arisings and emissions
- Substitute less harmful substances for potentially harmful resources, where possible
- Recover and treat solid and liquid wastes, with utilisation of the treated wastes wherever possible

In order to determine the scope for applying available SCP Tools and in the agricultural value chain it is necessary to analyse each step in turn, considering the ranges of resources and techniques employed, the wastes and emissions that result, and the appropriate actions to be undertaken to help bring about a greener economy. Sections 3.2 to 3.6 inclusive suggest the potential for applying resource efficiency, substitution and circularity approaches to manage resource inputs at each step in the value chain. **The most appropriate tools will depend on the specifics of each step in the value chain, but suggestions are made in the abovementioned sections.** The colour-coding shown below is adopted:

Key to Applicable SCP Tools and Measures

Resource efficiency	R
Substitution	S
Circularity	C

An appreciation of the undesirable environmental issues posed by these wastes and emissions, and how they may be better managed, is also needed so that the reasons why action is necessary may be best communicated to affected stakeholders. Sections 3.2 to 3.5 provide a qualitative analysis for the primary, secondary and tertiary sectors, while section 3.6 addresses final consumption.

Note: the contents of rows in the 'Resource Inputs' column and in the 'Wastes and Emissions' column are independent of each other (Figures 10 and similar).

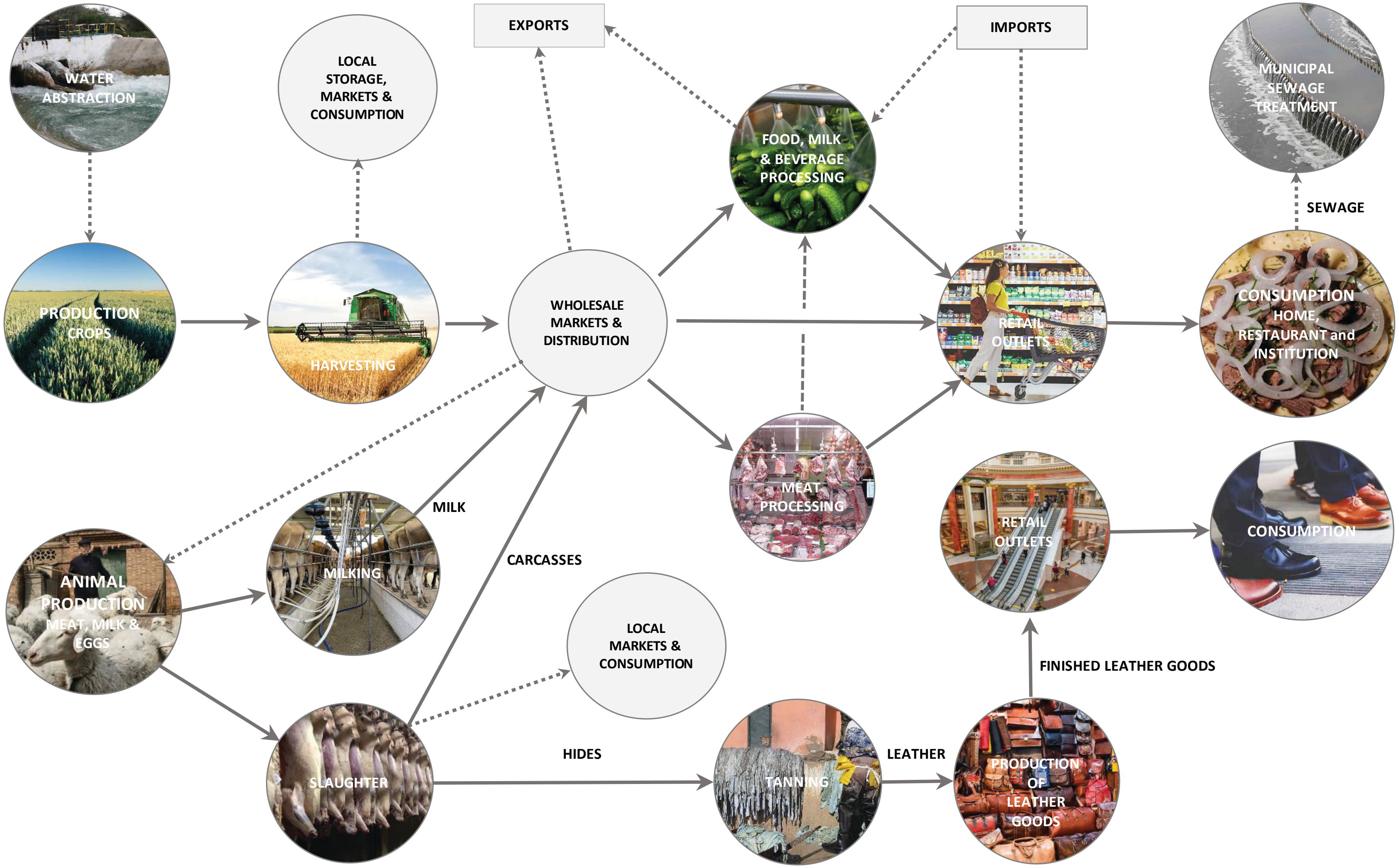


Figure 9 Mapping of the Product Chains for Agriculture, Agriculturally-Derived Products, and Consumption

3.2 Primary Production

Many types of resources are used in agricultural primary production, which may be broken down into three steps: (i) crop production (Figure 10), (ii) animal rearing – principally those animals that are housed for much or part of their lives, and (iii) slaughterhouses for both housed and free-ranging animals.

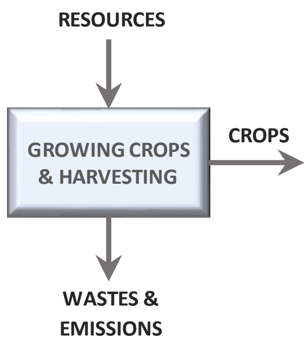
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
CROP PRODUCTION					
	Water	R		C	Crop spoilage – food waste
	Fertilisers – N and P	R	S	C	Crop residues
	Pesticides and herbicides	R	S	C	Emissions to air
	Seeds		S	C	Discharge to surface water & groundwater

Figure 10 Resource Inputs and Wastes Arising from Primary Production (Crops), and the Applicable Types of SCP Action

Crop Production and the Applicable Types of SCP Action

Crops include all cereals, vegetables and fruits whether grown for human or animal consumption. Adequate water and nutrients are essential whatever the crop grown, as is a healthy soil, and appropriate lighting and temperature conditions. While all these are prerequisites for good crop growth, farmers can make many choices which affect the impacts of crop production on resources and the environment. The introductory comments below address issues arising from specific resource use and waste arisings.

Water Consumption

The agricultural consumption of water (mainly for irrigation and crop watering, including the cotton crop) accounts for around 90% of the freshwater abstracted in Uzbekistan. Water conservation and efficiency measures to reduce overall water demand, thereby reducing the known pressures on the nation's river basins and water resources, must be applied as a priority in the agricultural sector. This need is reinforced by the priority given to increasing the availability of water to industrial sectors (including energy).[11]

The water resources actually available to Uzbekistan, therefore, need to be used with utmost efficiency, focused on the production of crops yielding high economic added value, and consistent, of course, with ensuring national food security and Uzbekistan's commitments to sustaining biodiversity.

SCP Tools and measures that may be applicable to making the most efficient use of water in crop production include the following:

- Maintenance of irrigation distribution systems (channels, etc.) to minimise leakage and evaporation losses
- Adoption of water-efficient crop watering techniques
- Innovation and adopting good practice guidance on the choice of crop and crop varieties grown – selecting crops requiring less water for their growth – with the twin goals of reducing water demand per hectare and increasing the added value of crops produced per hectare
- Innovation (medium- to long-term) to develop and plant seeds/plants that have been gene-edited (for example) to tolerate low levels of water availability or consume less water
- Adopting good practice guidance on the timing of water application (i) to soil prior to seed sowing/planting and (ii) to growing crops, the goal being to maximise the efficiency of water use

11 Concept for Development of Water Management in Uzbekistan, 2020–2030. Approved in 2020.

- Communication of good practices – both national and international – to the landowning and farming communities
- Outreach activities, providing advice and access to technical support on the above techniques

Policy measures that could help **incentivise farmers** to adopt the above tools and methods to reduce the water-intensity of crop production, many understood to be adopted currently, include the financial incentives presented by:

- Partial grants and subsidised loans for investing in water-efficient technologies
- Additional tax relief for making such investments

Policy measures that could help to **steer farmers** to adopt the above tools and methods to reduce the water-intensity of crop production include:

- Increasing the prices paid for water abstraction and use, the additional monies raised being used to invest in water efficiency measures and, for instance, outreach programmes to disseminate good practice
- Mandatory limits on the annual quantity of water abstracted from surface and groundwater resources for use in agriculture, those limits being enforced

Inorganic Fertiliser Consumption

Although the application of inorganic nitrogenous (N) and phosphate-based (P) fertilisers can boost crop production in the short-term, it does nothing to sustain the soil structure needed for healthy crop production in the long-term. Used to excess and in conjunction with over-ploughing or cultivation, such fertilisers may indirectly lead to exhaustion of the humous content of soil and increase the vulnerability of crops to water shortages. Also, several potentially significant environmental issues can result from the application of inorganic N and P fertilisers:

- The carbon footprint of these fertilisers is significant, their production involving substantial energy consumption (and the conversion of hydrocarbon feedstock in the case of N-fertiliser production). Their use, therefore, contributes to Uzbekistan's carbon footprint (whether nationally produced or imported) and GHG emissions.
- Dependent in part on the rate and timing of their application to land and their chemical speciation, N-fertilisers may degrade rapidly after application, releasing ammonia (NH_3) and nitrous oxide (N_2O). If not taken up by growing plants ammonia is either released to air as a gas or, if retained in the soil, oxidised to nitrite and nitrate-nitrogen in the soil moisture. Nitrous oxide is a GHG that is even more powerful in its effect than methane.
    - Ammonia is an air pollutant that may also react with other pollutants to form aerosols (fine particulate material, $PM_{2.5}$) that are harmful to human health
    - Oxidation of airborne ammonia may also contribute to acid rain and soil acidification in land distant from the site of fertiliser application
    - Oxidised nitrogen (nitrite and nitrate) may discharge diffusely into surface waters in wet periods, adversely affecting surface water quality and ecological state
    - Nitrite and nitrate-nitrogen may also percolate downwards into the groundwater with adverse effects for water quality, especially if the groundwater is used as a source of drinking water
- Dependent in part on the rate and timing of their application to land and their chemical speciation, break-down of the applied P-fertiliser may release more phosphate (PO_4) than can be readily assimilated by the growing crops. Excess PO_4 leaches out into surface waters and groundwater, potentially causing water pollution, and the eutrophication of water courses in particular.

SCP tools and measures related to the use of inorganic fertilisers principally involve the adoption of available good practice guidance.[12] Guidance should be sought on (i) when and how much of these fertilisers are applied, (ii) the types of inorganic fertiliser applied – for instance, the use of ammonium carbonate is banned in the EU, (iii) the partial or total substitution of organic N and P containing wastes for inorganic fertilisers, and (iv) effective communication and outreach programmes to disseminate good practice and guidance:

12 The UNECE Framework Code (2014) for Good Agricultural Practice for Reducing Ammonia Emissions,

- Subject to appropriate pre-treatment, controls to limit their application rates, and crop type, organic wastes such as animal manure, sewage sludge, and composted food and green wastes may be applied to arable land (and pasture) as a partial or total substitute for inorganic fertilisers.[13]
  - Salad vegetables which are eaten raw are examples of crops where the application of such materials may not be appropriate or is severely constrained
  - International good practice guidance and regulatory approaches may be taken as foundations for the development of trial-based guidance tailored to Uzbekistan's climatic range and crop types

Organic farming practices seeks to minimise or eliminate the use of chemicals, including inorganic fertilisers, going beyond the partial substitution of inorganic fertilisers by such treated wastes.

Pesticides and Herbicides

Pesticides and herbicides are hazardous substances by definition and are commonly used in modern agriculture: (i) to protect growing crops from depredation and infestation by pests and (ii) to suppress the growth of unwanted plants (weeds) that may compete for the light, water and the nutrients needed by crops.

However, their indiscriminate and excessive use can contaminate crop products, for example when applied to the surfaces of growing fruit and vegetables, posing health risks to the consuming population. Their adsorption onto soil particles, subsequently carried by surface water run-off to rivers and streams, may result in spreading the chemicals further afield.

Adhering to good practice guidance can reduce the quantities of these chemicals that are used and reduce such undesirable risks. Good practice can involve the use of naturally occurring substances instead of synthetic pesticides and herbicides.

Crop Spoilage

According to an estimate made in 2011 by the UN's Food and Agriculture Organization, about a third of all food produced globally is lost as food waste.[14] More refined estimates prepared in 2016 suggest that the average food loss from post-harvest up to but excluding food retailing was 13.8% globally but 20.7% in central and southern Asia.[15] Post-harvest crop spoilage arises from handling operations and storage. The adoption of post-harvest good practices not only reduces food waste but increases net output, productivity and the effective efficiency of all resource inputs to crop production.[16]

Crop Residue Management

After crops have been harvested a common traditional practice has been to burn the dried residues *in situ* – in the field. Field burning releases many pollutants to air including the products of incomplete combustion, such as particulate matter (both PM_{10} and the finer fraction $PM_{2.5}$), black carbon, PAHs, dioxins and furans. Nitrogen oxides (NOx) are also emitted into the air. Depending on the field burning locations relative to populated areas, and weather conditions, the air pollutants generated may contribute to health risks to surrounding populations subjected to the polluted air, and field burning can moreover cause severe nuisance.

Where field burning is practised, alternative methods of managing crop residues may be considered, adopting good practice. Alternative methods of dealing with residues include:

- Baling straw and other residues and transporting the compressed bales to engineered straw bale burning facilities equipped with energy recovery; the ashes may be applied to land as a fertiliser.
- Incorporating the residues into the soil by ploughing or other techniques, helping to sustain the humus and soil structure.
- Composting the residues and applying them to the land as a soil conditioner.

13 See, for example: WRAP (2016), Digest and Compost Use in Agriculture – Good practice guidance for agricultural contractors. https://wrap.org.uk/resources/guide/compost-and-digestate-agriculture-good-practice-guide

14 https://www.fao.org/food-loss-and-food-waste/flw-data

15 https://www.fao.org/sustainable-development-goals/indicators/12.3.1/en/

16 See, for example: https://www.fao.org/3/x0039e/X0039E01.htm

Ecosystems and Biodiversity

Sustainability relates not only to the physical world and the resources it provides to humanity but also, and perhaps even more so, to nature – the ecological system also inhabited by humankind. Sustainable development goal SDG 15 (Annex C) specifically refers to the protection, restoration and sustainable use of terrestrial ecosystems (including rivers and inland waters) and to halting the loss of biodiversity. Through the use of various chemicals and land management practices, agriculture, especially when practised intensively, is a major source of the pressures exerted on nature. This may be observed anywhere, whatever the state of economic development.[17]

Hence, changes in agricultural practice should be considered not only as a resource issue but for their repercussions in nature – on its ecosystems and biodiversity.

Animal rearing

Many animal species – including cattle, horses, pigs, goats, sheep, camels, chickens and other fowl – are raised to provide meat and/or other resources. Some are housed for at least part of their lives while others range more or less freely prior to collection and slaughter. Milk, eggs and wool are harvested from live animals while slaughtered animals provide meat, hides, skins, feathers and other animal by-products. The introductory comments below concern resources consumption and the wastes and emissions generated – see Figure 11. Good practice guidance is available.[18]

Food and Feeding Regime

A major issue in animal rearing, as with fertiliser applications in crop production, is the emission of nitrogen as ammonia. In general up to 90% of a nation's ammonia emissions to air are generated by the agricultural sector, of which about two-thirds can result from animal rearing. Increasing evidence points to the significant role that ammonia plays worldwide in the formation of secondary fine particulate matter ($PM_{2.5}$), $PM_{2.5}$ air pollution, and the health impacts of air pollution – $PM_{2.5}$ being the major air pollutant of concern for human health.[19]

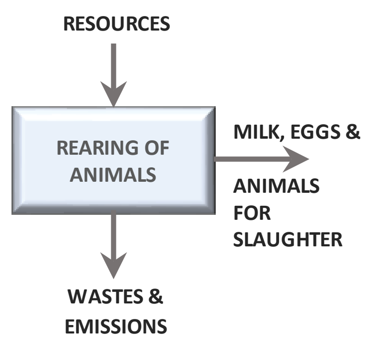
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
(HOUSED) ANIMAL REARING					
	Food – including additives	R	S	C	Manure – faeces & urine, bedding
	Water – drinking, cleaning	R			Emissions to air – ammonia, methane
	Bedding	R	S	C	Wastewater
	Energy – ventilation, heat	R			

Figure 11 Resource Inputs and Wastes Arising from Primary Production (Animals), and the Applicable Types of SCP Action

17 In the UK for instance, agricultural practices are associated with significant ecological impacts. See *The State of Nature 2019*., UK-wide assessment and national summaries available online at: https://nbn.org.uk/stateofnature2019/reports. Highlights are included in Frost RC and Newman PJ (2021) FWR Publication FR/G0011, 'Freshwater and Wetland Habits – Opportunities to Get Involved in their Conservation and Restoration.

18 Although the BAT Reference Document and BAT Conclusions published by the European IPPC Bureau refer specifically to the intensive rearing of poultry and pigs, many of the good practices that may be found there are generally applicable to rearing other animals. See: https://eippcb.jrc.ec.europa.eu/reference/intensive-rearing-poultry-or-pigs-0.

19 World Health Organization https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

Management of the nitrogen cycle therefore is one of the central features of modern, sustainable agriculture and animal feeding is just one aspect that has to be considered.[20] Housed animals need to be fed while free-ranging animals may also receive feed supplements, especially in harsh weather. Feeding regimes, therefore, need to take account of the lower protein conversion and higher ammonia emission rates when animals are fed high-protein feed.

Authorised food additives - to animal feed and/or drinking water – may be used to perform one or more specific functions[21], for example:

- In meeting the animals' nutritional requirements
- To improve the quality of feed and/or the quality of food (for human consumption) from animal origin (e.g. meat, fish, milk, eggs)
- To improve the animals' performance and health

The use of antibiotics as feed additives used to be permitted in the EU and UK but, with limited exceptions, their use is now prohibited. Coccidiostats and histomonostats are exceptions – these are antiprotozoal agents that act upon Coccidia parasites in poultry and sheep, for example.

Emissions of methane (a potent Greenhouse Gas, GHG) by ruminant animals such as sheep, cattle and horses – whether housed or free ranging – is probably an inescapable consequence of animal rearing. However, studies have suggested that emission volumes depend to an extent on animal diet and might therefore be reduced.

A further issue concerns the resource inefficiencies and associated generation of wastes implicit in producing food for animal consumption and its conversion into animal protein for human consumption. At-source means of reducing resource consumption, waste generation and methane emissions from animal rearing include a societal-wide change of diet, namely eating more cereal products, vegetables and fruit; and eating less meat and other protein-rich foods of animal origin. While such considerations may be culturally challenging, it is an issue that is raised and debated in Europe and elsewhere – not only for reasons of GHG emissions mitigation but as a healthier lifestyle choice.

Cleaning

Animal housing needs to be cleaned as a matter of routine. Cleaning will probably generate solid wastes such as soiled straw or other materials used as bedding, and wastewater from washing surfaces with water. However, care should be taken to avoid using excessive volumes of water when cleaning (for reasons of resource efficiency) and avoiding unnecessary mixing of cleaning wastewater with the manures and soiled bedding. Mixing lightly contaminated wastewater with manure dilutes the manure which may increase the cost and reduce the effectiveness of its treatment by anaerobic or aerobic digestion. While the wastewater generated initially in hosing down a soiled floor, for example, might be heavily contaminated and may be handled with the manure and soiled bedding, the wastewater generated subsequently is likely to be much less contaminated and it may be better treated by other means.

Manures and their Management

The excreta (faeces and urine) of free-ranging animals naturally falls onto land where it degrades naturally through a combination of aerobic and anaerobic processes and becomes incorporated into the soil. For housed animals, their wastes need to be collected, treated and disposed of effectively in order to reduce their potential adverse environmental effects and to recover useful energy and nutrients. Bedding that is biodegradable, such as straw, may be treated and disposed of with animal manure.

20 The UNECE Framework Code (of 2014) for Good Agricultural Practice for Reducing Ammonia Emissions. Available at: https://unece.org/environment-policy/publications/framework-code-good-agricultural-practice-reducing-ammonia.

21 In the EU and the UK, for instance, they are regulated through EU Regulation 1831/2003, which means that they can be: placed on the market only if they have been authorised for use and are used only for the purpose stated within the authorisation. See: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A02003R1831-20190726

Potential adverse effects resulting from the improper management of animal manures include the transmission of pathogenic organisms; high emissions of ammonia and methane to air; water pollution if either raw or treated manures are stored near to and are allowed to enter surface freshwater bodies and/or pollution of groundwater if they are stored in unlined ponds or lagoons; and severe odour nuisances if operations are conducted close to inhabited areas. Good practice techniques therefore should be adopted, including:

- Heated anaerobic digestion of manures coupled with the combustion of recovered biogas for digester heating and heat/power generation. An alternative option that may be considered, is the composting of mixed manures, bedding and other solid biodegradable wastes. Considering the climatic features of the northern regions, composting of waste can take place in enclosed areas or using a pile cover.
- Storage of untreated and treated wastes in ventilated housing or tanks, the air extracted being fed with air extracted from ventilated animal housing to digester gas burners, or treated otherwise.
- Lined and bunded storage areas to prevent surface water and groundwater pollution.
- Application of treated manures to arable land or pasture, reducing the need to apply synthetic inorganic fertilisers.

Wastewater and its Management

Wastewater generated in the cleaning of animal housing will be contaminated to a varying extent. Low volumes of highly contaminated wastewater, e.g. the first flush of wastewater from cleaning soiled floor areas and drains, may be mixed and treated with the manure and soiled animal bedding. Where climatic considerations permit, less contaminated wastewater may be treated in lagoons having a relatively long residence time, allowing sedimentation, natural degradation and oxidation processes to take place, prior to the discharge of treated effluent to surface water. Where climatic factors prevent such operations then it may be necessary to develop alternative good practice approaches.

Emissions to Air

As noted above, methane (a powerful GHG) and ammonia are the principal emissions to air of environmental concern, to which odour nuisance may be added in some locations. Adoption of good practice techniques – many have been documented and are available – should become the norm. Some research and development may be needed, however, to adapt them to accommodate Uzbekistan's climatic range and other potential considerations.

Slaughterhouses and Animal By-product Production

Whether housed or allowed to range freely, most farm animals raised by humans are destined for the slaughterhouse, either small-scale local operations or industrial-scale abattoirs.

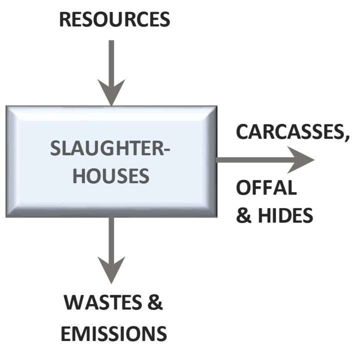
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
SLAUGHTERHOUSES					
	Animals for slaughter			C	Animal parts (waste)
	Energy – chilling & heating	R			Animal excreta – faeces & urine
	Water - cleaning	R		C	Wastewater

Figure 12 Resource Inputs and Wastes Arising from Primary Production (Slaughterhouses), and Applicable Types of SCP Action

The introductory comments below relate mainly to the consumption of resources and the generation of wastes and emissions in industrial-scale facilities – see Figure 12. Good practice for slaughterhouses and the production of animal by-products may be found in the appropriate BAT Reference Document: issued in 2005 (currently undergoing revision: the 1st draft of this revision was published in June 2021.)[22]

Resources Consumed and Wastes Generated

In addition to the provision of drinking water to animals held in pens or stockyards, slaughterhouses consume freshwater in washing down surfaces and cleaning of carcasses and animal parts (such as the intestinal tract). Energy is required also for space heating, hot water and steam-cleaning, stunning of animals prior to slaughter, and chilling of the skinned carcasses and by-products prior to further transport. Forming part of good practice, SCP tools and measures should be used to ensure that water and energy are used efficiently, and that wastewater is captured effectively.

In addition to carcasses that pass inspection for disease, significant by-products of animal slaughter can include offal (organs selected for human consumption or pet food), blood (as the basis for certain foodstuffs), untreated hides and skins, feathers, and other animal parts that can be either eaten or used to make food and non-food products.

All other non-retained parts of the slaughtered animals, including unwanted bones, form a significant waste stream that should be managed in a hygienic and environmentally acceptable manner. Good practice should be adhered to, including the separation of solid and waterborne wastes.

Animal excreta (faeces and urine) generated in the holding pens (lairage), in the slaughtering process, and produced in the post-slaughter cleaning of intestinal tracts, contribute to the waste streams. This waste, together with wastewater from other cleaning operations, should be managed using good practice at least as stringent as that applied to farm-generated manures.

3.3 Secondary Production

Food and beverage processing and packaging

Shown schematically in Figure 13, food and beverage production involves a wide and diverse range of activities. In addition to the transport and local storage of raw foodstuffs, intermediate and processed products are operations that need to be considered.

STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
PROCESSING AND PACKAGING OF FOODS AND BEVERAGES					
	Primary feedstocks: meat, fish, milk, cereals, vegetables, fruit, pulses, fungi etc.	R			Food wastes
	Other food ingredients and additives	R	S		Packaging wastes
	Packaging & other material	R	S	C	Other solid wastes
	Energy	R	S		Wastewater
	Water – process & cooling	R			Cooling water
	Chemicals	R	S		Emissions

Figure 13 Resource Inputs to and Wastes Arising from Food & Beverage Production, and the Applicable Types of SCP Action

Activities include:

- Bakeries – bread, pasta and pastries, etc.
- Bottling of beverages, vegetables and fruits, etc.

22 https://eippcb.jrc.ec.europa.eu/reference/slaughterhouses-and-animals-products-industries

- Butchering – preparing meat for retail sale
- Brewing – beer and other liquors produced by the fermentation of cereals, potatoes, etc.
- Canning of processed foodstuffs
- Dairies – milk pasteurisation and sterilisation, production of dried milk powder, cheeses, cream, yoghurts, kefir and other fermented products
- Distillation – of wines and other brewing liquors to make brandy, vodka and other high-strength liquors
- Freezing of meat, vegetables and fruits for sale
- Meat processing, e.g. to make mince, sausages, etc.
- Milling of cereal grains
- Packaging (primary and secondary) of foods and beverages
- Pet food production
- Pickling of vegetables, mushrooms and fruits
- Processing of raw and other food ingredients to make ready-meals, confectionary, etc.
- Storage of raw and processed foods, in bulk or small-scale
- Vinification – fermentation of grapes (and fruit) to make wine

Resource Efficiency

Generic SCP tools for identifying resource wastage and measures to improve resource efficiency are applicable to all food processing and beverage production operations. This applies to each agri-food sub-sectors although the precise measures adopted will be sub-sector and site specific. From an economic and financial perspective, it can be expected that taking SCP action to reduce the wastage of primary feedstock material will be especially beneficial since this material wastage represents lost product value. Relatively simple monitoring can indicate the amount of potential product wastage. For instance, monitoring the flowrate and chemical oxygen demand (COD) or organic carbon content of a dairy's wastewater – mostly associated with milk and other product or by-product losses – can readily give an indication of 'lost' product value. However, the efficiency with which the other resources noted in Figure 13 are used should be considered at all production-sites, using SCP tools. Expanding the sample presented in Table 3 (Chapter 1), those of most immediate practical relevance to the resource efficiency of food processing operations at the enterprise level are:

Baseline Assessment	Good Practice Guides and Case Studies
BAT Reference/Conclusions	Heat Exchanger Networks
Benchmarking	Mass and Energy Balances
Champions for resource efficiency	Metering, Monitoring and Sampling
Counter-current washing/heat-exchange	Resource Efficiency & Waste Minimisation Clubs
Environmental Management System	Separation of Wastes at Source
Fishbone Analysis	Walk-through Audit

Additives and Chemicals

The possibilities to reduce the addition of other food ingredients, or their substitution by other, healthier alternatives may also be considered. Examples of common ingredients and additives whose use may have undesirable side-effects for human health include salt, sugar, curing and preservative agents such as nitrites in processed meat, and a range of synthetic colouring and favouring agents. Similarly the quantity and type of chemical substances used for cleaning (for product safety and hygiene reasons) in the processing of food and beverages, and bottling operations, should be examined.

Packaging and Packaging Waste

Packaging is needed for the distribution, storage, presentation to consumers at retail outlets, and storage of food products in the kitchens of households, institutions and hospitality venues. It thus serves several purposes: protecting food from contamination, enabling its efficient transport and storage, serving as a medium for product advertising and the conveying of product information to the purchaser/consumer, and as a convenience for the consumer. Three levels of packaging may be identified: [23]

1) *Primary packaging* to contain and prevent contamination and spoilage of a product is usually essential and takes many forms: e.g. bottles (glass, plastic), jars, cans, cartons (plastic, cardboard and composite), tubes, plastic pouches or bags (e.g. to contain frozen foods), cardboard, and (portion) wrappers.
2) *Secondary packaging* for the ease of retailers and consumers includes e.g. cardboard boxes containing primary packaged products; shrink-wrapping to bind several cans, bottles or packets together.
3) *Tertiary packaging* to reduce damage during transport and for the ease of distributors and retailers includes pallets to support boxes containing primary-packaged products, and shrink-wrapping of such boxes to form a larger 'package', etc.

In meeting these and other requirements the cumulative consumption of packaging materials can be excessive, while the use of composite materials (such as plasticised cardboard, e.g. Tetra Pak) may result in the recovery and recycling of packaging material becoming impracticable. Food processors and distributors therefore should pay attention to all aspects of packaging design and materials specification in order to:

- Reduce the quantity of primary, secondary and tertiary packaging materials, and thus the resources consumed in their manufacture, to the minimum needed to meet functional requirements (this will also reduce the quantity of waste packaging arising at retail outlets and household consumers, etc.)
- Require that the producers and suppliers of packaging use recycled materials to as great an extent as practicable, and to at least the extent that Government may mandate
- Wherever possible, avoid the use of composite materials that inhibit or prevent the recycling of packaging waste
- Include signage on primary packaging to inform consumers as to whether the packaging waste may be recycled and, where this is so, to which waste stream it should be classified when separating at source. Allied to other measures, this will help enable final consumers to practice at-source separation of household and similar wastes, thereby enhancing the recycling of household and similar wastes.
- Replace materials that are difficult to recover and recycle with materials that can be reused, recycled, or processed for incorporation into the environment.[24]

SCP tools that are most relevant to packaging design and material specification include:

Benchmarking	Good Practice Guides and Case Studies
Champions for minimal packaging	Innovation
Cleaner Design	Life-Cycle-Analysis
Communication	Mapping the Sectoral Value Chain
Environmental Management System	Mass and Energy Balances
Fishbone Analysis	Metering, Monitoring and Sampling

Management of Food Wastes and Wastewater

Food wastes and wastewaters are generated at each stage of food and beverage processing. Their characteristics will be highly dependent on the nature of the feedstock and the operation, but it is likely that all may be biodegradable and therefore amenable to some form of biochemical processing, whether anaerobic or aerobic. In general, and where feasible, it is advisable that:

23 See, for instance, the EU's Packaging and Packaging Waste Directive 94/62/EC as amended by (EU) 2018/852.

24 An example of the latter, in the retail sector, is the replacement of plastic bags for holding loose vegetables and fruit by clear bags made from potato starch.

- Food waste streams are segregated according to whether they are solid, high-strength waterborne waste, or low-strength wastewater
- Where (solid) food wastes are deemed unfit for human consumption, they may be considered as feedstock for pet-food production; otherwise:

  - solid and high-strength waterborne food waste – including animal fats and greases - may be treated in heated anaerobic digestion reactors, utilising the generated biogas to provide process heating and for other beneficial purposes

  - aerobic treatment of solid food waste by composting is another possibility

- Medium to low-strength waterborne food wastes may be treated aerobically in wastewater treatment plants – there are many designs
- Unless there is a valid reason, spent cooling water should not be mixed with other waste/wastewater streams but discharged to surface water or to the sewerage system (mixing with food wastewaters increases wastewater volumes and treatment costs)

Subject to sanitary and hygienic protocols being adhered to, and ensuring that appropriate safeguards are upheld, treated food wastes may be utilised in agriculture as a soil additive, providing humus and partially substituting for inorganic fertilisers (N and P).

Management of Other Wastes and Emissions

Other solid wastes generated in food and beverage processing may be similar to household municipal solid waste (MSW). They may be managed similarly. Emissions from food processing operations and food waste treatment processes can cause major smell nuisance. Depending on their location, it may be necessary to treat the emissions in an odour removal process.

Leather and leather goods production

The production of leather involves the chemical stabilisation of raw animal hides and skins, a process known as tanning (see Figure 14, adapted from the BAT Reference document referred to in footnote 26). Appropriate levels of care need to be exercised in leather production as the stabilising agents, solvents (releasing non-methane volatile organic carbon substances (NMVOCs) to air), and other chemicals used, typically have hazardous properties.

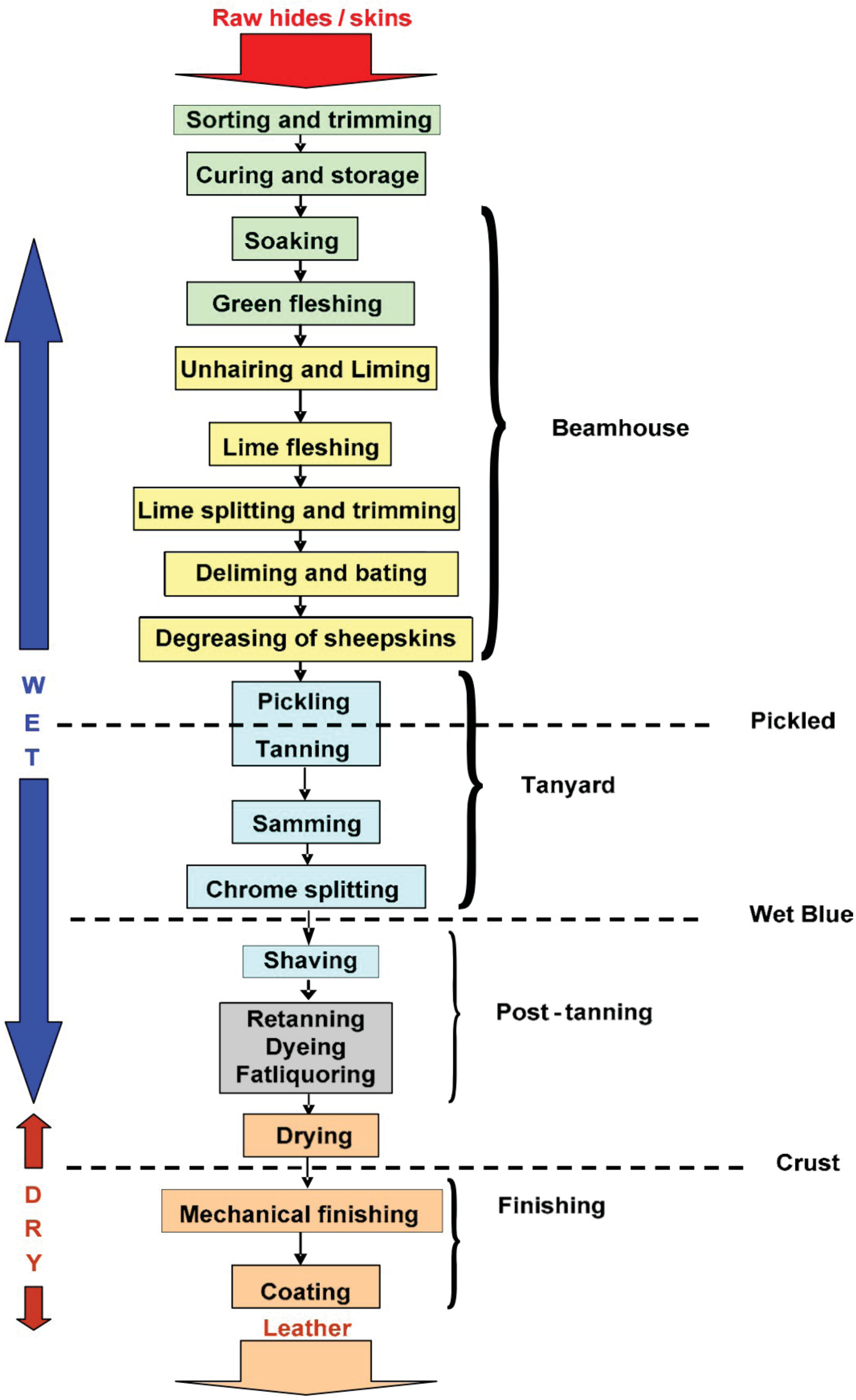


Figure 14. Process steps in the (chrome tanning) production of leather (BAT Reference Document)

The European Commission's BAT Reference Document for the Tanning of Hides and Skins gives a comprehensive description of the many steps involved in the process, and of applicable BAT, but is over 270 pages long.[25] Published in 2007, the World Bank Group's Environmental, Health, and Safety Guidelines for Tanning and Leather Finishing provides an easier 21-page introductory description to leather production and a good practice summary.[26]

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25 JRC Reference Reports, 2013, European Commission, *Best Available Techniques (BAT) Reference Document for the Tanning of Hides and Skins*, p.13.

26 IFC, World Bank Group (April 2007). 'Environmental Safety and Health Guidelines for Tanning and Leather Finishing'.

Figure 15 shows schematically the main types of resource inputs to, and wastes and emissions generated from tanning and leather finishing. SCP tools to identify resource efficiency saving measures, such as may be found by reference to good practice documentation, will likely play the major role, although substitution and circularity actions may also be relevant. Opportunities to substitute less-hazardous tanning chemicals and leather finishing solvents should be sought and implemented where feasible.

The wastes and emissions from tanning and leather finishing operations are environmentally damaging unless appropriately treated. Therefore adopting good practice guidance is essential.

STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
TANNING OF ANIMAL HIDES					
	Hides and skins	R		C	Raw hides and skins – trimmings, hair, grease and spoilage
	Tanning chemicals	R	S	C	Tanned hides and skins – trimmings and spoilage
	Solvents and other chemicals	R	S		Chemical wastes, drums, sludge etc.
	Water	R			Wastewater
	Energy	R	S		Emissions to air

Figure 15 Resource Inputs to and Wastes Arising from the Tanning of Animal Hides and the Applicable Types of SCP Action

The production of leather goods such as shoes, clothing, furniture upholstery and so on may be carried out in small workshops or as a large-scale activity employing many people. Whatever the scale, typical leather working operations include cutting to shape, stitching, gluing and trimming. Principal issues are to minimise the wastage of tanned and finished leather and ensuring that glues and solvents are used responsibly so as not to cause adverse health problems among leather workers.

3.4 Tertiary Sectors

Storage and distribution

Foodstuffs may be stored between most stages of production, and food wastage may occur at storage facilities and in transport operations: e.g. foodstuffs being eaten and or spoiled by vermin; spoilage resulting from inappropriate handling and storage conditions; spillages; etc. Tools such as baseline assessment, walk-through auditing and fishbone analysis are well-suited to identifying the sources and causes of such waste. Good practice should be adopted to minimise foodstuff waste, and to build knowledge and capacity in the treatment, use, and disposal of any wastes that do arise.[27]

Electricity is consumed in the storage and distribution of chilled and frozen foods. To ensure that this resource is used efficiently, attention should be paid to thermal insulation of cold container and storage units, and in maintenance and operating conditions. The replacement of old, inefficient units with new ones having higher design efficiency should also be considered.

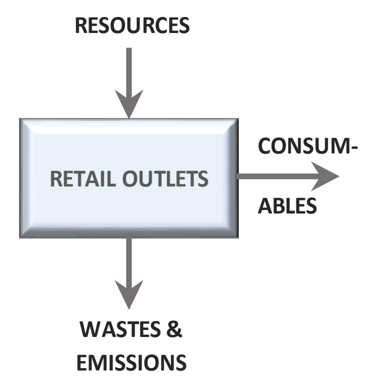
Should failures in transport logistics cause delays, perishable foods are the most vulnerable. Where this is an issue, baseline assessment and fishbone analysis may help in the assessment of current transport arrangements and assist in identifying effective measures to improve them.

Retail Outlets

Foodstuffs, beverages, footwear and other products for consumption are obtained by consumers from retail outlets. There are many types of outlets, ranging from local markets where products are sold by individuals on a semi-casual basis, through dedicated outlets such as bakery shops and retail butchers, small-scale local supermarkets that sell numerous goods (although the range of their stock might be limited), up to large

27 See, for example, the resources made available by WRAP: https://wrap.org.uk/taking-action/food-drink/sectors/manufacturers-brands

supermarkets able to provide a comprehensive range of products and services. Some of the latter may also provide their goods to consumers via a delivery service, the goods having been ordered over the internet. Figure 16 shows schematically the main resource inputs and the wastes and emissions generated. While appropriate good practice is applicable to all types and scales of retail outlet, the comment and discussion below is directed primarily at supermarkets and specialised shops.



STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
RETAIL OUTLETS					
	Foodstuffs etc.	R		C	Food wastes
	Packaging	R	S	C	Packaging wastes
	Energy – heating, chilling, freezing, lighting, etc.	R	S	C	Other solid wastes including used lamps & other equipment
	Water	R			Emissions to air – including refrigerants
	Transport (delivery to meet internet orders)	R	S	C	Wastewater

Figure 16 Resource Inputs to and Wastes Arising at Retail Outlets, and Applicable Types of SCP Action

Food Waste

Food waste (including beverages) at retail outlets results from foodstuff storage conditions, along with how they are packaged, displayed and handled on site. Waste is also created by store ‘sell-by date’ policies and practices, which lead to products being withdrawn from sale when not sold by the due date, because the withdrawn product then enters the waste stream.

Food wastage can also occur indirectly as a consequence of an outlet’s other policies and practice. For instance, large-scale supermarkets may have contractual agreements with commercial farmers that stipulate (unnecessarily) rigorous standards on the visual appearance of vegetable produce. The application of such standards may require the farmer to discard harvested produce as waste if it fails to meet these standards. Another example is where, for reasons of hygiene and food safety, an outlet (and supplier) applies ‘best before date’ information on products for sale. However, adopting an over-cautious approach can result in, say, a householder throwing away as ‘waste’ a food product as waste a product that is near to or beyond its ‘best before date’, even though its appearance (sight, smell, etc.) causes no concern.

Good practice to prevent and minimise the generation of food waste should be adopted at all retail outlets.[28] This can include participation in food banks whereby tinned and otherwise unwanted but packaged food products may be provided to poorer members of the local community. Consumer deposition at retail outlets of similarly unwanted food and beverage products can be included in such arrangements (see section 3.5).

Food waste that does occur should be collected separately, transferred to processing centres for treatment by anaerobic digestion or composting, and applied to land as a partial substitute for synthetic inorganic fertilisers and as a source of humus.

Packaging and Packaging Waste

The retail sector is largely the recipient of packaging (primary, secondary and tertiary). However, large retail outlets such as major supermarket chains act in many respects as wholesalers, not only as retailers. They may be able therefore to exert pressure on their suppliers to adopt good packaging practice (section 3.3). Wherever possible they should do so. They may be able to act in partnership – as members of a retail supply chain – to optimally reduce packaging and jointly agree target indicators.[29] Other areas where retail outlets may act to reduce packaging waste and increase the resource efficiency of the supply chain include:

28 See, for example, the resources made available by WRAP: https://wrap.org.uk/taking-action/food-drink/sectors/retailers

29 Retail outlets in EU member states are subject as economic operators to the provisions of the EU’s Packaging and Packaging Waste Directive 94/62/EC as amended by (EU) 2018/852.

- Ensuring that all primary, secondary and tertiary packaging waste generated at the retail outlet is collected separately from other solid wastes – in order to prevent and minimise cross-contamination - and that arrangements are put in place for its transfer to recycling entities. The latter include producers of cardboard who may pulp the recovered carboard waste, employing it as a partial feedstock;
- Stop providing customers with plastic carrier bags – whether free or not – for bulk purchases, substituting (free) paper bags or paid-for durable bags made of natural materials;
- Substitute bags made from compostable cellulosic material for thin-film plastic bags. Typically, customers may be provided with these to place several items of a product sold loosely (e.g. bread rolls, apples, etc.). Inform and encourage customers to reuse the bags where possible and to dispose of the substitute bags with green waste where facilities are available. Adopting these measures helps to minimise the generation of plastic waste;
- Participate in glass bottle (deposit and) return schemes, enabling customers to return empty bottles (with or without payment), for bulk transfer from the retailer to bottling plants;
- Provide space on available land, e.g. in associated car parking lots, for segregated packaging waste – cardboard and cleaned glass bottles, tinned cans and plastic bottles – enabling its collection and transfer to recycling entities.

Other Solid Wastes

Collected separately from food wastes and clean packaging wastes, all other solid wastes generated at retail outlets may be managed as a component or components of municipal solid waste (see section 3.5 and Chapter 6, Section 6.3).

Energy

Chilling and freezer compartments, space heating and lighting all contribute to the energy consumption of retail premises. The use of resource efficiency tools to benchmark an outlet's energy consumption and identify the scope for improving its performance should be considered at each site, and certainly at major sites. Good practice measures to reduce energy consumption should be adopted and, where feasible, renewable energy resources (such as heat pumps) considered for local substitution.

When considering the carbon footprint of a major food retailing entity, the energy consumption and GHG emissions of its product delivery fleet - supplying consumers directly (where ordering on-line is available) - should also be taken into consideration.

Other Considerations

Food production that adopts organic farming techniques typically eschews the use of synthetic fertiliser, pesticide and herbicide chemicals – relying on 'more natural' methods including the application of natural products and techniques to provide nutrients and pest control. Retail outlets may help promote the production, sale and consumption of such 'cleaner' organic products through the provision of aisles dedicated to organic produce.

3.5 Final Consumption

Food and beverages

Food and drinks are prepared, served and consumed in households, the hospitality sector (cafes, restaurants, hotels, etc.), industrial and commercial premises (offices, workers' restaurants, etc.), and institutional settings (hospitals, universities, government buildings, etc.). Figure 18 shows the main resource inputs and the wastes and emissions generated.

STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
CONSUMPTION					
RESOURCES ↓ CONSUMPTION ↓ WASTES & EMISSIONS	Foodstuffs including beverages	R			Food wastes
	Energy – cooking, heating, chilling, freezing	R	S		Packaging wastes
	Appliances – cooking, chilling, freezing	R	S	C	Wastewater
	Water – cooking, cleaning	R			Emissions – direct & indirect

Figure 17 Resource Inputs to and Wastes Arising from Final Consumption, and the Applicable Types of SCP Action

Food Wastes

At each step of food handling, waste is generated: storage whether in the kitchen or larder, meal preparation, serving food (with food left over on the serving dish), and eating meals (with left-over food remaining on the plate). Much of the wastage results from consumer behaviour, which may be more or less easy or difficult to change. However, moderation of consumer behaviour may be achieved through education and concerted communication effort. A number of examples illustrate the influence of behaviour on food wastage in final consumption. Depending on economic circumstances some at least of the behaviours indicated below might not apply:

- Frequency of household food buying: a household where one member of that household is the chief food buyer and meal preparer, who shops for food on a daily basis, buying as needed for the day ahead, is likely to waste much less food than one where food is bought once a week. The latter household will likely overbuy – 'just in case' – and this is behaviour whose effects are exacerbated when unplanned meals out are taken, leading to stored food becoming stale and surplus food accumulating.
- A tradition of generous hospitality, which can lead to excessive quantities of food being prepared at home, or ordered at a restaurant, with considerable wastage at the end of the meal; the net wastage may nonetheless be minimised if the leftover food is saved (at home), or taken away (at a restaurant) for consumption the following day or so.;
- How people respond to 'best-before' date information stamped on packaged food is a further factor. Those adopting a precautionary stance may consider that such food should be thrown away once the 'best before' date is passed, or even prior to that date, whereas a more reasonable attitude would be to discard the food only when the 'use by' date has been reached.
- Over-stocking of food in refrigerators, pantries or cupboards, resulting in foodstuffs being unseen (hidden out of sight) beyond their 'use by' date and being thrown away as waste.

Inappropriate or defective storage conditions may also result in the generation of food waste; again, poor economic circumstances may be a contributing and multiplying factor here. For instance, the absence of effective refrigeration for food storage at home may lead to perishable foods going 'off' or 'bad' in the heat of summer. Other examples: the storage of food stuffs such as cereals are vulnerable to infestation unless stored in air-tight containers, and dry foodstuffs stored in damp conditions are vulnerable to mould formation and spoiling.

Energy Consumption and Emissions to Air

Various appliances are used for the processing food (cooking, chilling, freezing, etc.), and the energy used is electricity, gas, etc. The energy efficiency of these appliances – and both their direct and indirect emissions of air quality pollutants and GHGs to air – will depend on their age, design and condition. Good practice techniques should be adopted, and there is a role here that concerted communication efforts can play in providing information to all consumers on the relative performance of different appliance types.

Restaurants, other enterprises in the hospitality sector, and institutions (hospitals, education establishments, government buildings, etc.) may also consider applying local renewable energy sources – such as heat pumps, solar panels, etc. – to provide at least some of the power needed to operate such appliances, thus reducing emissions of GHGs and air pollutants to the air.

Packaging Waste

- Packaging waste is largely outside the immediate control of the consumer: one buys what is needed, as it comes. But consumers can exert some influence and in several ways on the quantity of packaging waste generated and the efficiency of its reuse and recycling. For instance:
- Reuse plastic or other bags provided by retail outlets to bundle multiple purchases together
- Choose to use biodegradable 'thin-film' bags if made available by retail outlets
- Avoid breaking beverage bottles and return empty bottles if this option is offered by retail outlets;
- Where the collection of at-source separated waste – food waste, glass containers, clean tinned cans, plastics of defined types – is provided, make the effort to ensure that 'your' wastes are segregated correctly at source and deposited in the appropriate containers.

Indirect Effects – Use Consumer Choice to Influence Suppliers

Through awareness and interest activated by effective communication, consumers may also exert a potentially far-reaching influence in several other areas sharing with suppliers a collective demand for change. For instance, by requesting:

- Organic foods – an increase in choice and its availability in stores (and stating their willingness to pay the higher prices)
- Elimination of unnecessary (secondary) packaging, that the consumers have to dispose of
- An increase in the variety and availability of raw and processed vegetarian foodstuffs at retail outlets
- Effective local facilities for the storage of at-source separated wastes prior to their regular and efficient collection (and a willingness to pay higher waste management charges)

Wastewater and Wastewater Management

After the consumption of food and drink and their passage through the digestive system, much waste is excreted. Where flush toilets are provided these excretions form a major constituent of the domestic wastewater discharged to sewers for treatment at a municipal wastewater treatment plant (WWTP). WWTPs typically generate four main outputs:

- Treated effluent. Depending on the level of treatment provided and provided that all sanitary safeguards are met, such effluents may be (re)used in principle as an agricultural source of water and nutrients (nitrogen and phosphorus) for crop cultivation.[30] In many cases the volume of treated effluent might be small relative to agricultural water demand, but it may be blended with freshwater and could be useful at the margin.
- Emissions to air from the oxidation of organic and nitrogenous matter present in the incoming wastewater, and other emissions from sludge processing operations.
- Grit and gross solids separated and screened out from the incoming sewage. After washing, the grit may be recovered and used in various ways. But the gross solids comprise all kinds of detritus, sanitary products, etc. that are thrown into toilets. This waste stream cannot be recycled but should be disposed of appropriately, to landfill or incineration for example, either alone or with other solid wastes.

30 Within the EU, this practice (though uncommon) is governed by Regulation (EU) 2020/741 of the European Parliament and of the Council of 25 May 2020 on minimum requirements for water reuse. However, sophisticated forms of the activated sludge process for treating domestic wastewater may be designed and operated to remove a high percentage of dissolved phosphate-phosphorus. This minimises the phosphorus content of the final effluent, but the phosphorus-rich process side-stream has a smaller volume and may be utilised in agriculture as an alternative source of phosphorus.

- Sludge containing the solids arising from the settlement and treatment of sewage, after grit and gross solids have been removed (from the sewage). The liquid sludge may be subjected to treatment by a range of processes and, subject to appropriate sanitary and hygienic safeguards being met, may be utilised as a source of humus and nutrients (nitrogen and phosphorus) in agricultural crop production and on pasture.[31] Travel distances between the WWTP and the receiving agricultural land should not be too high or the financial costs of sludge transport may be excessive. For sludge to be used beneficially in agriculture, it is necessary that the municipal WWTP takes responsibility to ensure that environmental and health risks are minimised. Essentially, that:
  - Sludge is given extensive thermal or other treatment, followed by an appropriate period of storage, prior to its application to land. This is to minimise the risk posed by pathogenic microorganisms passed by people and ending up in sewage and sludge.
  - Householders and others do not dispose of toxic or otherwise undesirable wastes into toilets or drains that flow into the public sewerage system. Communication and educational messaging may be needed to minimise this practice.
  - The discharge of heavy metals and persistent organic micropollutants into sewage is minimised. Where industrial effluents are discharged into public sewers receiving domestic wastewater, this criterion demands that effective control is exercised over the volume and composition of trade effluents.
  - To control the accumulation of contaminants to within safe levels, the concentrations of heavy metals and nutrients in the sludge, and the land to which it will be applied, are monitored. And that records on where sludge has been applied are maintained.
  - Sludge should not be applied to land of high slope subject to heavy precipitation, on snow, or near to sources of water supply.
  - Sludge application to land should be timed to harmonise with the growth cycle of the receiving crop, to maximise nutrient uptake.
  - Farmers understand that appropriate time intervals have to be adopted between the application of sludge to land and planting, and especially before harvesting and consumption.
  - If and when applying inorganic fertilisers to land, farmers should allow for the nutrient content of the sludge they have already applied or intend to apply.
  - Liquid sludge may be applied to pasture, preferably by sub-surface injection.

The requirements summarised above for utilising sewage sludge may seem daunting. Yet with due diligence they can be met. The use of sewage sludge in agriculture then provides a valuable outlet for an unavoidable solid waste stream, a solution that demonstrates a prime example of the circularity principle being applied in practice.

Alternative beneficial outlets for treated sewage sludge can include land reclamation, forestry, and as a backfill material for MSW landfill sites.

Other means of sewage sludge disposal are possible but are non-beneficial: long-term deposition in lagoons, disposal to landfill site, and incineration. They also pose environmental issues regarding emissions to air and the potential pollution of groundwater resources.

Used Leather Goods

Such end-of-life products can be handled with other MSW streams for disposal to landfill or incineration. However, potential opportunities for leather recovery and recycling, and the repurposing of recovered products (such as footwear) should be sought where possible. For instance, local charities may be able to pass on discarded footwear to poorer members of the community.

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31 See, for example, DEFRA (May 2018), Guidance - Sewage sludge in Agriculture: Code of Practice, available at: https://www.gov.uk/government/publications/sewage-sludge-in-agriculture-code-of-practice/sewage-sludge-in-agriculture-code-of-practice-for-england-wales-and-northern-ireland. And Environment Agency (July 2020), Policy Paper - Environment Agency Strategy for Safe and Sustainable Sludge Use, available at: https://www.gov.uk/government/publications/environment-agency-strategy-for-safe-and-sustainable-sludge-use/environment-agency-strategy-for-safe-and-sustainable-sludge-use.

3.6 Summing Up

The preceding sections have outlined major issues concerning resource consumption and the wastes (solid, liquid, gaseous) arising at each step of the agriculture and agri-products value chain. The range of this value chain is both wide and deep. At each step there are opportunities to apply SCP to improve resource efficiency, substitute more benign for potentially harmful inputs, and reduce the nett generation of wastes. The SCP Action Plan (Chapter 9) addresses these issues and reflects the direction of travel of the EU's 'Farm to Fork' Strategy outlined in Annex B.

The resources available to the SWITCH Asia project have not been sufficient to establish a quantitative profile for the value chain. Hence an early step in the proposed SCP Action Plan is to collate available statistical data, making estimates where such data are unavailable, in order to develop this quantitative profile. This profile would then provide a proper basis for establishing priorities for SCP action within the agricultural value chain.

A further early step will be the collation of available, relevant information on national and international good practice in the value chain for:

- Improving resource efficiency
- Substitution to reduce the use of harmful resource inputs
- Reducing wastes
- Reducing the impacts of operations on the environment and human health

4. SCP AND THE TEXTILES VALUE CHAIN

4.1 Scope and Size of the Textiles Value Chain

The textiles value chain is dominated by cotton, the major natural fibre produced, although silk, and wool from sheep, astrakhan, goats and camels are also produced (see Table 5)[32]. Of the synthetic fibre consumed in the textiles sector (alone or in combination with natural fibres), most is imported: it has been estimated that synthetic fibre consumption increased by 14.2% in 2021 compared with 2020.

*Table 5 Natural Fibre Production **and Synthetic Fibres Consumption** in 2020*

Material	Production in 2020 (metric tonnes)
Cotton – raw	3,082,000
Cotton – fibre	574,800
Cotton – yarn	460,500
Wool	35,422
Silk – wet, raw cocoon	1200
Silk – fibre	800
Material	**Consumption**
Synthetic fibres[33]	93,911

Broadly speaking, the major stages in the value chain lie in the following economic categories:

- **Primary production**: production of natural fibres – cotton, wool, and silk. In many respects, the issues here are similar to those faced in the agricultural value chain.
- **Secondary production**: including synthetic fibres production, spinning natural and synthetic fibres to produce yarn, and using the yarn to manufacture a wide range of textile fabrics and products (clothing, bedding, knitwear, carpets, etc.). Not shown in the schematic representation of the value chain (Figure 18): each step in the production of loose fibres, yarns and fabrics includes the application of several treatments or 'finishing' processes, mostly involving the use of chemicals, energy and water.
- **Tertiary or Services**: comprising the sale of manufactured textile goods through retail outlets in Uzbekistan, ranging from large stores in cities to small shops and markets in villages and towns, as well as exporting these goods.
- **Consumption**: wearing clothing, using bedding, towelling, curtains, carpets, etc., and periodically washing and cleaning them, whether in Uzbekistan or in export markets.

Resources are used, and water, chemicals and energy are of primary concern,[34] and various wastes, liquids and gaseous emissions are generated throughout the value chain. In a green economy, however, actions are taken at each step to:

– Minimise resource consumption, waste arisings and emissions in production and in consumption
– Substitute less harmful substances for potentially harmful resources, where possible
– Reuse or repurpose discarded products, where possible, instead of disposing as waste
– Recover and treat solid and liquid wastes, utilising the treated wastes where possible

32 Sources: State Statistics Committee of the Republic of Uzbekistan and the Ministry of Agriculture of the Republic of Uzbekistan.
33 Comprising 55,250 t polyester, 15,200 t acetate, 14,310 t acrylic and polyacrylic, 4,300 t nitron, and 4,851 t other synthetic fibres. The figures exclude synthetic materials not intended for the production of textile yarns and fabrics.
34 Shanti Radhakrishnan, 'Sustainable Cotton Cultivation', in *Sustainable Fibres and Textiles*, 2017. https://www.sciencedirect.com/topics/engineering/cotton-cultivation

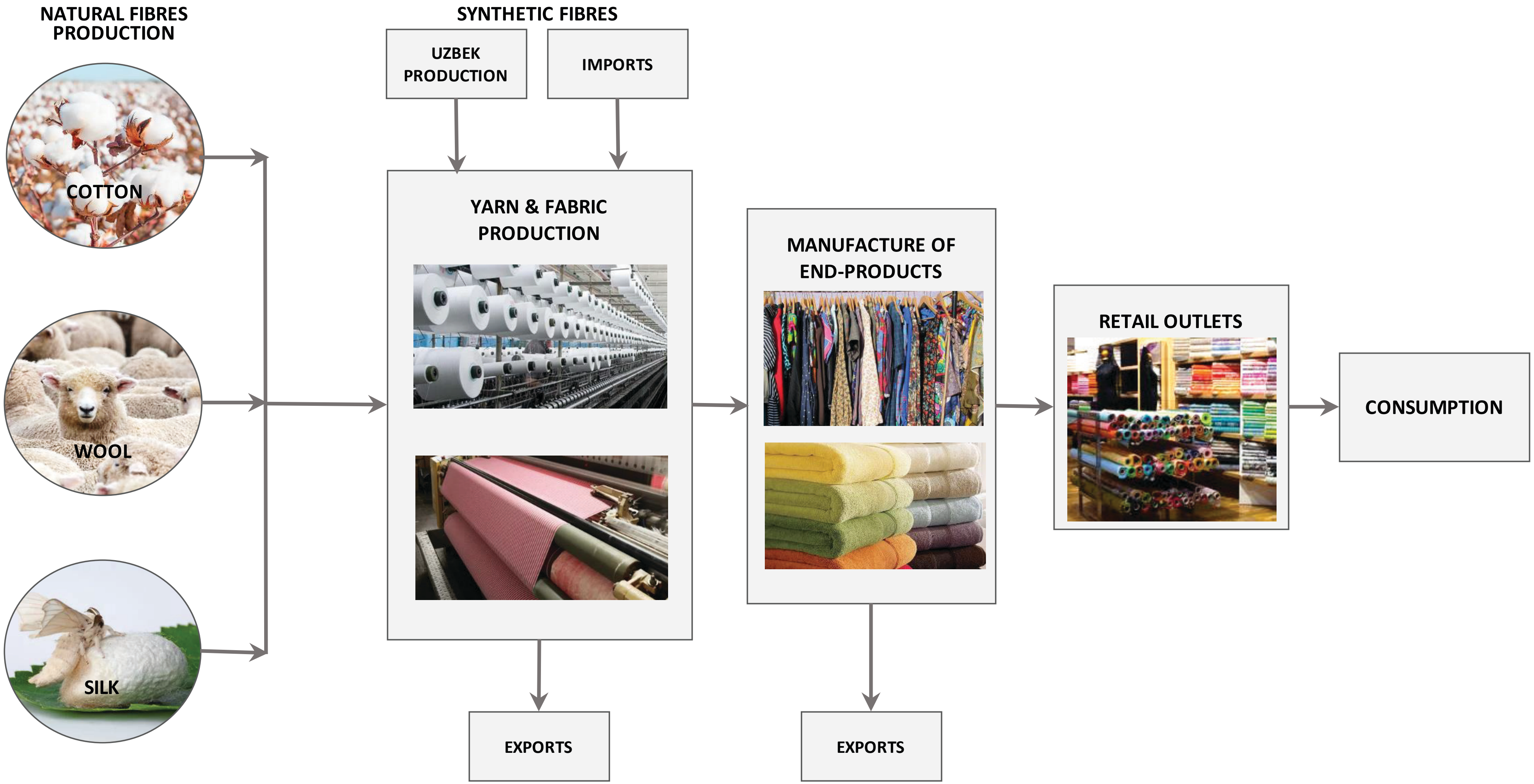


Figure 18 Schematic Illustration of the Textiles Value Chain

Sections 4.2 to 4.5 inclusive provide a qualitative analysis of the value chain – analogous to the analysis of the agricultural value chain – and suggest applicable approaches for resource efficiency, substitution and circularity to manage resource inputs at each step. These sections also take into account wastes and emissions, and how the issues arising from them may be better managed.

4.2 Primary Production and Preparation – Natural Fibres

Cotton

The cultivation of cotton requires a long frost-free period and plenty of sunshine. It is generally recognised that cotton is a relatively water-thirsty crop, a water consumption of between 10–20 m^3 to produce 1kg of cotton. However, it is an attractive crop for arid and semiarid regions if irrigation water is available.

Uzbekistan is one of the larger producers of raw cotton worldwide. Raw cotton production in 2020 was 9% more than in the previous year, with an average yield of 29.8 centners per ha (2.98 t per ha). Uzbekistan's cotton industry has undergone significant reforms in recent years and major developments include:

- Cancelling State-level planning of cotton production from 2020: the former State Order System had comprised the State production plan; State financing of raw cotton production, covering the provision of material and technical resources and the electricity consumption of pumping; State purchase price; mobilisation of labour for cotton picking in the peak harvesting months of September–October; and the State-level buying and sale of raw cotton.
- Forming a system of market-oriented 'clusters', or vertically integrated enterprises that are engaged in primary production, processing, logistics and the production of finished products (Figure 19 shows the rapid structural transition from 2016 to 2021).
- Paralleling the formation of 'clusters', Uzbekistan's raw cotton processing capacity has expanded, reaching 100% in 2021, up from 37% in 2021.[35] Consequently, it was possible to stop significant exports of raw cotton in 2020, shifting to a focus on the production and export of finished goods with higher added value.
- Reducing the area under cotton production from 1.4 million ha in 2008 to 1.0 million ha in 2020.

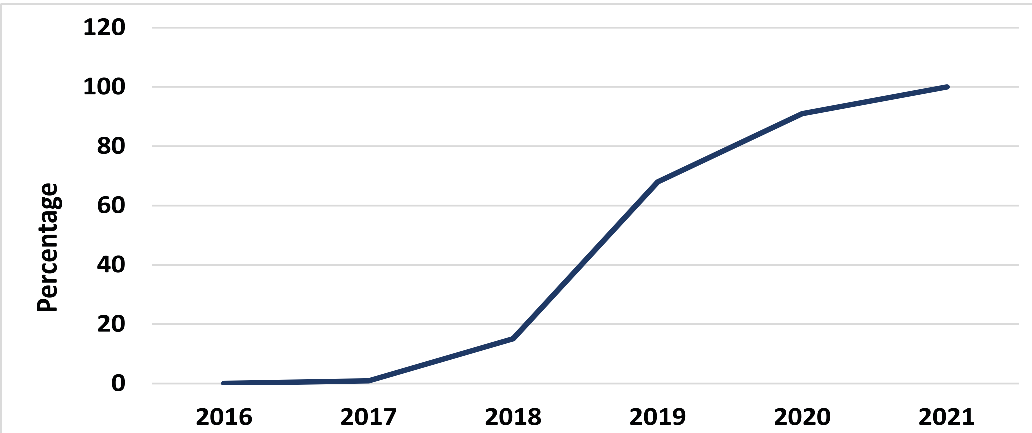


Figure 19 Rapid Structural Transition in the Cotton Production System: Percentage of Total Production in 'Clusters' to 2021

Several resources are used in in the production of raw cotton production (Figure 20). Adequate water, nutrients, healthy soil, and appropriate sunlight and temperature conditions are necessary. But growers have choices to make that affect resource use and their impacts on the environment. The introductory comments below address issues arising from the use of specific resources and the generation of wastes, emissions and discharges.

35 According to the Association of Cotton Textile Clusters of Uzbekistan.

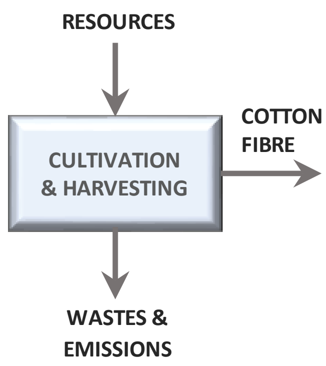
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
COTTON CROP PRODUCTION					
	Water	R		C	Crop residues
	Fertilisers – N and P	R	S	C	Emissions to air
	Pesticides and herbicides	R	S	C	Carry-over to fibre processing Discharge to surface water & groundwater

Figure 20 Resource Inputs and Wastes Arising from Raw Cotton (Crop) Production, and the Applicable Types of SCP Action

Water Consumption

The agricultural sector in total – which includes cotton production – accounted for about 90% of the 51–53 billion m^3 freshwater consumed in Uzbekistan in 2020.[36] Water conservation and efficiency measures to reduce the overall water demand of cotton cultivation should be applied, therefore, to reduce the known pressures on the nation's river basins and water resources, many of which are transboundary. This is reinforced by the priority assigned to the freshwater needs of industry (including energy), on which no limits are placed.

Applicable SCP Tools and measures to making the most efficient use of water in cotton production are the same, in principle, as in the cultivation of other agricultural crops (Chapter 3), and they include the following:

- Maintenance of irrigation distribution systems (channels, etc.) to minimise leakage and evaporation losses
- Adoption of water-efficient watering techniques
- Innovation and adopting good practice guidance on the choice of cotton varieties grown – selecting crops requiring less water for their growth – with the twin goals of reducing water demand per hectare and increasing the added value of crops produced per hectare
- Innovation (medium-long term) to develop and plant seeds/plants that have been gene-edited (for example) to tolerate low levels of water availability or consume less water
- Adopting good practice guidance on the timing of water application to soil prior to and during the growing season, the goal being to maximise the efficiency of water use
- Communication of good practices – both national and international – to all 'clusters'
- Outreach activities, providing advice and access to technical support on the above techniques

Policy measures that could help **incentivise growers** to adopt the above tools and methods to reduce the water-intensity of cotton production include the financial incentives presented by:

- Partial grants and subsidised loans for investing in water-efficient technologies
- Additional tax relief for making such investments

Policy measures that could help to **steer growers** to adopt the above tools and methods to reduce the water-intensity of cotton production include:

- Increasing the prices paid for water abstraction, with the additional monies raised being used to invest in water efficiency measures and, for instance, to create outreach programmes to disseminate good practice for water efficiency
- Setting mandatory limits on the annual quantity of freshwater abstracted from surface water resources for cotton cultivation, those limits being enforced.

36 Concept for Development of Water Management in Uzbekistan, 2020-2030. Approved in 2020.

Inorganic Fertiliser Consumption

Although the application of inorganic nitrogenous (N) and phosphate-based (P) fertilisers can boost crop production in the short-term, it does nothing to sustain the soil structure needed for healthy cotton production in the long-term. Used to excess and in conjunction with over-ploughing or cultivation, such fertilisers may indirectly lead to exhaustion of the humous content of soil and increase the vulnerability of crops to water shortages. Also, several potentially significant environmental issues can result from the application of inorganic N and P fertilisers:

- The carbon footprint of these fertilisers is significant, their production involving substantial energy consumption (and the conversion of hydrocarbon feedstock in the case of N-fertiliser production). Their use, therefore, contributes to Uzbekistan's carbon footprint (whether nationally produced or imported) and GHG emissions.
- Dependent in part on the rate and timing of their application to land and their chemical speciation, the N-fertiliser may degrade rapidly after application, releasing ammonia (NH_3) and nitrous oxide (N_2O). If not taken up by growing plants ammonia is either released to air as a gas or, if retained in the soil, oxidised to nitrite and nitrate-nitrogen in the soil (see Chapter 4 also). Nitrous oxide is more powerful than methane as a GHG.
- Dependent in part on the rate and timing of their application to land and their chemical speciation, break-down of the applied P-fertiliser may release more phosphate (PO_4) than can be readily assimilated by the growing crops. Excess PO_4 leaches out into surface waters and groundwater, potentially causing water pollution, eutrophication of water courses in particular.

SCP tools and measures related to the use of inorganic fertilisers principally involve the adoption of available good practice guidance[37] on (i) when and how much of these fertilisers are applied, (ii) the types of inorganic fertiliser applied – for instance, the use of ammonium carbonate is banned in the EU, (iii) the partial or total substitution of organic N and P containing wastes for inorganic fertilisers, and (iv) effective communication and outreach programmes to disseminate good practice and guidance.

Pesticides and Herbicides

Pesticides and herbicides are hazardous substances by definition and are commonly used in the cultivation of cotton: (i) to protect growing crops from depredation and infestation by pests and (ii) to suppress the growth of unwanted plants (weeds) that may compete for light, water and nutrients. However, their indiscriminate, excessive use can contaminate the crop of raw cotton, leading to a carryover of persistent organic micropollutants into downstream processes and into finished products for sale.

Adhering to good practice guidance, such as the of naturally occurring substances instead of synthetic pesticides and herbicides, can reduce the quantities of these chemicals that are used and reduce such undesirable risks. Box 1 summarises the approach to insect management in cotton cultivation in the USA. An approach that has been adopted in many countries has been the use of genetically modified (GM) cotton to reduce the heavy reliance on pesticides.[38] The bacterium *Bacillus thuringiensis* (Bt) naturally produces a chemical harmful to only a small fraction of insects, most notably the larvae of moths and butterflies, beetles and flies. Inserting the gene coding for the Bt toxin into cotton causes cotton (termed 'Bt cotton') to produce this natural insecticide in its tissues. This eliminates or reduces the need to use large amounts of broad-spectrum insecticides to kill lepidopteran pests (some of which have developed pyrethroid resistance). This spares natural insect predators in the farm ecology and further contributes to non-insecticide pest management.

37 The UNECE Framework Code (2014) for Good Agricultural Practice for Reducing Ammonia Emissions,

38 For example: Martha G. Rocha-Munive et al. Evaluation of the Impact of Genetically Modified Cotton After 20 Years of Cultivation in Mexico. Front. Bioeng. Biotechnol., 22 June 2018: https://www.frontiersin.org/articles/10.3389/fbioe.2018.00082/full

Box 1: Insect Management in the USA[39]

The cotton plant has evolved with numerous damaging insects. These insects, if left unattended, would virtually eliminate the harvestable crop in most cotton-producing areas. Plants infested with leaf-feeding insects are able to compensate somewhat by producing more leaves. However, many of the insects in cotton fields feed on squares and bolls, which reduces the yield and leads to delays in crop development, often into the frost or rainy season.

The cotton industry in the USA utilises a multifaceted approach to the problem of insects. Known as Integrated Pest Management (IPM), it keeps pests below yield-damaging levels. IPM is dependent on natural populations of beneficial insects to suppress damaging pests. Additionally, some cotton varieties are genetically bred to be less attractive to insects.

Some plants are improved by modern biotechnology, which causes the plant to be resistant to certain damaging worms. Other modern biocontrol strategies also are used. For example, where populations of damaging pink bollworm insects break out, sterile insect releases are used to target the pest and minimise disruption to the beneficial insects. In addition, cultural practices that promote earliness and short-season production reduce the vulnerability of cotton production to pests. Plant protection chemicals are often used to prevent devastating crop losses to insects.

All plant protection methods used in cotton cultivation in the USA are thoroughly evaluated by the Environmental Protection Agency (EPA) to assure food safety and protection to humans, animals and to the environment.

Organic cotton production accounts for only a minor faction of the cotton produced worldwide, but organic cultivation practices seek to minimise or eliminate the use of chemicals.

Crop Residue Management

After the cotton crop has been harvested, a common traditional practice has been to burn the dried residues *in situ* – in the field. This practice, known as **field burning**, is undesirable for many reasons, and a better option might be to incorporate the remaining plant material into the soil, helping to condition and ready it for spring sowing. Alternatively, plant residues may be collected and composted, and the composted residues applied to land as a soil conditioner.

Initial Cleaning of Raw Cotton

From the field, raw cotton is passed through equipment (commonly referred to as 'cotton gins') to separate the cotton lint from the seed and other detritus. Raw cotton may first pass through dryers to reduce its moisture content and then through cleaning equipment to remove foreign matter. These operations facilitate processing and improve fibre quality. The cotton may then be air-conveyed to revolving, teethed equipment that pull the lint through closely spaced ribs that prevent seeds from passing through. Lint is removed from the revolving teeth by air blasts or rotating brushes, and then compressed into bales. The baled cotton is then moved to a warehouse for storage until it is shipped to a textile mill for use. Energy is the main resource consumed in this stage, for drying and to drive the equipment.

Wool

After a steady increase in production since 2000, wool production from sheep, astrakhan, goats and camels (combined) stabilised from 2014 at about 35,000 t/year (see Figure 21). The animals are mainly free-grazing, and are brought in annually to be sheared. Less than 10% of the raw wool is exported (mainly to Russia and China); the rest is processed within Uzbekistan.

39 Cotton from Field to Fabric: https://www.cotton.org/pubs/cottoncounts/fieldtofabric/upload/Cotton-From-Field-to-Fabric-129k-PDF.pdf

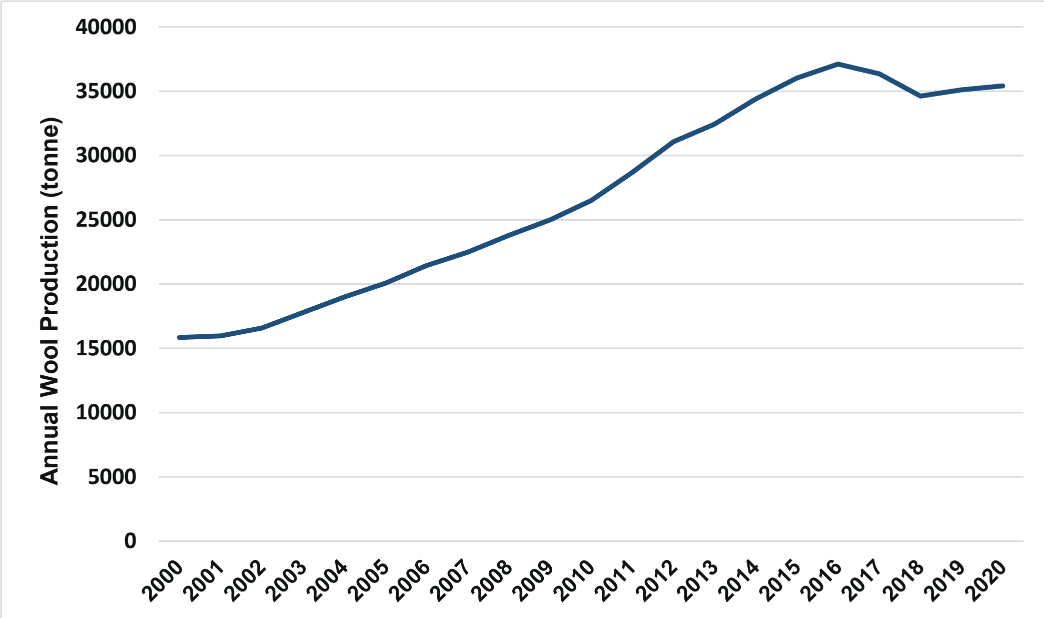


Figure 21 Raw Wool Production from Year 2000 to 2020

Resource consumption and environmental issues are potentially similar to those presented in Chapter 3 for animal rearing. However, the resource and environmental issues presented by range-grazing animals are minor relative to those of housed animals. An exception is the use of pesticides such as organophosphates, synthetic pyrethroids and organochlorine chemicals to prevent sheep and similar animals becoming infested with external parasites and insects. Raw wool will contain traces of such substances which transfer to wastewater and emissions to air in the downstream preparation of yarn and products.

Silk

Raw silk production involves the cultivation of perennial mulberry trees in plantations or farms, and harvesting their leaves. In parallel, silk moths are reared, the hatched eggs of the female silk moth forming the larvae or caterpillars that are known as silkworms, and the silkworms are then fed with the harvested mulberry leaves. The silkworm spins a cocoon from which – if nature was allowed to take its course – a silk moth would eventually emerge. In silk production, however, this is prevented by heating the mature silk cocoon using steam or hot water. The thread removed from the cocoon comprises the silk fibre and from 10%–25% sericin, a gum produced by the silkworm to glue the fibres together to form the cocoon. The silk yarn is then soaked in warm soapy water to remove the last of the sericin gum and give the silk fibre its distinctive softness and shine.

In 2020 some 506 ha of land was under cultivation by twenty-two farming companies for mulberry leaf production, and more than 150 enterprises for silk processing were registered. Ninety-one of these have united under the umbrella of ‘Uzbekipaksanoat’, an Association established in 2017 through a decree of the President of the Republic of Uzbekistan. It is the main organisation representing all sectors of the silk processing industry in Uzbekistan, ranging from traditional handicraft to fully integrated modern processing companies. Uzbekipaksanoat Association:

- Supports the development of silk industries and craft enterprises and aims to increase silk production through a strategy of cluster formation along the silk value chain. This includes promoting the establishment of mulberry tree plantations and the rearing of silk worms to produce silk cocoons.
- Is responsible for the Sericulture Research Institute (SRI) in Tashkent, the oldest and leading research facility on silk production in Central Asia. It undertakes research and provides training to the silk processing companies on all aspects of mulberry cultivation and silkworm rearing.
- Is a member of two international organisations:
  - The International Sericulture Commission ISC, with its headquarter in Bangalore, India (https://inserco.org/en/)
  - The Regional Sericulture Organization Black, Caspian Seas and Central Asia Silk Association, ‘BACSA’ with headquarter in Vratza, Bulgaria (https://www.bacsa-silk.org/)

With regards to mulberry leaf production, potential resource consumption and environmental issues are similar to those involved in the cultivation of food crops (see Chapter 4). These are unlikely to be significant, however, provided that the fruits and woody mulberry cuttings generated in plantation management are put to beneficial use. The main resource consumption and environmental issues[40] relevant to silk cocoon production are likely to be:

- Energy use to maintain the temperature conditions needed by the silkworms feeding on the mulberry leaves
- Energy and water use to provide steam and hot water to kill the silkworms once cocoons have formed, and to release much of the sericin gum
- Putting the sericin gum to beneficial use as a by-product, e.g. as an additive to food, cosmetics, textiles, and pharmaceuticals

4.3 Secondary Production – Synthetic Fibres

The production of synthetic fibres is not undertaken extensively in Uzbekistan owing to economies of scale, most such fibres being imported. Were this to change, then it would be appropriate to adopt regulatory standards equivalent to those adopted in the EU based on the BAT Reference Document for the production of polymers used in the textiles industry.[41]

4.4 Secondary Production – Yarns, Fabrics and the Manufacture of End-Products

Overview of the Manufacturing Process: Yarns and Fabrics

Textiles production can involve many processes (see Figure 22). With regard to yarn and fabric production, this section draws on Chapters 2 to 7 of the first working draft of the updated EC's BAT Reference Document for the Textiles Industry, 2019.[42] Resource consumption, waste arisings and emissions issues in yarn and fabric production (Figure 23) differ significantly between the dry and wet processing steps. The characteristics of common, major processing steps in yarn and fabric production, and significant issues from an SCP perspective, are introduced below, concluding with aspects of aspects of end-product manufacture. Opportunities for adopting an SCP approach to improve resource efficiency and reduce the environmental impacts of textiles production are then introduced, relating these opportunities to the activities of Textile Clusters as introduced earlier and in Annex E.

40 https://ecocult.com/why-does-silk-have-such-a-bad-environmental-rap/

41 The latest currently available version of the BAT Reference Document was published in August 2007. Available at: https://eippcb.jrc.ec.europa.eu/reference/

42 The manufacture of textile end-products is outside the scope of the BAT Reference Document for the Textiles Industry.

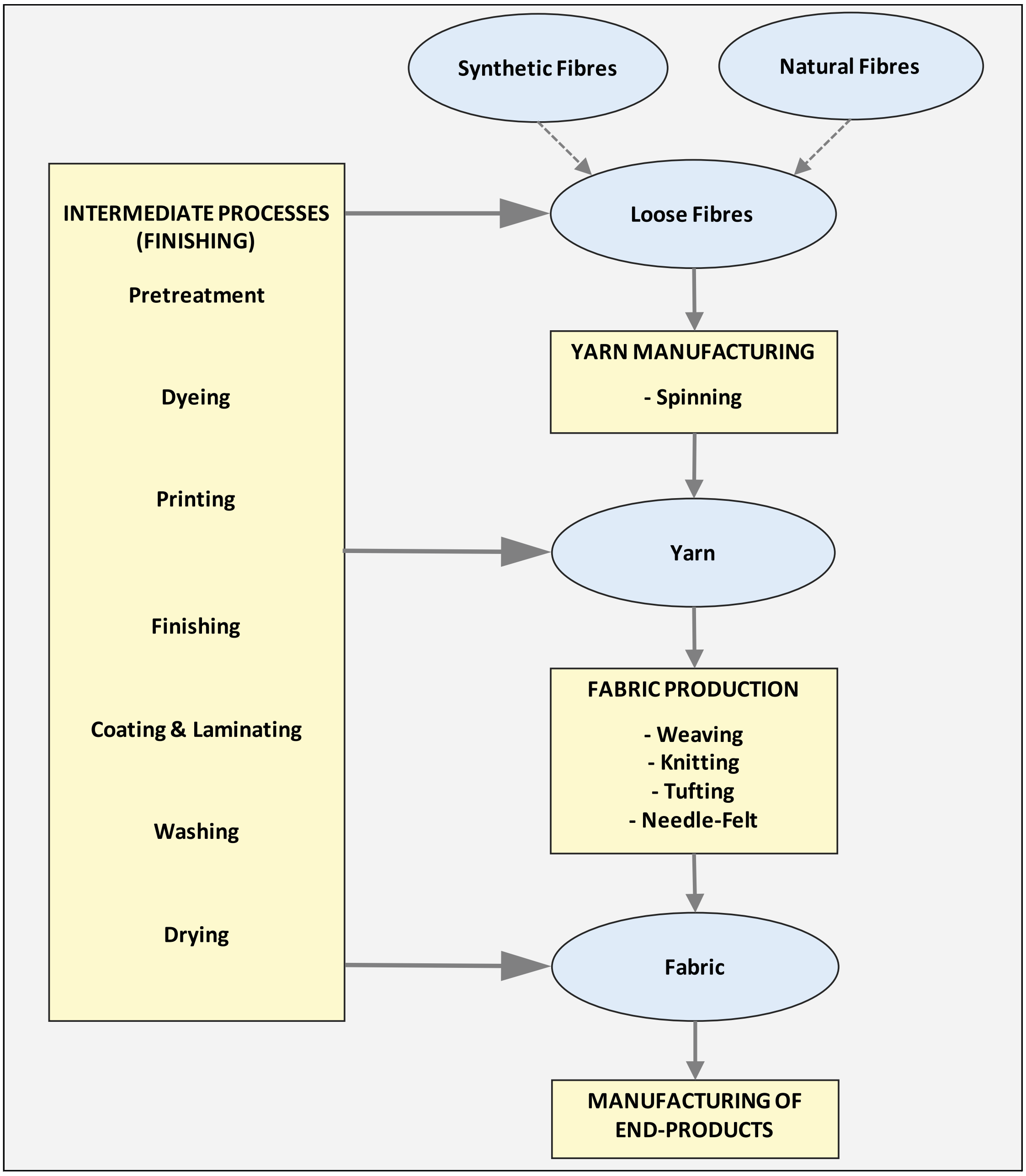


Figure 22 Schematic Diagram Indicating the Range of Processes Used in Textiles Production[43]

Dry Processes: Yarns and Fabrics

The spinning of loose fibre into long lengths of yarn and the weaving and knitting of yarn to produce cloth fabric are processes generally conducted on a semi-continuous basis using multiple machines on a factory floor. Several other dry processing steps are associated with yarn production. They include the blending of different types of fibre, and carding, in which the entangled mass of fibres is transformed into a filmy web. Apart from the fibre and yarn material inputs, resources consumed in the dry processing of yarn and fabric include the following:

– ***Spinning oils*** and conditioning agents applied in the spinning process to lubricate the fibres. They have to be completely removed before dyeing or printing, thus contributing to the organic pollutant load of wastewater from subsequent wet processes (see below) and to emissions in the exhaust air from higher temperature wet processes. The use of spinning lubricants thus generates hard-to-bio-degrade mineral oils and a range of hazardous components.

43 Adapted from 'Best Available Techniques (BAT) Reference Document for the Textiles Industry', Draft 1, Figure 2.1, p. 19, December 2019. Available at: https://eippcb.jrc.ec.europa.eu/reference/

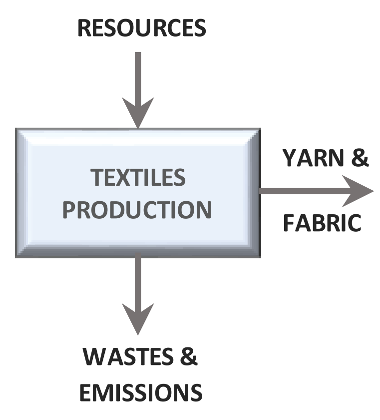
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
TEXTILES PRODUCTION – YARN AND FABRIC					
	Fibres	R		C	Fibre, Yarn and Fabric losses
	Water	R	S	C	Wastewater
	Chemicals	R	S	C	Chemical wastes – in drums and in wastewater
	Energy	R	S		Emissions to air – from the dry processing of fibre, yarn & fabric – and from chemical & energy use

Figure 23 Resource Inputs, Wastes Arising, and Applicable Types of SCP Action in Yarn and Fabric Production

- ***Weaving lubricants*** applied to the looms on which yarns are assembled to form woven fabric.
- ***Yarn and knitting machinery lubrication***: yarn is usually lubricated with paraffin wax prior to knitting, while mineral oils are widely used to lubricate the needles and other parts of the knitting machinery. The consumption of these latter oils depends on the technology employed and the speed of the knitting needles, but can range between 4% and 10% of the weight of fabric produced. Waxes and oils are removed downstream in the wet processing of textiles, and appear therefore in wastewater and emissions to air.
- ***Electricity*** is used to drive the textile production machinery and the air-exhaust fans that are used to remove the dusts emitted to air and to protect the health of factory workers. The indirect emissions to air arising electricity consumption depend on the source of energy used in its generation.

Wet Processes: Yarns and Fabrics

Multiple wet preparation and finishing processes are involved in yarn and fabric production –termed ‘intermediate’ processes in Figure 22. Their deployment is dependent on the types of fibre used, the fabric being produced, and the nature of the end products. Wet processes are major consumers of the water, chemicals and energy resource inputs indicated in Figure 23. Processes commonly used, whether in sequential treatment stages or in combination, include:[44]

- ***Scouring***: applied to *raw wool* after it has been opened and de-dusted in a mechanical, dry process. Wool scouring involves treating the wool with heated water (typically 55–70 °C) to which detergent is added to remove grease, residual dirt, and residual insecticides and insect growth regulators.
- ***Carbonising***: to aid the removal of vegetative impurities from *wool* to be used for preparing fine fabrics for garments (‘worsted’ fabrics woven from longer fibres), scoured woollen fibre or fabric is contacted with an aqueous acidic solution (typically 6–9% sulphuric acid) followed by pH adjustment to a pH value of 6 using sodium acetate or ammonia.
- ***Sizing***: to lubricate and protect (‘warped’) yarn in the weaving operation, so-called ‘sizing’ agents are added to the yarn in a water solution or dispersion. Two main classes of sizing agent used are (i) those based on naturally occurring polysaccharides (e.g. starch and derivatives of starch and cellulose) and (ii) synthetic polymers (polyvinyl alcohols – PVA, polyacrylates, polyvinyl acetate, polyester). In *cotton*

44 For example: bleaching/scouring or bleaching/scouring/desizing can be carried out as single or combined treatments. A full listing of the applicable ‘intermediate’ treatment processes is given in the first draft of the ‘Best Available Techniques (BAT) Reference Document for the Textiles Industry, December 2019, as referenced above. The processes are referred to as ‘finishing’ in that document. The BAT Reference Document for the Textiles Industry produced in July 2003 currently remains the official adopted BAT source in the EU and may be considered. This document also is available from: https://eippcb.jrc.ec.europa.eu/reference/

sizing, additional auxiliary chemicals are added to the sizing mixture: viscosity regulators, sizing fats, antistatic agents, wetting agents, de-foaming agents, and preservatives.

- ***Desizing***: the removal of sizing agents (and auxiliary chemicals) from woven fabric, usually the first wet process operation performed on woven fabric. Desizing is carried out either by water washing (with the addition of wetting agents, allowing adequate retention time, and thorough hot water wash subsequently), or by enzymatic treatment (often in combination with cold bleaching in an 'oxidative desizing' process involving the use of chemicals such as hydrogen peroxide and caustic soda – NaOH).
- ***Mercerising***: yarn or woven/knitted fabrics are mercerised to improve the tensile strength of *cotton*, its dimensional stability and lustre, and to improve subsequent dye uptake. Conventionally, mercerising is carried out by passing cotton yarn or fabric (under tension) through a concentrated aqueous solution of caustic soda (270–300 g NaOH/l). Where lustre is the priority a bath temperature of 5–18 °C is maintained, but a slightly higher temperature is maintained if other textile properties are more important.
- ***Bleaching***: bleaching of *cotton yarn or woven/knitted fabric* is obligatory if the fibre has to be dyed in pastel colours or subsequently printed. Bleaching (in Europe is most frequently) carried out using hydrogen peroxide (H_2O_2) in aqueous solution at 60–90 °C with caustic soda to maintain a pH value of 10.5-12, and chemical stabilisers (e.g. sodium silicates with magnesium salts and sequestering agents) to minimise the formation of hydroxyl radicals (OH*) that attack and depolymerise cellulose fibre. Anionic surfactants with non-ionic surfactants or biodegradable fatty alcohol ethoxylates are additionally used in peroxide bleaching. Other treatments used in the EU include bleaching in an acidic sodium chlorite/chlorate solution, and bleaching with peracetic acid at pH 7–8.[45]
- ***Dyeing***: a method of colouring a textile material in which a chemical substance (dye) is applied uniformly to the fibrous material to provide an even colour shade with a fastness appropriate to the textile's final use. Dyeing techniques involve: (i) the diffusion of dissolved or partially dissolved dye into fibre, or (ii) pigment dyeing, in which insoluble pigment is deposited onto the textile substrate and is then fixed with a binder.[46] Dyeing may be undertaken either as a continuous or as a batch process, usually at a moderately elevated temperature. Many dyes exist, those most commonly used with cellulosic fibres being: reactive, direct, vat, sulphur and azoic dyes. Other chemicals and auxiliaries also used include acidic and alkaline substances, salt, urea, surfactants, cationic fixatives, reducing agents, hydrogen peroxide, and dispersants.
- ***Printing***: a process for applying colour to a substrate but, unlike dyeing, printing is applied to defined areas of the fabric only, to produce a desired pattern. Printing typically involves the following steps:
  - Preparation of colour paste in a 'colour kitchen', the dyes or pigments usually being supplied in drums
  - Printing, in which the paste is applied to the fabric substrate
  - Fixation, involving drying of the printed fabric and its fixation using steam or hot air
  - Washing and drying the printed fabric (not needed if printing with pigments)
- ***Washing and Drying***: washing with water at 40–100 °C in the presence of a wetting agent and detergent emulsifies residual mineral oils and disperses undissolved pigments. Washing always involves a final rinsing step to remove emulsified impurities, followed by mechanical or suction dewatering and final thermal drying.
- ***Finishing***: all treatments that impart to a dyed or printed textile its desired end-use properties, often but not always applied as a separate operation. Finishing treatments include the impartment of: fabric softening properties; water-proofing properties; flame-retardant properties (for cotton and synthetic fibre fabrics in particular); easy-care properties (for cotton); antistatic properties (for synthetic fibre fabric); mothproofing and anti-felt properties (for woollen fabric); and anti-UV protection (against fading) through the dispersion of titanium dioxide nano-particles into fabric. Such chemical finishing treatments are mostly undertaking by 'padding' techniques These involve passing dry fabric through an aqueous bath, in which the necessary finishing agents are dissolved or dispersed, and then

45 Only one out of 52 reporting plants in the EU use sodium hypochlorite bleaching treatment.

46 Mass dyeing (gel dyeing) is third technique, applicable only to synthetic fibres, in which dye is incorporated in the synthetic fibre during its production.

passing the fabric through roller pads to squeeze out as much of the treatment liquor as possible before the fabric is dried. (The fabric is washed and then dried if phosphor-organic flame-retardants have been applied.) Residual chemical losses may lie in the range of 1–5%, but losses of 35%–50% have been observed when finishing runs are small, and firms have taken on small commission jobs.

Water, a diverse range of chemicals, and energy are clearly major consumable items. Unless the chemicals are consumed in reactions or fixed in the yarn or fabric product, they will be found in wastewater or in emissions to air. Apart from basic chemicals such as acids, alkalis and hydrogen peroxide, many of the chemicals used in the wet processing of yarns and fabrics are resistant to biodegradation and possess hazardous properties. Textile mill wastewater also contains the spinning, weaving and knitting lubricants that are removed in the wet-processing of textiles; and residual pesticides present in the natural fibres passed forward to the spinning processes.

In addition to using water efficiently and recycling water and wastewater wherever feasible, effective wastewater treatment and its proper discharge have to be factored into textile materials production as part of the SCP approach. As should the effective treatment of emissions to air.

Coating and Laminating Processes: Fabrics

Coated and laminated textiles typically consist of a woven or knitted textile fabric combined with a thin, flexible film of natural or synthetic polymeric substances.[47] They differ in the means of production:

- Coated fabrics are usually produced by the direct application of polymer in the form of a viscous liquid to the fabric, a full-width roll of it being held under tension, the thickness of the applied film being controlled by applying the polymer via a blade or similar. After the application of auxiliary chemicals, the fabric is then passed through an oven to cure the composite and volatilise solvents, before subsequent cooling and rolling up.
- Laminated fabrics are produced similarly except that a pre-prepared polymer film or membrane is affixed to the fabric using adhesives prior to heating.

The main resource and environmental issues concerning coating and lamination operations relate to the emission to air of solvents, additives and by-products contained in the formulation of the coating compounds – the emissions arising principally in the heating stage. With the exception of polyamide 6 (PA 6), emissions from coating powders are negligible, but those from the wide range of organic additives used – surfactants, emulsifiers, dispersants, hydrotropic agents, foaming agents, softeners/plasticisers, and thickeners – are not.

Secondary Production: Manufacture of End-Products

As in spinning, weaving and knitting, the cutting and sewing of fabric to produce finished product items such as clothing, bedding, towelling, furnishings are dry operations, often undertaken in large workshops. The direct resource inputs and wastes/emissions from these, often labour-intensive, operations are largely limited to fabric and fabric losses in cutting operations, and the energy consumed in powering the equipment used for fabric cutting/sewing and the provision of space heating and lighting (see Figure 24). However, this is a rather narrow perspective.

Adopting a more holistic, life-cycle viewpoint, the waste of fabric at this stage amplifies the collective resources consumed, as well as the substances emitted to water, air and land, in all the upstream stages of production. Significant efforts should be made therefore to adopt cleaner design techniques to minimise fabric losses in the manufacture of end-products. Whether efforts should be directed to using more advanced technology to automate product manufacture or, if policy prioritises the provision of employment and poverty reduction, to train factory staff in techniques to minimise waste, is a matter for factory managements to decide. Other factors to be considered in applying the SCP approach at this end-textiles textiles in the stage of the production cycle include:

- Whether manufacturers are producing in response to customer demand – orders placed by retailers in the Uzbek and export markets – or are generating products that their sales force then make efforts to sell to retailers

47 The description provided here excludes consideration of carpet back-coating, a production step that is important in improving the stability of textile floor coverings. For information on this aspect, see Section 2.10.2 of the 'Best Available Techniques (BAT) Reference Document for the Textiles Industry', Draft 1, December 2019, pp. 130-137.

– The nature of demand for textile products in the home and external markets with regard to their design, fashion, durability, etc., and how this is expected to develop in future

– If there is an intention to significantly expand the export of textile products to markets beyond the present focus (see Figure 8a, Ch. 2.2 above), the potentially stricter sustainability demands of those customers will need to be met

– The locations of the designers of apparel, curtains and other consumer products, and the extent to which they take account of resource consumption issues – essentially, fabric consumption and losses – in designing such products. It is those designers, and the enterprises in which they sit, who need to be involved in the practice of cleaner design.

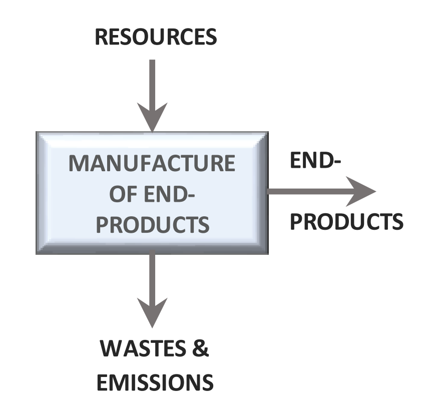
STEP IN THE VALUE CHAIN	RESOURCE INPUTS				WASTES & EMISSIONS
MANUFACTURE OF END-PRODUCTS					
	Fabric	R		C	Fabric losses from cutting and sewing operations
	Energy	R	S	C	Indirect emissions to air arising from electricity consumption, space heating and lighting.

Figure 24 Resource Inputs, Wastes Arising, and Applicable Types of SCP Action in the Manufacture of End-Products

In applying a cleaner design approach to textile products, consideration also needs to be given to the potential incorporation in future of recycled textiles – whether natural fibre or synthetic fibre based. Given the apparent growth of Uzbek textiles production based on synthetic fibres, a further issue to be borne in mind is the microplastics environmental burden resulting from the use and washing of synthetic-fibre based clothing.[48] Addressing these issues could involve rethinking the specification of fibre materials (and their mixture) employed in making textile yarns, fabrics and end-products.

Opportunities to Apply SCP – Potential Roles of Textile Clusters

As elaborated above and in Annex E, textile clusters now dominate textiles production. Vertically integrated enterprises that engage in all stages of the value chain from fibre production through to end-product manufacture, their formation provides a sound basis, in principle, for the adoption of a value chain approach in applying SCP. Four key elements that clusters may address are:

1. Adoption of an environmental management system (EMS) that considers all stages of the value chain from primary production through to end-product manufacture. This would harmonise with the adoption of production related quality assurance systems noted in Annex E.
2. Collaboration with the retail sector, working in partnership to help overcome constraints on minimising the generation of textile solid wastes – see section 4.5.
3. Adoption of best practice in textiles production wherever appropriate, or as close to best practice as is realistically achievable. It may be considered that best practice is specified in the BAT Conclusions of the EC's first draft of the 'BAT Reference Document for the Textiles Industry, December 2019', referenced previously. A total of 52 techniques are defined – see Annex F – the first of which is to elaborate and implement an EMS, as noted above. In addition, a range of techniques are described for:

48 See e.g. De Falco *et al.* (April 2019) 'The contribution of washing processes of synthetic clothes to microplastic pollution', available at: https://www.nature.com/articles/s41598-019-43023-x; XiaoZhi Lim (May 2021) 'Microplastics are everywhere - but are they harmful?', available at https://www.nature.com/articles/d41586-021-01143-3; and Alice Horton (2017) 'Microplastics in the Freshwater Environment', Foundation for Water Research, FRR0027, available at http://www.fwr.org/environw/frr0027.pdf

- Monitoring emissions to air
- Reducing emissions to air
- Reducing emissions to water
- Reducing the consumption of water, energy and chemicals

4. Apply specific SCP tools drawn from those identified in Chapter 1. Those that may be most usefully applied in textiles production (other than those noted 3 above) are as follows:

SCP Tool/Measure	Notes
Baseline Assessment	
Benchmarking	Focus external benchmarking on primary production & internal on secondary production
Carbon Footprinting	
Champions	Appoint a 'champion' to lead and promote SCP through all operations within a cluster
Cleaner Design	
Communication	SCP messages to be tailored to workers' situations and communicated effectively
Consumer Awareness, Interest, Motivation & Behaviour	Address the retailer and importer as the immediate customer
Counter-current washing/heat-exchange	
Energy Audits	
Fishbone Analysis	
Good Practice Guides and Case Studies	Learn from the experiences of others and be inspired by available guidance
Heat Exchanger Network	
Innovation	
Life-Cycle-Analysis	
Mapping the Sectoral Value Chain	
Mass and Energy Balances	
Metering, Monitoring and Sampling	
Reformulation	With the aim of using fewer chemicals and less harmful chemicals
Resource Efficiency & Waste Minimisation Club	Individual clusters can learn from the general experience of others – including benchmarking – and *vice versa*
Separation of Wastes at Source	Keep wastes of different character separate to maximise reuse and recycling opportunities
Walk-through Audit	

4.5 Retail Outlets and Consumption of Textile Products

Textile products are made available to customers by retail outlets who, in a market economy, seek to make a profit from meeting customer demand. However, customer demand is uncertain. And, while some demand might be unmet (which, in a market economy, may prompt the retailer to order more product), demand can also fall short of supply – resulting in unsold products i.e. textile waste. Also, the household consumption of textile products such as clothing, bedding and carpets involves their wear, cleaning and eventual disposal as textile waste.[49] In dealing with textile waste, the waste management hierarchy introduced in Chapter 1 should serve as a guide, with priority given, in descending order, to:

Prevention > Preparation for Reuse > Recycling > Other Recovery > Disposal

Prevention: Cleaner design allied to smart responsive ordering, short supply chains, and customer behaviour and attitude are key to the prevention of textile waste – to the extent that this is possible.

Preparation for Reuse: The reuse of textile products by other consumers should be undertaken as far as possible subject to minimum quality standards and cultural acceptance.[50] The cascading use of clothing is one aspect: ecologically sound practice which tends to be shied away from, for social and cultural reasons, by economically upward moving consumers. At the lowest level, textiles could be repurposed for use as rags, etc.

Recycling: The reincorporation of textile products into the production of yarns and fabrics. This may be limited by textile composition i.e. the use of mixed fibres.

Other Recovery: Textiles produced using natural fibres only are biodegradable, so they may be processed into a form that is amenable to treatment by composting with other feedstock, for instance, the resultant compost having agricultural value. Textiles of any composition – natural and synthetic fibres – are combustible to varying extents, so may be burned in waste-to-energy plants.

Disposal: Collection as municipal solid waste and disposed of to landfill.

Apart from end-of-life textile waste, significant consumption and ecological issues also arise from washing textile products in use, clothing in particular. Whole life-cycle-analysis shows that the carbon footprint of clothes washing can be significant, second only to fibre production.[51] As noted above (section 4.4) the release into wastewater and the water environment of microplastic particles from the washing of synthetic fabrics is also a significant issue. Although synthetic textiles washing is not the only significant source of microplastics in the water environment, such particles are already ubiquitous, and may be found in animal (and fish) species now.

At the present time, it is unclear to what extent the public in Uzbekistan is amenable to receiving and acting on environmental messaging. However, this is an aspect that should be explored in the coming years.

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49 The consumption of other commercial and industrial product use is not considered explicitly in this discussion, but analogous issues should be borne in mind by textile product manufacturers and users.

50 The Waste and Resources Action Programme (WRAP) formed the Sustainable Clothing Action Plan (SCAP). This is a collaborative agreement working to reduce the use of resources in the clothing industry – including by encourage the reuse and repurposing of used clothing. Its signatories and supporters represent over 58% of UK retail sales by volume. The resources made available to those having an interest in SCP related to textiles may be accessed at: https://wrap.org.uk/taking-action/textiles

51 See, for example, WRAP (July 2017) 'Valuing Our Clothes: The Cost of UK Fashion', Figure 1, p.12. Available at https://wrap.org.uk/resources/report/valuing-our-clothes-cost-uk-fashion

5. SCP AND THE ENERGY VALUE CHAIN

5.1 Scope

The extraction, refining and use of natural gas and mineral oil (petroleum) is one of the main sources of GDP, budget revenues and foreign exchange earnings, plays a significant role in the structure of industrial production and attracting investment, while natural gas is the predominant fuel used to produce electricity in Uzbekistan's thermal power plants. Coal is also mined in substantial quantities. Table 6 gives energy production figures for the year 2019, prior to the Covid-19 pandemic, while Figure 25 provides a simplified indication of the scope of the energy value chain.

Table 6 Indicative Energy Production Quantities for 2019[52]

Resource	Product	Production	Units
Fossil Fuels	Coal	4.1	million t
	Oil	0.7	million t
	Gas concentrate	2.1	million t
	Natural Gas	60.5	billion m^3
Derivatives	Gasoline (motor)	1.03	million t
	Diesel	1.03	million t

Much of the extractive and processing activity indicated in Figure 25 is, in the EU, the subject of BAT Guidance and Reference documentation published by the European Commission (Table 7). These documents provide a comprehensive review and statement of the measures that operators can adopt to prevent waste and environmental pollution, achieve high resource efficiency, mitigate environmental pollution, and reclaim polluted land. They are a vital source of information when seeking to adopt Sustainable Consumption and Production practice in the primary and secondary stages of the energy value chain.

Table 7 Latest Versions of the BAT Guidance and Reference Documents Published by the European Commission[53]

Sector	BAT Document Title	Publication Year
Extractive Industries	Guidance on Upstream Hydrocarbon Exploration and Production	2019
	Reference for the Management of Waste from Extractive Industries	2018
Processing & Transformation	Reference for the Refining of Mineral Oil and Gas	2015
	Reference for Large Combustion Plants	2017
	Reference for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers	2007

52 Source: State Statistics Committee of the Republic of Uzbekistan

53 All BAT Reference documents referred to in the table, and others, are available from: https://eippcb.jrc.ec.europa.eu/reference/

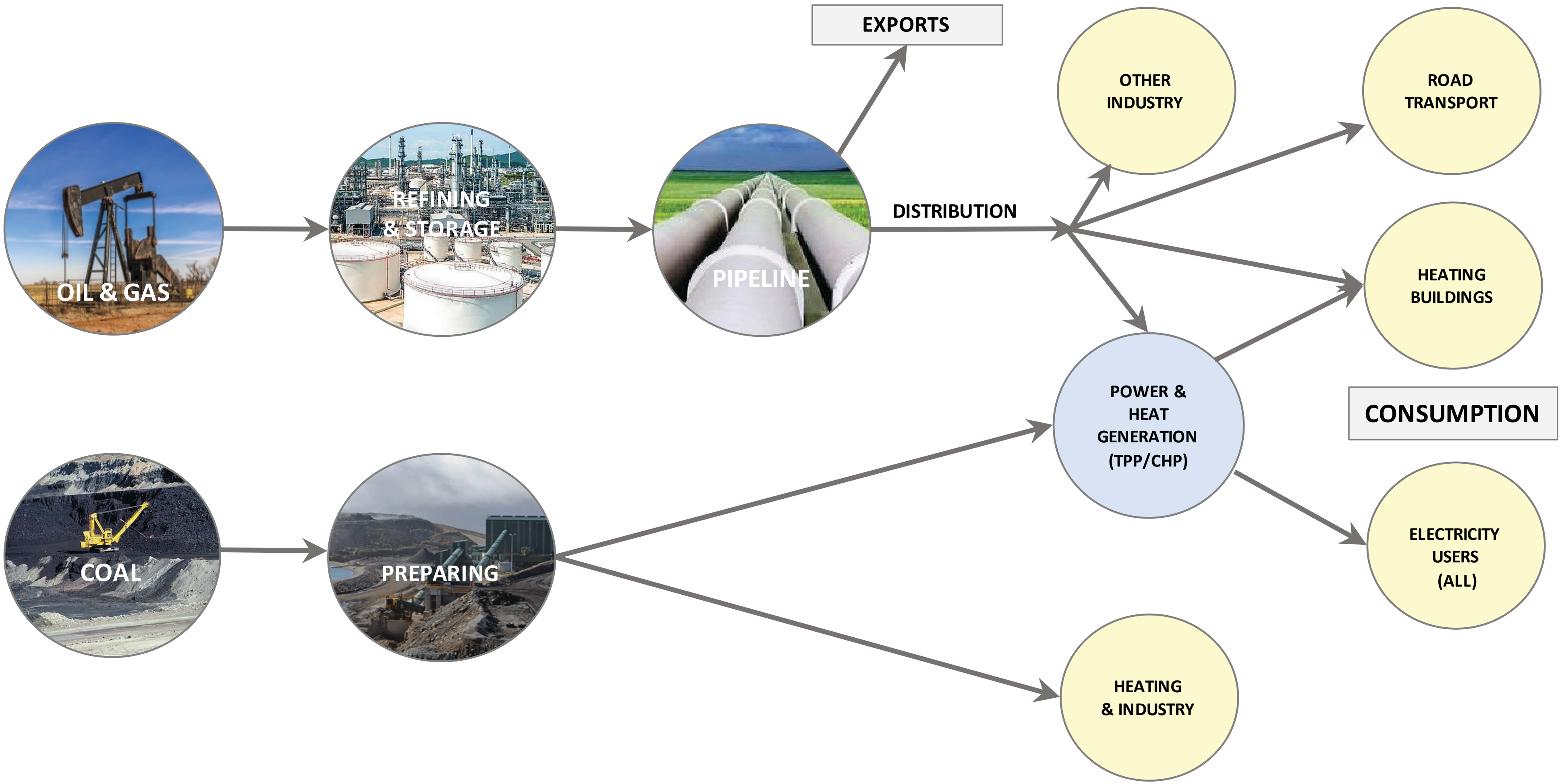

Figure 25 Simplified Mapping of the Energy Value Chain

5.2 Natural Gas and Mineral Oil (Petroleum)

Exploration and Extraction

The Guidance document on the extraction and production of petroleum oil and natural gas (Table 7) covers both off-shore and on-shore production and identifies the major issues impacting the environment. It suggests a risk-based approach to address issues and identifies BAT for each. Having an organisational Health Safety and Environment (HSE) management System is a recommendation that is common to tackling most of the identified issues:

- Management of drilling muds and drill cuttings including treatment, recycling and disposal
- Handling and storage of chemicals
- Handling and storage of hydrocarbonsEnergy efficiency, the adoption of a whole-of-field-life approach to energy management (based on life-cycle analysis) is recommended
- Flaring and venting of gases
- Fugitive emissions (to air)
- Management of production water arising in the hydrocarbon reservoir and from the use of chemicals at the production facility
- Management of drainage water arising from process systems, spillages and other systems
- Facility decommissioning and aftercare
- Environmental monitoring

The relevant BAT document could form the basis for setting future exploration and operational permits and ensuring that permit conditions are applied and complied with.

Refining and Distribution

Important issues for the refining of mineral oil and gas are the emissions to air of methane, volatile organic substances, nitrogen oxides, sulphur oxides, hydrofluoric acid, ammonia, carbon monoxide, dioxins and furans, and dust; emissions to water of oils, benzene, suspended solids, COD, nitrogen, metals (lead, cadmium, nickel, mercury); energy efficiency; and the prevention of emissions to soil and groundwater. The BAT Reference Document for the refining of mineral oil and gas addresses many aspects of refinery processing:

Alkylation	Combustion of refinery fuels	Primary distillation
Base oil production	Etherification	Product treatments
Bitumen production	Gas separation	Storage and handling of materials
Catalytic cracking	Hydrogen consuming processes	Other thermal conversions
Catalytic reforming	Hydrogen production	Waste gas treatment
Coking	Isomerisation	Waste water treatment
Cooling	Natural gas plants	Waste management
Desalting	Polymerisation	

Information on the environmental impacts of the natural gas industry is limited yet gas leakages cause the release of methane, carbon monoxide, carbon dioxide, nitrogen oxides, sulphur compounds, methanol and other pollutants. In the past few years, although several natural gas processing facilities in Uzbekistan have introduced new technologies to improve environmental protection. And the volume of gas flaring has declined from 1.494 billion m^3 in 2013 to 0.788 billion m^3 in 2018, the decrease being brought about not only by a reduction of oil production but by improvement measures introduced by oil production companies.[54]

While there is no policy to adopt BAT into the environmental regulatory approach in Uzbekistan, it would be beneficial to consider its future incorporation in the regulation of heavy industry, including the exploration and processing of natural gas and oil. The relevant BAT documents could be tailored to the Uzbek situation and

54 UNECE (May 2020) Uzbekistan Environmental Performance Reviews: Third Review – Highlights, p.26.

applied as the basis for setting future exploration and operational permits and ensuring that permit conditions are applied and complied with.

5.3 Coal Mining

Uzbekistan's proven coal reserves at the end of 2020 have been assessed as 1.375 billion t, in principle allowing for several hundred years of mining at current production levels.[55] Coal mining is carried out at the Angren, Baisun and Shargun mines.[56] The Angren deposit is developed by surface mining, while the Baisun and Shargun deposits are exploited by underground mines.

Coal mining makes several impacts on the environment. For surface mines, the main environmental problems are large-scale land use, overburden removal and disposal, disturbance of hydrology, acid mine drainage and fugitive dust; and the dumping of overburden in piles around the mines results in its exposure to the weather and to air. Apart from fugitive dust and overburden removal, acid mine drainage arising for the oxidation of pyrite (iron sulphide) and other sulphides exposed to air, and polluting wastewater, are substantial problems. In underground mining the main environmental issues are mine water drainage, methane emissions and fugitive dust.

As Alimbev et al. recommended in their analysis of coal mining in Kazakhstan, preventive measures are needed in addition to mitigation actions.[57] Operators therefore should be required to prepare comprehensive assessments of the potential environmental impact of coal mining – obliged to plan programmes to minimise impacts and to implement them.

5.4 Power and Heat Generation

Thermal power plants are fuelled by natural gas (93.9%), coal (5%) and fuel oil (1.1%) and generate about 85% of the electricity and heat generated in Uzbekistan, see Figure 26 below, the respective fuel consumption figures being 16.5 billion m^3, 2.3 million t, and 86,000 t. Given that total domestic national gas consumption in Uzbekistan has averaged 47.3 billion m^3 per year in the 10-year period prior to the Covid-19 pandemic,[58] these data suggest that power generation accounts for about 35% of natural gas consumption nationally and about 46% of coal production. There is no nuclear-powered electricity generation plant in Uzbekistan.

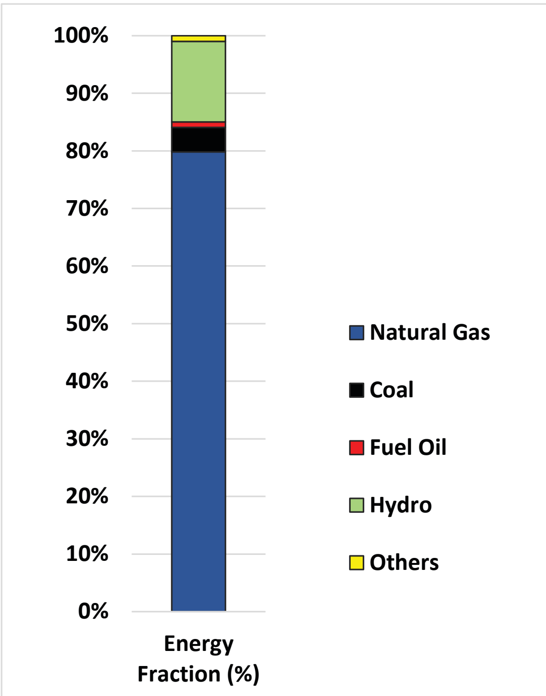

Figure 26 Sources of Energy Used for Generating Electricity and Heat in 2020

55 BP Statistical Review of World Energy 2021.

56 UNECE. Environmental Performance Reviews – Uzbekistan, Third Review, Highlights, p.26.

57 T. A. Alimbev et al. (2019), IOP Conf. Ser.: Mater. Sci. Eng. 663 012041. Available at: https://www.researchgate.net/publication/337610602_Environmental_problems_in_the_Kazakhstan_coal_industry_and_their_solutions

58 Source: State Statistics Committee of the Republic of Uzbekistan. Over the 10-year period from 2010 to 2019, the annual natural gas consumption has ranged between 41.5 billion m^3 (in 2015) and 54.5 billion m^3 (in 2011), averaging 47.3 billion m^3.

Fossil-fuelled power plants at or above the 50 MW_{th} threshold capacity in the EU are regulated under the Industrial Emissions Directive and are subject to BAT.[59] Unless designed and operated to high environmental standards – as embodied in BAT – such installations can emit substantial quantities of air pollutants to air. The principal pollutants emitted from thermal power plants of potential concern for ambient air quality and human health are $PM_{2.5}$, PM_{10}, NOx, and $SO_{2,}$ although there are others. Their concentrations are dependent on fuel composition, operating conditions and the pollution abatement provided, although only NOx should be an issue for gas-powered plants unless the use of supplementary fuel (mazut and coal) is significant.

Although BAT is not part of Uzbekistan's regulatory approach, the relevant BAT Reference documents are a key source of information, assessment and guidance. Tailored to the Uzbek situation they could in future form a basis for setting future operational permits. Regarding SCP, these should embrace energy efficiency within the installation, using water and chemicals efficiently, and maximising the productive use of solid residues – bottom ash or slag and fly ashes. In addition they should require that residual wastes are disposed of safely, and that emissions to air are within the prescribed limits. Regulatory efforts must ensure that the permit conditions for such plants are applied and complied with by operators.

5.5 Future Considerations

The significant reductions in fuel fugitive GHG emissions made up to 2017 (Section 6.4) have been achieved by making technological improvements in natural gas and oil production, and in natural gas distribution systems. Further improvements may have been made since 2017. Future improvements will require yet more renovation and upgrading of these installations, adopting best practice techniques such as those as identified in the BAT Reference documents of the European Commission. However, progress on this issue will not necessarily reduce fuel combustion emissions which changed little between 2010 and 2017.

In the short-to-medium term the adoption and implementation of international good and best practices in the oil, gas and coal exploration, extraction and processing sector is the right direction to take regarding SCP. However, in parallel there is a need also to look further ahead to what may potentially be a very different future.

With most countries of Europe committed to net zero GHG emissions by 2050, for instance, Europe's delivery on that commitment would change the nature of European demand quite considerably in the medium-to-longer term. Such a development, and related developments in other regions and worldwide, could transform energy value chains in future. This observation should not be taken as negative for the future exploitation of Uzbekistan's very significant energy reserves, but it would have substantial implications for the transformation of extracted fossil fuels, and for decarbonisation – the generation of 'blue' hydrogen and carbon-capture-storage (CCS) technologies, for instance.

It is encouraging, therefore, that the Government is already considering the policy and investment implications for Uzbekistan of a world in which the decarbonisation of energy supply and its use becomes substantial reality and not just a goal, see Annex G. To increase the effectiveness of scientific and practical research in the fields of renewable and hydrogen energy, as well as to ensure the transition of the Republic of Uzbekistan to a 'green' economy, a resolution of the President of the Republic of Uzbekistan of 09.04.2021 was adopted. №PP-5063 'On measures for the development of renewable and hydrogen energy in the Republic of Uzbekistan'.

And, together with the World Bank and international consultants, an assessment of the technical potential of the Republic of Uzbekistan for the production of 'blue' hydrogen is planned in 2022. It is expected that a 'Roadmap' will be developed for the development of 'blue' and 'green' hydrogen[60] in Uzbekistan based on the results of the study. The challenge will be to take appropriate policy decisions and other actions based on its analysis and deliberations.

59 Formerly, such plants were regulated in the EU in accord with the Large Combustion Plant Directive.

60 'Blue Hydrogen' is the term used for the production of hydrogen gas by the steam reformation of methane (natural gas), the CO_2 (carbon dioxide) by product of this process being separated from the hydrogen and either put to beneficial use in industrial processes or immobilised using CCS technologies. 'Green Hydrogen' is hydrogen produced by the electrolysis of water using electricity generated from renewable energy sources.

6. CROSS-SECTORAL SCP

6.1 Cross-Sectors and Value Chains – Relations and Overlaps

Cross-sectoral approaches are advisable when many value chains call on a specific resource (such as water), and/or generate specific emissions (e.g. GHGs and air pollutants) or outputs (e.g. solid wastes). Such approaches need to recognise the partial overlaps that inevitably exist between value chains and cross-sectors: value-chain and cross-sectional approaches, therefore. should be complementary to each other. Figure 27 illustrates the concept, major examples of which include:

- *Agriculture and water*: regarding the predominance of the water demand for growing crops in the overall quantity of freshwater abstracted; the smaller demands for freshwater in food processing and consumption sectors; and the potential for returning treated wastewater and treated wastewater sludge to land for crop watering and as sources of nutrients.
- *Agriculture, cotton-based textiles, and water*: as above, but noting that the cultivation of cotton is a branch of agricultural crop production.
- *All value chains and GHG emissions mitigation*: all sectors result in GHG emissions and a holistic approach is needed, therefore, to affect national reductions in GHG emissions.
- *Energy and water*: regarding the substantial use of abstracted freshwater as a coolant in oil refining and thermal power plants, and its partial return to surface water.
- *Metals and the recovery of resources from waste*: regarding the production and supply of metal-based goods and, once they have reached the end of their useful lives, the recovery of material resources from the resultant waste.
- *Agriculture, agri-products and the recovery of resources from waste*: regarding the generation of food waste in all stages of the agriculture and agri-products value chain and the recovery of energy, nutrients and other resource value from these wastes.

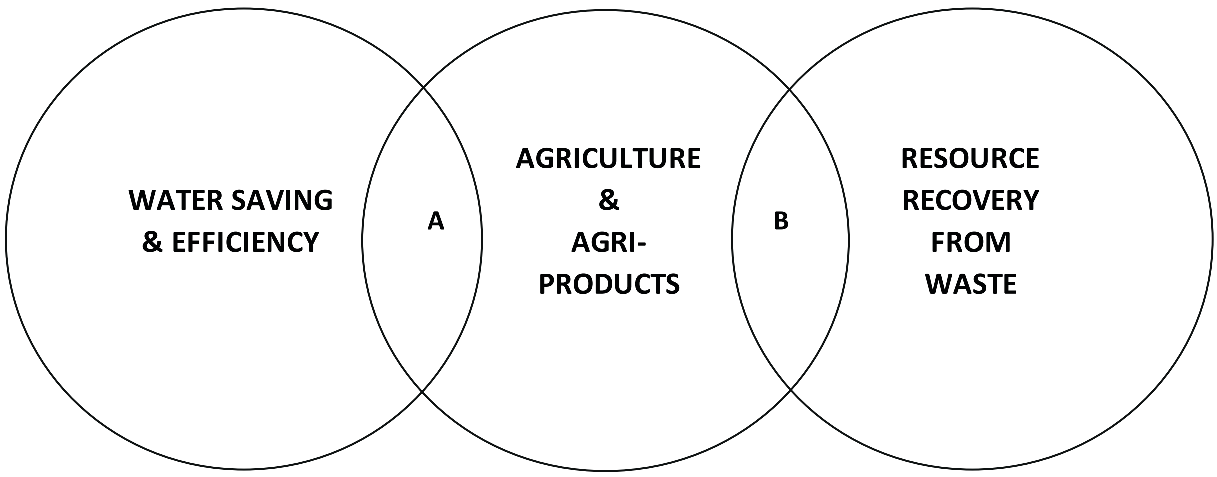

Figure 27 Examples illustrating the overlaps that may occur between value chain and cross-sectoral SCP

Hence a pragmatic approach is required when promoting SCP. For instance, generic SCP may be promoted in a cross-sectoral area, such as water, while complementary SCP promotion efforts may target the specifics of value chains, such as agriculture and energy, using tailored materials.

6.2 Water Conservation and Efficiency

Consumption and Goals

Of the 51-53 billion m^3 freshwater consumed in 2020, most by far was used in the agricultural sector including the cultivation of cotton – see Table 8. The industrial and energy sectors have been developing rapidly in recent years and the water consumption in these sectors is growing also. The Law of the Republic of Uzbekistan, 'On Water and Water Use', gives priority to industrial water demand and no limits are placed on this. It is thought that the total industrial and energy water demand may increase by about 75% in the near future, from 2 billion m^3 in 2020 to 3.5 billion m^3 in 2030.

Fisheries are also developing intensively. Over 3,600 fish farms operate in the country, their combined consumption in 2020 being about 0.61 billion m^3. Fresh river water is traditionally used to grow fish but, in recent years, due to water scarcity, some fish farms have been forced to use brackish water.

Table 8 Sectoral Consumption of Freshwater in 2020[61]

Sector	Freshwater Consumption (%)
Other	1.0
Heating	0.5
Fisheries	1.2
Industry	1.4
Housing and Public Utilities	4.5
Agriculture	90.0

Uzbekistan has committed to achieving the Sustainable Development Goal 6 (SDG6), 'Ensuring the availability and rational use of water resources and sanitation for all' (see Annex C). The main objectives of this goal are:

- Target 6.1 By 2030, ensure universal access to safe drinking water.
- Target 6.2 By 2030, ensure universal and equitable access to adequate sanitation and hygiene, paying special attention to the needs of the socially vulnerable segments of the population.
- Target 6.3 By 2030, significantly reduce all water pollution, including from land-based activities, and increase the safe reuse of wastewater.
- Target 6.4 By 2030, significantly improve the efficiency of water use in all sectors of the economy.
- Target 6.5 By 2030, ensure integrated water resources management at all levels, including through transboundary cooperation where necessary.
- Target 6.6 By 2030, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.
- Target 6.b Support and strengthen the participation of citizens' self-government bodies in improving water management and sanitation.

Chapter 3 of the present document confirmed the significance of water consumption as an issue for the agricultural value chain, inclusive of cotton cultivation. It also indicated relevant SCP tools and measures that may help to address this issue at different steps of the value chain. The present Chapter, therefore, addresses the potential for applying the SCP approach in other production and commercial activities, institutions, households, and water distribution networks.

61 Concept for Development of Water Management in Uzbekistan, 2020-2030. Approved in 2020.

Institutional Developments

According to UNECE, the current policy framework for tackling the consequences of water abstraction and the drastic shrinking of the Aral Sea, and its consequent impacts, focuses on the two most affected regions – the Republic of Karakalpakstan and Khoresm Oblast. Key actions from a water management perspective include:[62]

- Improving the management and rational use of water resources (e.g. by creating local water bodies and modernising water management infrastructure)
- Restoring ecosystems and biodiversity (e.g. by designating new protected areas, preserving natural water bodies in the Amu Darya delta and planting forest on the dried bed of the Aral Sea)

And, from an impact mitigation perspective:

- Improving health conditions (e.g. by ensuring stable drinking water supply, preventing respiratory diseases and enriching food products with iron, folic acid and iodine)
- Expanding opportunities for employment and income generation
- Improving infrastructure to ensure socioeconomic development (e.g. by refurbishing existing enterprises and introducing new production facilities)

These are positive actions and consideration should be given to strengthen them, and to strengthening institutional aspects of water resources management at a river basin and lower levels through Uzbekistan. Such policy action would indirectly strengthen considerably the institutional capacity and mechanisms for using water efficiently and in line with SCP philosophy.

The recent (2017-2018) formation of the Ministry of Water Management and the Ministry of Housing and Communal Utilities in 2017–2018 adds focus to the key issues of water resources management and water supply and sanitation. The need to move towards the principles of integrated water resources management (IWRM) and greater stakeholder involvement remains, though, along with the opportunities to better coordinate the activities of various actors and harmonise the use of data collected. Policy movement on this front could include a strong embracement of SCP.

SCP Applied to Water Saving and Efficiency in Industrial Production

Water is used extensively for heat exchange and direct cooling duties and in numerous process applications in heavy industrial and energy sectors including:

- Gas refining
- Thermal generation of electricity and heat (large combustion plants)

The application of Best Available Techniques (BAT) is required in the EU at most if not all the operations and installations in these energy activities – BAT to include good practice techniques for water conservation and water efficiency. Uzbekistan currently has no provisions for requiring such installations to adopt BAT.[63] However, introducing such a requirement would make a big contribution to ensuring that water is used efficiently in these sectors in Uzbekistan – and in many other environmental respects. SCP tools (Table 3) that may be considered in applying BAT for water use in installations in the above-mentioned sectors include:

- Baseline Assessment
- BAT Reference Document and BAT Conclusions
- Benchmarking – external and internal
- Champions
- Communication
- Counter-current washing/heat-exchange
- Energy Audits
- Environmental Management System
- Financial Incentives

62 UNECE (May 2020) Uzbekistan Environmental Performance Reviews: Third Review – Highlights, Box 2, p.5.

63 *Ibid*, p.18.

- Fishbone Analysis
- Good Practice Guides and Case Studies
- Heat Exchanger Network
- Innovation
- Life-Cycle-Analysis
- Mapping the Sectoral Value Chain
- Mass and Energy Balances
- Metering, Monitoring and Sampling
- Pricing of Publicly Delivered Goods such as water
- Reuse and recycling of (treated) water/wastewater
- Separation of wastewater streams at source
- Walk-through Audit

All of the above SCP tools are equally applicable to the multitude of other secondary production activities that use water, such as in the agri-food and textiles production sectors.

The effective pricing of water should be considered as a driver to encourage the voluntary adoption of good practice. However, it is understood that:

- The Government has made progress on reform of tariffs for utility services (including water) by bringing them closer to cost-recovery levels, although tariffs remain below cost-recovery levels
- The abstraction of water from natural sources is subject to payment of a water-use tax, but water used for irrigation in agriculture is not subjected to taxation; this, and other exemptions from the water tax, weakens the incentive to use water rationally

If water is undervalued, the costs of its consumption may appear too low to warrant the consideration of measures to improve water efficiency. Financial incentives, offered by tax-breaks for instance, contribute also a 'pull-factor', acting to encourage investment in water conservation and efficiency, but are likely to be most effective when the water price is such that water consumption becomes a significant production cost. For these mechanisms to be effective, though, it is essential that water consumption is metered and paid for on a volumetric basis.

SCP Applied to Water Conservation and Efficiency in Other Commercial Activities

Apart from its use in the secondary production processes itemised in Chapters 3 to 5, water is used in a wide range of commercial and associated activities in the secondary and tertiary economic sectors. They include, for instance:

- Washing down process equipment, floors and other hard surfaces at industrial and other commercial sites
- Pulping of recycled paper and cardboard
- Paper and cardboard production
- Printing of paper and cardboard products
- Vehicle washing
- Laundries
- Hotels and restaurants
- As a coolant
- Watering of commercial green spaces
- Bathrooms associated with offices, workshops and other work-places
- Miscellaneous other economic activities

Several SCP tools and actions may be suitable in such situations to help identify the scope to make water savings and raise water efficiency, and effective measures. They include:

- Baseline Assessment
- Benchmarking – external and internal
- Champions
- Communication
- Counter-current washing/heat-exchange
- Education
- Environmental Management System
- Fishbone Analysis
- Good Practice Guides and Case Studies
- Green Purchasing Criteria/Code
- Innovation
- Mass and Energy Balances
- Metering, Monitoring and Sampling
- Resource Efficiency & Waste Minimisation Club – for water
- Walk-through Audit

Generic measures to reduce water consumption and improve water use efficiency may be identified through consulting good practice publications, while identifying other measures may require site-specific analysis, investigation and innovative thinking.[64] Measures can range from making simple changes in operational practice to introducing more sophisticated technical measures requiring investment. For example, such changes might range from equipping water hoses with trigger nozzles (shutting-off by default) to ensure that unattended hoses do not discharge water to waste, to using water sequentially in cascading stages (the wastewater from one stage being used as feedwater to a second, the water quality requirements of the second stage being less strict than in the first stage).

SCP Applied to Water Conservation and Efficiency in Distribution Networks

Harking back to the waste hierarchy noted in Chapter 1 and the principle that waste prevention is the first option that should be considered in a waste reduction strategy, minimising leakage from distribution systems supplying water to consumers should be a strategic priority. This requires effective metering of the water supplied to distribution systems and the application of effective leak detection and repair technologies. This parallels and should inform the repair and or replacement of sections of the distribution system. Good practice guidance on adopting a strategic approach to minimise leakage, and on the available techniques and technologies, is available and should be considered.[65]

SCP Applied to Water Conservation and Efficiency in Institutions and Households

Institutional settings comprise:

- Hospitals
- Educational establishments – kindergarten, schools, universities, etc.
- Research and development institutes
- Public offices – governmental and others
- Municipal swimming baths, etc.
- Bathrooms for public use
- Watering of public roads (dust suppression) and green open spaces such as ornamental parks and gardens, as well as supply to ornamental water fountains
- Miscellaneous other settings

Improving the efficiency of water use and reducing the net water consumption in institutional and household settings involves the same spectrum of tools and measures noted above. In households, of course, only the simpler measures will be appropriate. Effective communication is essential. Both to raise the awareness of households of the overall need to conserve water, and specifically to inform them of the practical steps they can take to reduce their water use while maintaining good levels of hygiene and standards of living.

64 See, for example, Waterwise (2009, updated 2019) Water Efficiency Retrofitting: A Best Practice Guide References, available at: https://www.waterwise.org.uk/knowledge-base/water-efficiency-retrofitting-a-best-practice-guide-2009/

65 European Commission (2015), EU Reference document - Good Practices on Leakage Management, available at: https://circabc.europa.eu/sd/a/1ddfba34-e1ce-4888-b031-6c559cb28e47/Good%20Practices%20on%20Leakage%20Management%20-%20Main%20Report_Final.pdf. Also, see CIWEM Policy Position Paper: Water distribution system leakage in the UK, available at: https://www.ciwem.org/assets/pdf/Policy/Policy%20Position%20Statement/Water-distribution-network-leakage-in-the-UK.pdf

In kitchen and bathroom settings, simple measures can include communicating to personnel the need to save water by ensuring that, for instance, taps are turned off after use and that leaking taps are repaired promptly. Replacing conventional taps with plunge-bayonet taps (supplying water for a set time) is an example of a specific measure that can also be adopted. Installing water efficient flush-toilets is another good practice measure. Many more examples are available from sources of good practice guidance.

6.3 Resource Recovery from Municipal Solid Waste

Background

In 2017 the responsibilities of the State Committee of Ecology and Environmental Protection (SCEEP) were strengthened and institutional arrangements were put in place that allowed the waste (collection) service coverage to increase from 22% of the population in 2016 to 53% in 2018.[66] And the Strategy on Municipal Waste Management for the period 2019–2028 (MSWM Strategy 2019-2028) sets well-defined goals until 2029, to support the achievement of target 12.5 of the Sustainable Development Goals (Annex C), i.e. '*By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse*'. Moreover, STRUGE priorities include the creation of a modern solid waste processing system and, specifically (Annex A):

- Development of sanitary cleaning infrastructure aimed at ensuring full coverage of population with services for collection and removal of solid waste
- Reducing the volume of solid waste for disposal in landfills, the creation of modern solid waste landfills that meet the requirements of sanitary and environmental standards
- Using MSW as an alternative source of energy

Overall, however, the current waste management system – considering not only waste collection but its treatment and disposal, with resource recovery and recycling – is in an immature state of development, with most waste dumped on land. Further characteristics are noted below:[67]

- All waste data in the MSWM Strategy 2019–2028 are estimated and incomplete and the 2002 Law on Waste does not respond to the needs of the new system of waste management.
- The number of land-based sites for municipal solid waste (MSW) in Uzbekistan is recorded, see Table 9. While details as to their design and operation, i.e. the extent to which these sites conform to the engineering and environmental standards expected of a good practice, modern landfill site (polygon) are unclear, it is thought likely that the vast majority of sites are operated as dumpsites. A recognised Government priority is to replace existing dumpsites by controlled landfills (polygons). It is thought possible that many dumpsites may be regularly set on fire to make space for additional waste.
- The first MSW sorting plant was put into operation in 2018 but the separation or sorting of MSW has not yet been formally introduced as a national policy, although the informal sector and private companies are active in recovering a range of recyclables from waste – see Table 10. A recycling rate of 5-10% was estimated for 2017 but could be higher in reality.
- Although requirements on safe handling and treatment of medical waste are in place, public hospitals face challenges in complying with them owing to limited funds being allocated to medical waste management by hospital budgets. A specialised service for collection and treatment of medical waste is not available.

Table 9 Municipal Solid Waste Disposal on Land – Numbers of Sites in 2017[68]

Region	Official Sites	Unofficial Sites	Unconfirmed Other
Republic of Karakalpakstan	17	12	804
Andijan	15	29	1 865
Bukhara	15	26	1 137

66 UNECE (May 2020) Uzbekistan Environmental Performance Reviews: Third Review – Highlights, pp.22-23.
67 *Ibid*
68 *Ibid,* Table 4, p.23. Source of data: SCEEP, 2018.

Region	Official Sites	Unofficial Sites	Unconfirmed Other
Jizzakh	10	250	-
Kashkadarya	16	141	1 384
Navoiy	9	10	695
Namangan	12	96	1 786
Samarkand	15	86	2 502
Surkhandarya	18	12	1 613
Syrdarya	12	83	498
Tashkent	23	96	2 358
Fergana	15	15	2 091
Khorezm	9	75	1 217

Table 10 Numbers of Recycling Organisations and Quantities of Recovered Waste Materials (processed Waste), 2017[69]

Material Recovered from Waste	Number of Organisations Engaged in Recovery Activity	Material Recovered (tonnes)
Polyethylene	72	34,400
Paper	65	91,000
Tyres, rubber	16	35,500
Textiles	1	7,000
Glass	7	11,100
Oils	1	35,000
Metals	10	216,000
Other	11	201,000

Materials Recovery: End-of-Life Products (ELP)

While the MSWM Strategy 2019-2028 and STRUGE demonstrate the Government's intention to modernise the system of municipal solid waste management in the Republic of Uzbekistan, neither identifies ***specific*** measures to reduce the rate of increase in MSW generation (decoupling this from GDP growth); or to foster at-source separation, collection and recycling of ELP such as vehicles, vehicle tyres, batteries embedded in vehicles and electronic equipment, freezers and refrigerators (and the refrigerants they hold), computers, printers, scanners, televisions, washing machines, light fittings, and other waste electric and electronic equipment (WEEE).

Most such ELP waste streams contain materials that are hazardous to some extent and/or have economic value. Disposing of such products in a manner that ignores their economic value (and the depletion of Natural Capital[70] that it represents) epitomises a linear, 'use-throwaway' economy (see Chapter 1).

Furthermore, key issues such as financing of waste management and others, need to be addressed satisfactorily in order that MSW management can be upgraded sustainably to the desired level. Six essential building blocks of an enabling environment necessary for a modern MSW management system applying SCP – including the minimisation of waste generation and maximising material and energy recovery from wastes – may be identified: a consistent legislative and regulatory framework, institutional capacity and capability, operational infrastructure, sustainable finance, a culture of compliance, and efficient and supportive markets/

69 UNECE (May 2020) Uzbekistan Environmental Performance Reviews: Third Review – Highlights, Table 5, p.23. Source of data: SCEEP, 2018.

70 A generic introduction to the concept of Natural Capital, providing links to many authoritative sources, is given by Frost, R.C. and Faircloth, P.L. (October 2021), FWR Publication FR/G0012, *Natural Capital and its Relevance to Improving Freshwater and Wetland Habitats*. Available to download from Library/Guides at http://www.fwr.org.

outlets. In many respects these are generic features, applicable to all value chains and cross-sectoral areas. Their relative significance depends on specific value-chain and cross-sector characteristics, but all are strong regarding resource recovery from waste. Chapter 7 develops this theme using resource recovery from waste as an example.

Minimising Solid Waste Generation Rates

A goal for producers, importers and suppliers should be to minimise the quantity of materials used to make and package products for supply to retailers and consumers – while retaining product quality and protection against damage in transit. They ought to do this for financial reasons, at least, although they may need encouragement to appreciate the potential to save costs, increase profits, and protect the environment. Extended Producer Responsibility policies can, however, strengthen the obligations placed on producers, importers and suppliers. They can do this, for instance, through requiring that products placed on the market are repairable – thus extending useful product lives – and may be readily dismantled (for material recovery) when they have reached the end of their useful lives. In both cases the effective rates of waste generation are reduced. The EU's Circular Economy Action Plan embodies such a regulatory approach.

Through behavioural change – which might need to be stimulated through effective communication techniques – consumers also may exert direct and indirect influence on the rates of waste generation. For instance:

Directly, through

- Ensuring effective maintenance and repair of products, so extending their useful lives
- Choosing not to throw away products unless they are unfit for purpose, and when disposing of still-serviceable products, trying to pass them on to others for their use
- Making full use of consumable items, e.g. using both sides of printing paper
- Amending their food buying and hospitality behaviour so as to avoid generating excessive food waste

Indirectly, through

- Their purchasing choices, sending market signals to producers, importers and suppliers that there is significant consumer demand for 'low waste' products

It should be noted that where waste disposal strategy includes one or more waste-to-energy plants there will be an in-built conflict of interest regarding paper, cardboard, plastics and textile wastes. These wastes are the combustible components of MSW and a waste-to-energy-plant will be designed for a relatively narrow range of these arisings. Once designed and built there is no or limited incentive for minimising the generation of such wastes.

Strengthening Waste Collection and Resource Recovery – Target Waste Components

Certain components of solid waste should be diverted from disposal with mixed dry waste whatever national or regional waste management strategy is implemented – regardless of whether waste-to-energy plants are provided. They include end-of-life electrical and electronic appliances such as batteries, refrigerators, freezers and other so-called 'white-goods'; and biodegradable 'wet' wastes including food, 'soil' from babies' nappies and from pets, and green wastes.[71] All these wastes either contain hazardous substances or the products of their decay are hazardous. The collection of such wastes separately from mixed 'dry' waste is needed therefore, to enable their processing, to maximise resource recovery, and render them safe.

Ideally, paper, cardboard, plastics, textiles, miscellaneous metal items, and glass wastes should be collected as separate, segregated waste streams. This maximises the recovery of quality materials for recycling or waste-to-energy-recovery. Where cost and practicability considerations rule out separate collection arrangements, however, waste sorting is needed subsequently: (i) prior to disposal of residual dry waste to landfill, where material recovery is the objective, or (ii) prior to combustion, or of the bottom ashes removed from the combustion unit.

71 Treatment needs to be undertaken in ways that are consistent with the availability of outlets for treated 'wet' waste and are compatible with regional climatic and practicability considerations.

Clinical wastes such as infectious materials and body parts, fluids, needles, etc. (so-called 'sharps') arising at hospitals and other medical facilities, and waste pharmaceutical products arising in medical facilities and in homes, should also be diverted from collection and their untreated co-disposal to landfill with MSW.[72] The segregation of such wastes at source is needed to enable their collection, appropriate treatment and disposal, avoid causing harm to the public and workers engaged in other waste management operations, and to avoid the contamination of other wastes from which resources may be recovered.

Hence, municipal solid waste collection systems need to be configured to allow consumers (households, institutions, hospitality and retail outlets) to dispose of their solid wastes in ways that are compatible with resource recovery and local waste management strategy. Collection arrangements may vary to an extent depending on whether household waste collection is communal or property-based. Consideration could also be given to making use or a greater use of larger-scale communal facilities (such as Civic Amenity Sites in the UK). Households (and small businesses) may deposit multiple segregated wastes in assigned containers at such sites – which typically might serve a community population of 10,000 or more – enabling the collection of segregated wastes and their transfer to recycling centres.

Whatever the degree of waste segregation that is expected of the public, it is important that households and businesses are both able to fulfil these expectations and do so in practice. If either of these conditions are not satisfied then cross-contamination of wastes will occur, reducing the rate of recovery of useable material resources, and increasing the quantity of residual waste sent to landfill. Where waste-to-energy is practised, then failure to separate 'wet' from 'dry' waste at source will lead to a carryover of 'wet' waste into the combustion chamber, the water content of this waste leading to a lower combustion temperature and reducing the energy recovery rate.

Consultation with the public on practicable waste collection arrangements is always desirable, therefore, and should be supported through the use of effective communication messages and techniques.

Strengthening Waste Collection and Resource Recovery – Strengthening the Markets

As noted in Table 10, markets exist in Uzbekistan for some recovered waste streams, such as paper, cardboard, plastics, and metal. However, relatively resource-rich waste streams such as end-of-life electrical and electronic equipment (WEEE) are typically disposed of with MSW at present. And the markets for recovered material resources such as composted or digested solids (from the processing of 'wet' waste), and energy recovered as biogas, electricity and heat, are immature at best. Adoption of the SCP approach in practice demands that all of the above markets are developed as far as it is reasonable to do so.

Waste electrical and electronic equipment and end-of-life vehicles

Although most high quality electrical and electronic equipment in use in Uzbekistan, such as computers, is imported, an enterprise (Artel) located in Tashkent was formed in 2011 to produce and supply household electrical and electronic goods to the Uzbek, Central Asia more widely, and other markets. Its product catalogue currently (2022) includes: TVs, monitor screens, mobile phones, air conditioners, thermal and microwave ovens, refrigerators and freezers, dishwashers, washing machines, vacuum cleaners, kettles and other small household appliances.[73] The company also cooperates with international producers, producing their products in compliance with their partners' technical requirements and standards.

Hence there exists a potential local market for the materials that might be recovered from the waste electrical and electronic equipment (WEEE) generated in Uzbekistan. Given the right regulatory push and infrastructural development, it may be possible therefore to create an environment in which materials recovery from WEEE becomes established in Uzbekistan. The recovered materials might be:

- Utilised by existing and potential future producers of electrical and electronic equipment as noted above
- Any surplus recovered materials might be exported as feedstock to neighbouring countries that have the necessary manufacturing capacity

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72 Clinical wastes should be segregated at source adopting a risk-based approach. Some waste may be autoclaved prior to disposal to landfill. Other, more hazardous wastes including pharmaceutical waste arisings in households and dispensaries may be incinerated in high-temperature units, including waste-to-energy plants.

73 https://www.artelgroup.org/catalog-artel/

An EPR (extended producer responsibility) operator, responsible for implementing the principle of extended obligations of producers (and importers) in Uzbekistan, could play a major operational role here.[74] Its role in resource recovery from end-of-life motor vehicles – imported and domestically produced – could be enhanced in parallel. Actions that might stimulate the formation or strengthening of such a system could include:

- Development of a costed national strategy and plan for the enhanced collection of end-of-life appliances and equipment, their disassembly, the reclamation of resource-rich components and, using existing and planned transport infrastructure, the transfer of recovered materials to active markets for them – whether in Uzbekistan or in neighbouring countries. This strategy and plan would have to consider the characteristics and proximity to resource markets of major cities and regions.
- Amendment of legislation to prohibit the disposal of WEEE to landfill sites (perhaps phased-in over, say, 10 years); to require City and Regional authorities to provide separate containers for the deposition and collection of WEEE – in local communities and at larger scale; and, if not already provided, extending the remit of the EPR operator to include electrical and electronic equipment and end-of-life vehicles.
- Republic and Regional budget provision for investment in necessary infrastructure and establishment costs.

Processed ‘wet’ waste solids

If wet wastes are collected separately, the biodegradable components are amenable to treatment by composting and/or anaerobic digestion. Provided that climate-related considerations are not an issue for wet waste collection and treatment, the post-treatment solids may be used beneficially in a number of land-based applications. Other potential constituents of the collected waste, however, may interfere with the treatment process or contaminate the post-treatment organic solids, thereby reducing the quality and usefulness of the product biosolids. For instance, householders placing their ‘wet’ waste in a communal container might collect their waste into a plastic bag and drop the bag of waste into the ‘wet’ waste container. Such bags will likely interfere with mixing, aeration or other process equipment. Effective communication, alongside the provision of practical household ‘wet’ waste containers to be emptied into communal containers, would be needed to help overcome such issues.

After a period of storage, both composted and digested solids may be applied to arable agricultural land, communal parkland and forested land, as a source of humus and nutrients (less so for compost), and as cover for landfill sites. It may also be used for land reclamation purposes. The treated biosolids might also be used for household gardening purposes where this is applicable. Quality requirements are important for those uses that involve growing edible crops. This should be factored in if developing a marketing and outreach strategy for the composted and digested biosolids. Such a strategy should be underpinned by a testing regime and communication to effectively convey the positive benefits of using the treated biosolids. And realism would be needed when assigning a financial ‘value’ to what recipients of the biosolids will be willing to pay for treated biosolids.[75]

Energy from waste

As noted previously, energy can be recovered from MSW components in two combinations: (i) heated anaerobic digestion of the biosolids in ‘wet’ waste, and (ii) incineration of the combustible constituents of ‘dry’ waste. Biogas may be burned to generate heat and electricity, but much of the heat may be needed to meet the process’s heating needs. Outlets for any surplus heat energy are likely to be local and would need to be cultivated. Electricity generation, whether in waste-to-energy or digestion plants, will require that grid connections be made.

74 Lessons might be learnt from the experience of the EPR Operator in the Republic of Kazakhstan.

75 Analogous experience in the United Kingdom, where much of the sewage sludge generated is treated and recycled to land, suggests that recipients might pay nothing. Authority recycling operations there are undertaken as a cost to the Authority, recovered from the charges on their household and business customers.

6.4 Climate Change: Mitigating Greenhouse Gas Emissions

Background

Over the period 2010 to 2017, Uzbekistan's reported gross GHG emissions decreased by 5.4% from 200.1 to 189.2 million t CO_2-eq, while national GDP at constant prices (USD 2015), increased by close to 57%% from USD 60.9 Billion in 2010 to USD 95.3 billion in 2017.[76] Related to GDP at constant prices, therefore, reported carbon intensity fell by close to 40% over the period.

The 2017 Intended Nationally Determined Contribution (INDC) of Uzbekistan stipulates that carbon intensity – as measured by GHG emissions per unit of GDP – should decrease by 10 per cent from 2010 levels by 2030.[77] This commitment is repeated in the Strategy for Transitioning to a Green Economy, STRUGE 2019-2030. However, the latest year for which Uzbekistan's GHG Emissions Inventory has reported emissions[78], and an assessment of the progress since 2017 in meeting the INDC target seems not to have been made. The UNECE's Third Environmental Performance Review took the rather pessimistic view that '*considering the strong growth of the economy and the projected growth of the population, it is very probable that overall GHG emissions will increase significantly, even if the mitigation target of the INDC is reached*.'[79]

However, it is necessary to consider also the past changes in sectoral contributions to GHG emissions, and potential near-future changes to these. Figure 28 illustrates the compositional changes in overall GHG emissions by sectoral groupings from 1990 to 2017. Highlights from these and other, in-depth sectoral, data included in the UNFCC Biennial Report (Footnote 36) include:

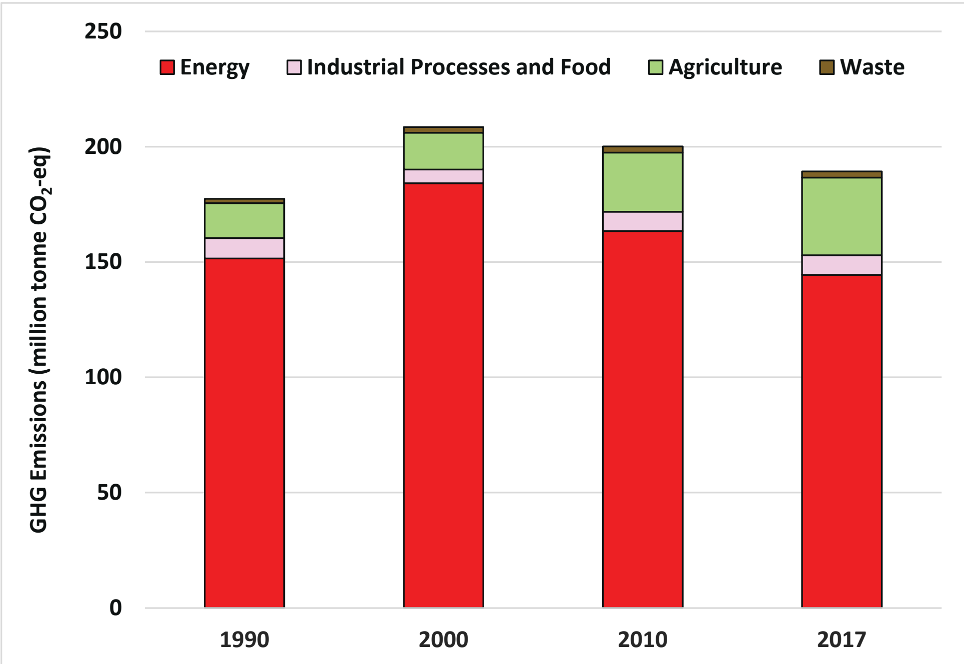


Figure 28 Total GHG Emissions from 1990 to 2017 by Sector (excluding absorption by FOLU)

- The predominance of the energy sector's GHG emissions throughout the period, even though emissions declined in absolute terms since 2000, and decreased by 13.2% between 2010 and 2017 from 163.4 to 144.4 million t CO_2-eq. Noting that the reported GHG inventory data for the energy sector includes both the production and consumption of energy, emissions from this sector comprised 80% of total GHG emissions.

76 https://data.worldbank.org/indicator/NY.GDP.MKTP.KD?locations=UZ. The reported GHG emissions did not allow for the absorption of carbon dioxide in Forestry and Other Land Use (FOLU).

77 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Uzbekistan%20First/INDC%20Uzbekistan%2018-04-2017_Eng.pdf

78 First Biennial Update Report of the Republic of Uzbekistan Under the UN Framework Convention on Climate Change, Tashkent 2021. https://unfccc.int/sites/default/files/resource/FBURUZeng.pdf

79 UNECE. Environmental Performance Reviews – Uzbekistan, Third Review, Highlights, p.16.

- GHG emissions from the energy sector as defined above include emissions from fuel combustion and fugitive emissions (e.g. leaks from oil and gas production, and from gas distribution systems). Total reported emissions from fuel combustion declined a little since 2010, from 96.8 million t to 95.0 t in 2017, but as shown below (Figure 29), this relatively static overall picture hides significant apparent sectoral changes, most especially in the industrial and construction, commercial, and residential (heating) sectors.[80] Strikingly, the emissions from fuel combustion in the energy production sector have been fairly static since 2010, averaging 32.3 million t CO_2-eq per year.
- In contrast, fuel fugitive emissions, which with fuel combustion emissions comprise the total energy sector emissions, declined progressively since 2010, from 66.6 million t to 49.4 million t in 2017, Figure 29. Although a big improvement on 2010, when fugitive fuel emissions comprised 40.8% of total GHG emissions from the energy sector, the equivalent percentage of 34.2% in 2017 remained high – outweighing those from fuel combustion in the energy production sector.
- Residential sector GHG emissions from fuel combustion declined from 32.2 million t in 2010 to 19.6 million t in 2017, presumably through fuel use changes and heating system improvements.
- GHG emissions from agriculture increased from 16.0 million t in year 2000 to 25.7 million t in 2010, and to 33.7 million t in 2017 when they accounted for 17.8% of all emissions. Growth in livestock raising (emissions of methane, CH_4) and the intensive use of synthetic nitrogenous fertilisers (emissions of nitrous oxide, N_2O) are the principal causes – reiterating the general comments made in Chapter 3.

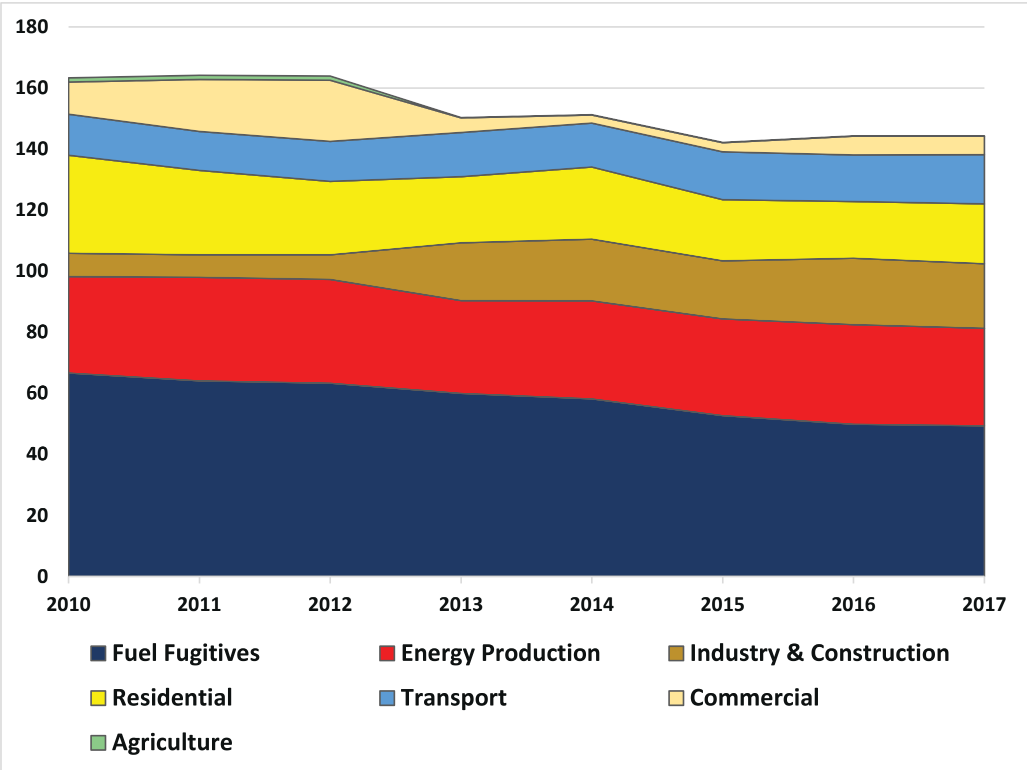


Figure 29 Sectoral Composition of GHG Emissions from the Energy Sector – Fugitive Fuel and Combustion: 2010-2017

Observation

Based on the above summary analysis, achieving Uzbekistan's INDC commitment to 2030 and further reducing GHG emissions in future will likely require concerted action on many fronts:

- Further steps to reduce fugitive and point-source GHG emissions from natural gas and oil exploration, production and distribution systems (Chapter 5)
- Moving towards a decarbonisation of the existing energy system through carbon capture and storage, (blue and green) hydrogen production, innovations yet to be discovered, and the potential adoption of nuclear energy (Chapter 5)

80 The sharp drop in commercial sector emissions in 2013, accompanied the same year by the step increase in industry and construction emissions, suggests there might have been changes in inventory data methodology at that time.

- Effective management to minimise fugitive and point-source GHG emissions in the agricultural sector (Chapter 3)
- Widespread adoption of energy efficiency (EE) measures throughout all production and consumption sectors of the economy
- Adoption of renewable energy resources to a maximal extent: solar, wind, geothermal, hydro, and bio-mass based
- Further cross-sectoral policy initiatives

Energy efficiency, promoting the adoption of renewable energy sources and further, SCP relevant policy initiatives are considered below.

Energy Efficiency

One of the six strategic priorities developed in STRUGE 2019-2030 is to improve energy efficiency in basic sectors of the economy – power generation; heat and power generation; oil and gas extraction, processing and distribution; and the chemical industry – and to improve the energy efficiency of buildings and transport. Annex A summarises the proposed measures, all sensible and mostly technological. Specific energy efficiency goals are that, by 2030:

- The energy efficiency indicator, i.e. the specific energy consumption per unit of GDP, should decrease by 50% relative to that in year 2019
- The energy efficiency of industrial enterprises should increase by at least 20% relative to that in 2019

Also included in STRUGE, is action to raise the awareness of the public more widely on matters of energy efficiency and renewable energy sources. Communication with the public to motivate them as consumers to take practical steps to buy energy efficient appliances and use resources efficiently is emphasised in Chapter 8 of the present document. The use of effective communication as a SCP tool differs from most measures in STRUGE 2019-2030, being generic and 'soft' rather than technological. It seeks to change people's behaviour – individually and collectively – and motivate people to search for effective local resource efficiency measures, substitutions and circularities.

There are boundless operational opportunities for improving energy efficiency in the economy and many might be being pursued already. Energy efficiency monitoring and auditing is one such opportunity. Energy monitoring and targeting (internal benchmarking) is also a powerful technique that may be used to set internal benchmarks, stimulate a search for achieving efficiencies against the benchmark, and assess performance against set targets. It is a far more valuable technique for a given activity (whether institutional, an office, or an enterprise) than the broad-brush approach of making comparisons with the performance of external activities (external benchmarking). Other potentially applicable SCP policy and application tools[81] that may be deployed are listed in Table 11.

Table 11 Potentially Applicable SCP Tools – Energy Saving and Efficiency

Policy Tools	Application Tools
BAT Reference/Conclusions	Baseline Assessment
Benchmarking – external	BAT Reference/Conclusions
Carbon Footprinting	Benchmarking – internal
Carbon Pricing/Taxes	Champions
Communication	Cleaner Design
Consumer Awareness, Interest, Motivation & Behaviour	Counter-current washing/heat-exchange
Eco-design Product Standards	Dematerialisation
Education	Eco-design Product Standards
Emissions Projection	Energy Audits

81 Some SCP tools may be useful for both policy purposes and practical application.

Policy Tools	Application Tools
Financial Incentives	Environmental Management System
Green Purchasing Criteria/Code	Fishbone Analysis
Life-Cycle-Analysis	Good Practice Guides and Case Studies
Mapping the Sectoral Value Chain	Green Purchasing Criteria/Code
Pricing of Publicly Delivered Goods	Heat Exchanger Network
Producer Responsibility	Innovation
SCP Support Mechanism	Life-Cycle-Analysis
	Mass and Energy Balances
	Metering, Monitoring and Sampling
	Product-as-a-Service
	Resource Efficiency Club
	Walk-through Audit

Given the wide-ranging opportunities for energy saving and efficiency measures, it may be sensible to develop a national strategic ‘Roadmap for Energy Conservation and Efficiency, 2022-2030’. An indicative scope for such a Roadmap, included for illustrative purposes only, is given in Table 12. The preparation of such a Roadmap is suggested as an action of the SCP Action Plan in Chapter 9, as is an SCP Support Mechanism to institutionalise SCP (including energy efficiency) promotion and adoption.

Table 12 Potential Scope of an Energy Saving and Efficiency Road Map

	1 – Innovative Energy
1.1	Conducting a comparative analysis of energy efficiency of energy-producing and energy transmission enterprises of the Republic of Uzbekistan
1.2	Setting and updating of energy consumption standards approved by the Government
1.3	Energy audit by energy producing and transmission enterprises
1.4	Development and approval of an action plan based on the results of the energy audit by energy producing and transmission enterprises
1.5	Implementation of the energy management system at energy producing and transmission enterprises
1.6	Annual reduction of energy resources consumption per unit of production by energy producing and transmission enterprises
1.7	Monitoring of compliance with the annual reduction in the volume of energy resources consumption per unit of production to the values determined by the results of the energy audit by energy producing and transmission enterprises
1.8	Implementation of BAT by energy producing and transmission enterprises according to the Energy Efficiency Handbook
1.9	Implementation of a platform for the exchange of experience between energy companies
1.10	Studies on the inclusion of measures for energy saving and energy efficiency in the investment programs of subjects of natural monopolies
1.11	Attraction of international financial institutions to finance energy saving measures
	2 – Energy Efficient Industry
2.1	Conducting a comparative analysis of the specific rate of consumption for production activities in the Republic of Uzbekistan
2.2	Updating of energy consumption standards approved by the Government
2.3	Energy audit by industrial enterprises

2.4	Implementation of the energy management system at industrial enterprises
2.5	Annual reduction of energy resources consumption per unit of production to the values determined by the results of energy audit by energy producing and transmission enterprises
2.6	Development of an online platform for industrial enterprises for the purpose of international exchange of experience
2.7	Implementation of BAT by industrial enterprises according to the Energy Efficiency Handbook
2.8	Dialogue of the Minister with the main experts of industrial enterprises on energy saving and energy efficiency
2.9	Development of support programs to improve energy efficiency in the industrial sector
2.10	Attraction of international financial institutions to finance energy saving measures
2.11	Development of a brochure on energy saving, within the framework of which a technical and economic assessment is carried out on the feasibility of implementing energy-saving measures, considering the restructuring of the company or the modernisation of production facilities
3 – Energy Efficient Transport	
3.1	Conducting an analytical study on the transport sector
3.2	Conducting voluntary and mandatory technical inspections (audits) of transport organisations, fleets
3.3	Improving the energy efficiency of railway transport
3.4	Organisation of events for the disposal of old cars
3.5	Installation of GPS trackers on public and official transport
3.6	Provide for public procurement of transport equipment (cars) with low specific fuel consumption
4 – Energy Efficient Public Sector	
4.1	Research, adaptation, updating of existing orders in the field of energy efficiency and energy saving in construction
4.2	Development of an interactive map of energy efficiency of all buildings of the Republic of Uzbekistan
4.3	Adaptation, development of new standards of the public sector
4.4	Implementation of energy management system in the public sector
4.5	Introduction of energy-saving procurement in public institutions and quasi-public sector entities
4.6	Installation of automatic heat points
4.7	Modernisation of indoor and outdoor lighting
4.8	Installation of metering devices for electricity, gas, heat
4.9	Ensuring energy efficiency requirements at all stages of construction
4.10	Information campaigns and consulting services
4.11	Identification and awarding of energy-efficient institutions
5 – Cross-Sectoral	
5.1	Attraction of foreign universities and energy efficiency centres for cooperation
5.2	Creation of an interregional competence centre in the field of energy saving and energy efficiency
5.3	Development and approval of Roadmaps for energy saving and energy efficiency of major cities and regions
5.4	Training of domestic (national) specialists of large enterprises in the energy management system
5.5	Elaboration of the issue of promotion of energy saving
5.6	Various conferences on energy saving and energy efficiency

Also worth considering are regulatory instruments such as prohibiting the placement on the market of energy-consuming appliances that do not comply with minimum performance standards (taking inspiration from the EU's Eco-Design Regulation); and the voluntary adoption of Eco-Label standards for energy efficiency, enabling consumers to take energy efficiency into account when exercising choice in their purchase of energy products. Keeping abreast of developments in the EU's Circular Economy Action Plan and its implementation is also advisable, and should be kept under review by the Government.

The inclusion of 'green' criteria based on internationally accepted standards for priority areas of public investment and spending is a further policy strand, as recognised by STRUGE 2019-2030. This is an instance where Government may play a powerful role as major influential consumer.

Other policy instruments having a bearing on energy efficiency may be considered, including:

- Emissions Trading System (ETS)
- Carbon tax

They are introduced below in a concluding paragraph to Section 6.4.

Renewable Energy Resources

Developed in order to fulfil Uzbekistan's commitments under the Paris Agreement on Climate Change, STRUGE 2019-2030 envisages the development of renewable energy resources (RES) such that they account for 25% or more of electricity generation.[82]

Hydropower already accounts for 14% of power generation so the target relates to increasing RES use for power generation from 14% to 25%. A start has been made with the commissioning in 2021 of the first solar electricity plant installed in the Republic and commencing the construction of a first wind-powered plant. But achieving the STRUGE target by 2030 may be challenging: it will require commitment and political will to make the necessary investments in RES power generation and its integration into the electricity grid, and to introduce financial and other incentives to assist the adoption of small-scale RES-generated power installations. Government, therefore, may wish to consider policies that encourage, incentivise and enable:

- The adoption of small-scale (solar, especially) units on residential housing, apartment blocks, institutions, etc. in addition to centralised installations – schemes to catalyse their introduction and adoption could be designed.
- Biogas generation in the anaerobic digestion of farm wastes and MSW 'wet wastes'. The available gas energy has to meet process heating requirements, so its contribution to energy supply is likely to have local significance only. Nevertheless, it might contribute significantly to energy supply in rural areas.
- Energy storage to help navigate the peaks and troughs of renewable energy supply, and other supply disruptions; developments in this fast-moving area of renewable energy supply should be monitored and fed into ongoing policy development.

STRUGE 2019-2030 also envisages the development of electric vehicles for road transport. Total GHG emissions from fuel combustion in the transport sector increased from 13.4 million t in 2010 to 16.1 million t in 2017, since when they may have increased substantially. While electrically powered road vehicles (and trains, etc.) reduce air pollutant emissions locally, their effective GHG emissions will depend on how electricity is generated. Promotion of electric-powered mobility, therefore, should be undertaken in parallel with increasing the use of RES for power generation – thereby placing still greater urgency on the introduction of RES generated electricity and/or the adoption of CCS.

Further Policy Instruments

Further policy instruments that the Government may wish to consider include an Emissions Trading System (ETS) and the introduction of a carbon tax. These would be positive moves, fully consistent with an SCP approach, but would need to be introduced with care to ensure that consumers and producers are not faced with precipitate, steep hikes in costs and prices. Such policy initiatives ought to stimulate the energy

82 A significant assumption is that this target relates to electricity generated and not generation capacity.

efficiency drive; the more efficient use of inorganic fertilisers; and help to encourage the uptake of renewable energy generation at various scales.

Adopting an ETS consistent with the parameters of emission trading systems in regions and countries such as the EU and China could involve:

- Developing acceptable proposals regarding cost-free CO_2 emission quotas for installations and sectors of the economy
- Determining an acceptable level of carbon prices and accounting for them when determining the amount of emission allowances allocated free of charge
- Ensuring two-way communication with facility operators regarding Government's plans for the allocation of quotas and their impact on the activities of these operators
- Ensuring the functioning of exchange trading in carbon units, reducing the risks of uncertainty in the distribution of quotas
- Planning a reduction in the volume of quotas distributed annually, placing a limit on the maximum volume of CO_2 emissions

A carbon tax might be included in the fuel price as a VAT or excise duty. Other forms of carbon tax may also be formulated. Carbon taxes are fully in line with the adoption of a SCP approach. But care needs to be taken that their intended introduction is communicated in advance and that its scale is increased gradually, not resulting in unexpectedly steep rises, and in consideration of other measures that may have major cost implications. Moreover, the tax should be revenue neutral, i.e. there should be compensating reductions in other forms of taxation, so that the effect of the tax is to 'nudge' enterprises and people to behave differently – in ways that reduce their GHG emissions without being a drag on the national economy.

Other financial incentives to stimulate the uptake of renewable energy and energy efficiency measures in buildings – residential and others – might also be introduced.

GHG Emissions Inventory and Emissions Projection – a Policy Assessment Tool

It is notable that the process of preparing and publishing annually a GHG inventory[83] appears not to be adopted in Uzbekistan. UNECE has noted the same.[84] Functional national emissions inventories for GHGs (and for major air pollutants), ought to be able to capture historic trends in national emissions, year-by-year. Such an emissions inventory is valuable in enabling retrospective analysis of emission trends but cannot provide insight into future emissions. To fulfil this function it is necessary to link the historic inventory to an emissions projection tool which, loaded with customised policy scenarios, may be used to estimate annual emissions year by year to a pre-set future date. By this means, the potential effects of alternative policy measures may be assessed quantitatively at an early stage before policy and investments commitments are made. Hence, an emissions projection tool is an aid to decision making.

Given the range of policy measures that are potentially appropriate to reducing GHG emissions, and the need to appraise and prioritise them, the possession of an emissions projection tool coupled with a robust historic emissions inventory should be regarded an indispensable policy tool. Hence, action to review and strengthen the process of preparing a national GHG emissions inventory, the methodologies for estimating emissions, and the development of emissions projection capacity is included in the SCP action plan (Chapter 9).

Also, given the multiple sectors involved, close cooperation between Government Ministries on policy formulation, the appraisal of alternative and complementary policies, and policy decision making is essential. And the institutional arrangements to ensure this cooperation occurs should be confirmed and developed.

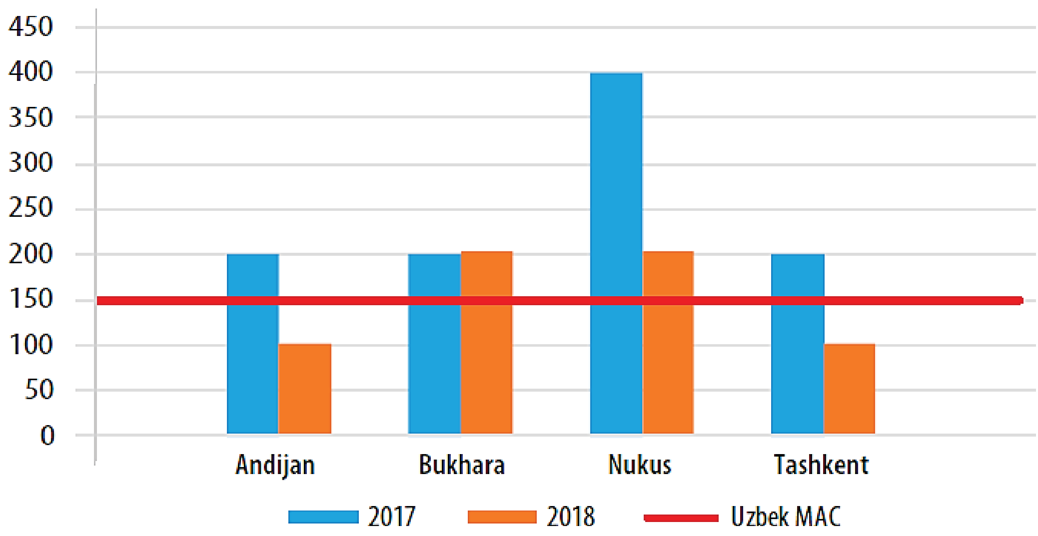
83 This comment applies also to air quality pollutants – see Section 7.8.

84 UNECE. Environmental Performance Reviews – Uzbekistan, Third Review, Highlights, p.16.

6.5 Ambient Air Quality

While improving ambient air quality and public health are not specified as STRUGE priorities, the implementation of climate change mitigation measures signalled in STRUGE, including energy efficiency, should help deliver these as co-benefits. Taking into consideration the UNECE's Environmental Performance Review of 2019,[85] significant observations on air quality management (AQM) in Uzbekistan include the following:

- Compared with World Health Organization (WHO) and European Union (EU) air quality standards, the air quality standards in Uzbekistan are the same for NO_2 and ozone, more stringent for CO and less stringent for SO_2. But no air quality standards are defined in Uzbekistan for particulate matter (PM), neither PM_{10} nor $PM_{2.5}$. The finer PM fraction, $PM_{2.5}$, is considered the principal air pollutant of concern for human health, its potentially toxic composition and ability to penetrate the lungs and blood stream resulting in its association with many human non-infectious diseases.[86] Setting ambient air quality standards for PM (PM_{10} and $PM_{2.5}$) would bring the Republic's AQM system further into line with good international practice.
- Uzbekistan has a comprehensive air monitoring network with 63 fixed posts and measurement of 13 different substances. However, the monitoring of PM_{10} and $PM_{2.5}$ by automatic equipment, along with acquiring technical support for compiling air pollutant emission inventories, should be undertaken as a priority.
- There are some PM_{10} and $PM_{2.5}$ air quality data in Uzbekistan but they are scarce. The available data on PM and dust concentrations suggest that the probability of WHO Air Quality Guidelines for the mean concentrations of PM_{10} being exceeded in cities is high. Annual dust concentrations have exceeded the national standard for dust in some cities, see Figure 30.[87]
- Emissions of aerosols by sandstorms from the Karakum and Kyzylkum Deserts and from dry parts of the Aral Sea, result in a transport dust from the western to the eastern part of the country. Together with the transboundary transport of dust, these sources are likely to be an important contributor to high background levels of dust.
- Air pollution from the residential sector contributes to bad air quality. Contributory factors include:
  - The use of firewood and coal in individual stoves and furnaces with low emission heights
  - Low energy efficiencies in district heating installations resulting from their poor maintenance and inadequate building insulation



Source: Uzhydromet, 2019.

Figure 30 Annual Mean Dust Concentrations in Selected Cities, 2017-2018, μg/m³

85 UNECE. Environmental Performance Reviews – Uzbekistan, Third Review, Highlights, pp. 18-19.

86 WHO Global Air Quality Guidelines, 2021 Update: https://apps.who.int/iris/bitstream/handle/10665/345329/9789240034228-eng.pdf?sequence=1&isAllowed=y

87 UNECE. Environmental Performance Reviews – Uzbekistan, Third Review, Highlights, p.19, Figure 5.

- Industrial emissions of SO_2, NOx and total suspended particles (TSP) have accounted for 40%, 5% and 38% of the total national emissions respectively. In industrial cities such as Angren, Almalyk, Fergana and Navoiy, emissions from mining and industry lead to relatively high values on the Air Pollution Index used in Uzbekistan.
- Best available techniques (BAT) to abate air pollutant emissions as described in guidance documents developed under the EU Industrial Emissions Directive are not applied in Uzbekistan. Emission reduction plans for air-polluting industrial sectors are not developed.
- In 2016, 19% of SO_2 emissions and 70% of NOx emissions from stationary sources were caused by thermal power plants (TPPs). The emission limits defined for specific plants in Uzbekistan are generally less stringent in comparison with EU emission standards based on BATs. On a positive note, the modernisation of old TPPs has begun.
- The agricultural sector is the largest source (99 per cent) of NH_3emissions. Measures to reduce ammonia emissions are not yet widely applied.

Strengthening the air quality management system will take time and resources. Progress in building institutional, technical and human capacity may be required in several areas, including:

- Development and implementation of enabling legislation, including the PM standards indicated above, and the introduction of BAT-inspired regulation of heavy industry
- Development of functional historic emission inventories for air pollutants – priority being given to $PM_{2.5}$, PM_{10}, NOx, SO_2, NH_3, and Non-Methane Volatile Organic Compounds (NMVOC) – initially at national level but extending to major cities and areas where ambient air pollution is evident from monitoring and or modelling data
- Development of national emissions projection capacity, the projections tool being coupled to the national historic emissions inventory to enable policy development (as introduced with regard to the mitigation of GHG emissions)
- Strengthening the air quality monitoring network as noted above
- Air quality modelling to enable the impacts on air quality (and public health) of the expected emissions reductions brought about by policy measures to be assessed – a further policy and decision-making tool
- Source apportionment studies involving the modelling of pollutant emissions dispersion and their reactions with other air pollutants, and chemical analysis of air borne particulate matter
- Interdisciplinary planning of air quality improvement and emissions reduction at national and lower levels, and the implementation of measures

From a SCP perspective, priority should be given to the first three areas above. These would provide a solid groundwork on which other areas could build. Hence these three only are included in the suggested SCP Action Plan, in Chapter 9.

7. AN ENABLING ENVIRONMENT FOR SCP UPTAKE

7.1 Building Blocks of an Enabling Environment: Introduction

An enabling environment is one in which actions to achieve desirable outcomes are facilitated and not unduly constrained by external factors. Such an environment is necessary for the SCP 'resource efficiency', 'substitution' and 'circularity' cornerstone principles (Chapter 1) to be adopted in practice. While the concept applies to SCP uptake in all value chains and cross-sectoral areas, its relevance to the recovery of resources from solid waste – and their economic use and return into the productive sectors of the economy – is especially strong. Hence, the recovery of material and energy resources from municipal solid waste serves as an illustrative example of the concept and the significance of its six key interlocking features or building blocks; see Figure 31. Sections 7.2 to 7.7 introduce the significance of each.

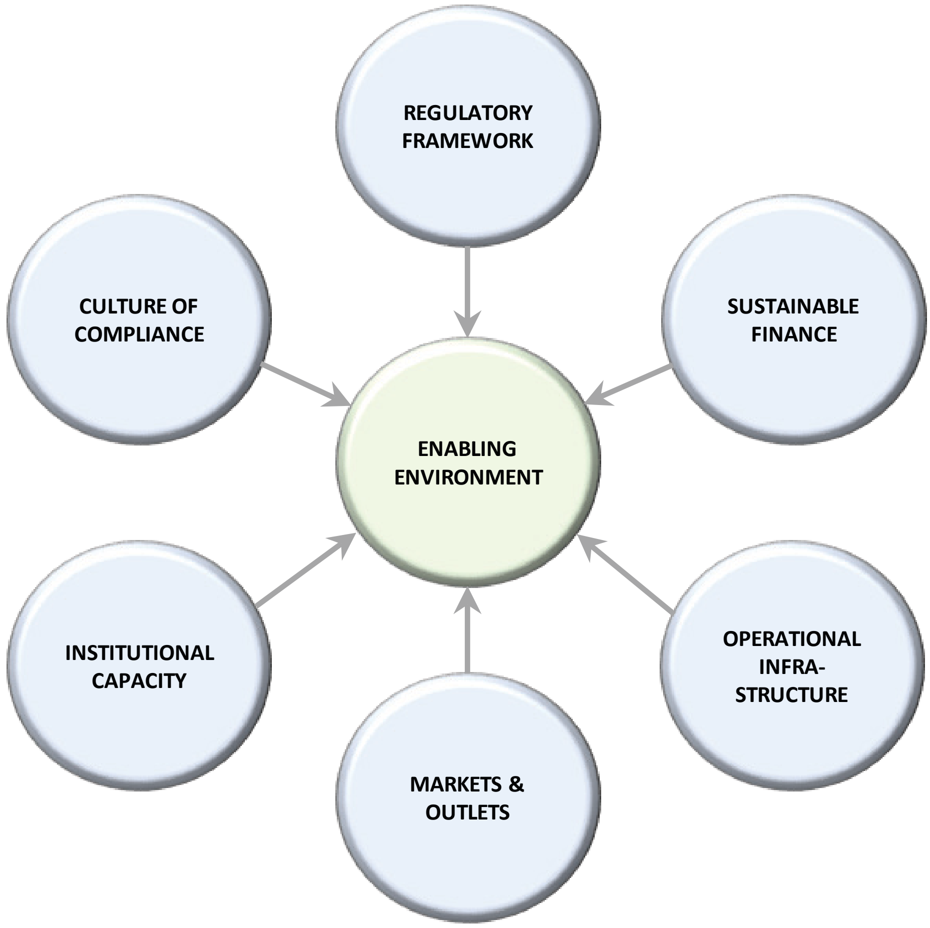


Figure 31 Building Blocks of an SCP Enabling Environment, e.g. for Resource Recovery from Municipal Waste

7.2 Regulatory Framework

Environmental and waste-related legislation - laws and, if applicable, subsidiary regulations - need to reflect and be supportive of high-level goals, as established by national Concepts or other means. Legislation must also be clear, unambiguous, and realistic – capable of being put into practical effect. It needs to establish the direction of travel, specify the mandatory requirements in pursuing high-level goals, and specify the institutional framework and responsibilities. Such issues are summarised separately.[88] As far as possible, the 'hard-wiring' of technological solutions into legislation should be avoided. Legislation otherwise can become obsolete quite quickly. The need for legislative requirements to be realistic suggests also that when a practice is to be banned (e.g. the disposal of food wastes to landfill), the published regulations should come into force

88 Yerbol Orazbekov (December 2021), On the Review of Programmes, Regulations and Initiatives of the Republic of Kazakhstan and Best Practices at the National and International Levels in the Field of Food/Biodegradable Waste Management.

at a given future date, allowing operators sufficient time to introduce new practices and new infrastructure. Not doing so is guaranteed to result in non-compliance, tending to enforce a culture of non-compliance and disrespect for the legislative process.

7.3 Culture of Compliance

What does a culture of compliance mean? It means that society in general tends to act in conformity with legislative requirements, i.e. the law and rules. It does not imply that all individuals and enterprises comply all of the time, but that compliance is the norm, tending to become self-enforcing – setting the standard of behaviour expected of people, institutions and business. In the absence of a culture of compliance, members of society seek out ways to evade their obligations, behaviour that is compounded when enforcement and penalties are weak.

A simple example illustrates the practical significance of having a culture of compliance. Consider the imposition of a weight-based tax (Tenge/t) on MSW disposed of to landfill sites, the tax being payable by the landfill operator (whether in the public or private sector) to the government's revenue collection arm. Such a tax represents a financial mechanism for increasing the effective costs of waste disposal to landfill relative to the costs of material recovery and recycling. By adjusting the relative costs of waste disposal options via a landfill tax, therefore, the recovery of materials from MSW and the diversion of untreated biowastes to digestion or composting plants - can become commercially viable, which otherwise tends not to be the case.

Box 2 below presents a case study of the imposition of a landfill tax in the UK since 1996. This shows that the landfill tax, supported by other regulatory measures, was highly effective in diverting MSW (non-inert solid wastes) away from landfill while not causing a significant increase in illegal dumping. In the absence of a culture of compliance, however, it is improbable that such a financial mechanism would achieve the desired outcome. Far more likely, instead, is that significant quantities of collected MSW would be dumped illegally, forming yet more dump sites.

7.4 Sustainable Finance

Investment funds and finance to sustain operations and infrastructure maintenance are essential for waste management to be effective and meet planning and design goals. Funds may come from several sources, such as:

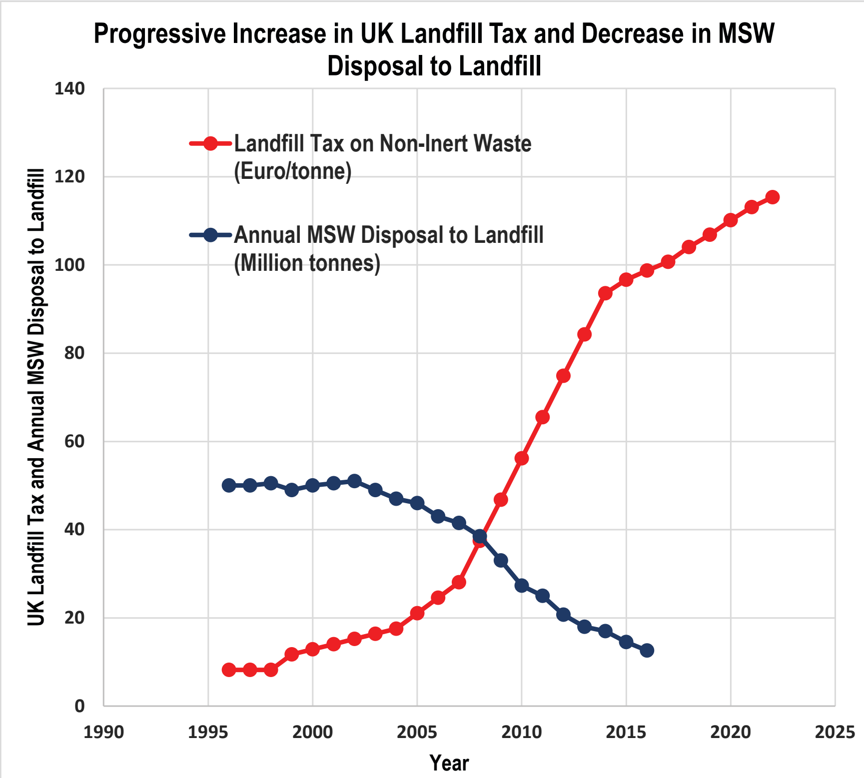
- Cost-recovery from the users of the waste management service, to cover operational and maintenance costs, and debt service charges
- Government (national, regional, city) partial grant-funding of infrastructure investments;
- Taking on debt to finance infrastructure investments
- Environmental Funds (e.g. a landfill tax) established to receive tax payments and disburse part of the monies to worthy causes that meet predetermined criteria
- Income received for the sale of recovered waste materials or energy into the market
- Government subsidies to operators, to partially meet operational and maintenance costs

The present status of waste collection and disposal suggests that sustainable finance may be a critical issue in much of Uzbekistan. In the absence of adequate and sustainable finance, however, ambitious waste management aspirations cannot be realised. Over-reliance on government budgets to help meet (subsidise) operational and maintenance costs is probably unwise since changing budgetary circumstances and government priorities risk the sustainability of such finance.

If raising additional sustainable finance from users of waste management services or government is constrained by affordability considerations, it may be prudent to scale-down ambitions to match the available budgets. Constrained finances should be taken into consideration, therefore, when planning future infrastructural developments, whether engineered landfill sites, biowaste treatment processes, or incineration plants equipped with energy recovery.

BOX 2: Tax on Landfilling of Waste – a Case Study from the UK (1996-2020)

In 1996 a landfill tax was introduced in the UK to better reflect the environmental (non-market) costs of landfilling, to recover value more of the waste that is generated, and to dispose of less waste to landfill. The tax has been applied to two categories of waste – inert and non-inert – the latter attracting the higher tax level. The chart below shows the rate of landfill tax for non-inert wastes increasing from £7.00/t in 1996 (about EUR 8.19 at 2021 exchange rate) to almost EUR 100/t in 2016 and EUR 113.1/t in 2021. The tax on inert wastes has been much lower, increasing from EUR 2.3 per t in 1996 to 3.6 per t in 2021.[89]



Following the introduction of the landfill tax on non-inert wastes (MSW) the quantity of MSW disposed of to landfill in the UK decreased significantly, from about 50 million t in 1996 to 12.6 million t in 2016. Regulatory instruments implementing the Packaging and Landfill Directives (the latter requiring reductions in the quantity of biodegradable waste disposed of to landfill) will have had parallel influences also on practice over that period. There is no evidence that illegal disposal of waste onto land in the UK increased as a result of the landfill tax being applied. However, lessons learned from the application of the landfill tax in the UK include:

- The effectiveness of the tax in diverting waste from landfill was minimal in early years owing to the low tax rate/t of waste
- The much higher rates of tax in later years have led to some exporting of residual waste, in part as refuse derived fuel (RDF) to continental incinerators having spare capacity and lower gate-fees
- To provide a further driver towards material recovery and recycling, consideration should have been given to impose a tax on waste disposal to incineration plants also (whether or not energy recovery was practised)
- A lower rate of tax than the standard (for non-inert wastes) should have been set for stabilised wastes (outputs from biological treatment plants), providing further stimulus to their adoption

7.5 Operational Infrastructure

Infrastructural requirements depend on the waste management system adopted. They comprise the methods used to collect household waste and other sources of municipal solid waste, the treatment and disposal of collected wastes; the recovery of materials and energy from waste; the pre-treatment (e.g. sorting) prior to such recovery operations; and the associated equipment, containers and facilities for waste storage,

89 See Elliott, T. *Landfill Tax in the United Kingdom*: https://ieep.eu/uploads/articles/attachments/e48ad1c2-dfe4-42a9-b51c-8fa8f6c30b1e/UK%20Landfill%20Tax%20final.pdf?v=63680923242; and https://www.gov.uk/government/statistics/landfill-tax-bulletin/current-and-historic-lft-rates

collection and delivery to waste processing and disposal. The infrastructural needs of a modern MSW management system are extensive. Annex H indicates significant issues concerning two representative systems, both requiring consumers to separate their waste into dry and wet fractions prior to collection, appropriate management of wet wastes being required in each alternative system:

- One in which the goal is to recover materials from dry waste for recycling, the residual waste being disposed of to an engineered landfill site; and
- One in which dry waste is fed to a waste-to-energy plant, materials recovery being a secondary consideration.

Each requires sustainable financing for the operations to be carried out effectively and in an environmentally satisfactory way, though the waste-to-energy route is usually considered to incur higher costs.[90]

Additionally, each system should accommodate facilities to enable the separate collection and management of wastes such as end-of-life electronic equipment, batteries, white goods, etc., and hazardous household substances (small batteries, paints, solvents, pharmaceuticals, etc.). In the absence of appropriate facilities, such wastes are likely to contaminate segregated dry waste streams.

Local civic amenity sites where citizens may dispose of unwanted items in dedicated containers offer one opportunity for the collection of wastes such as: electronic equipment, paints, etc., light fittings, white goods (washing machines, freezers, etc.), and a wide range of other recyclable materials (paper, cardboard, glass, metals, textiles, wood and hardboard, aggregates and more). Once collected, such segregated wastes may be distributed to centralised facilities for further processing. Arrangements need to be in place also for centralised facilities where end-of-life vehicles may be brought to be disassembled into (i) components to be reused in the repair and maintenance of vehicles on the road and (ii) other materials that may be returned as feedstock into the processing and productive sectors of the economy (either nationally or in other countries).

7.6 Markets, Outlets and Demand

Any waste management strategy that involves the recovery of materials or energy from collected waste depends on there being outlets or markets for the recovered material or energy streams. Without there being an active demand for these, the adopted strategy will default to disposal only. But where demand is latent (there but not realised), active communication and promotion of the benefits may be required, perhaps supported by appropriate, tailored legislation.

Some constraints cannot be waived away, however; for instance, a dispersed population and low national population density, which limit the opportunities to achieve economies of scale in materials recovery and recycling operations. Table 13 considers market outlet and demand issues for materials and energy that typically may be recovered from MSW and end-of-life products.

Table 13 Outlets and demand considerations for various waste recovery streams

Waste Recovery Stream	Market Outlets	Demand Considerations
Energy – electricity (generated in waste-to-energy plants or from biogas)	Domestic	As waste is generated continuously, so should energy generation. However, local electricity demand may be variable. Hence power may need to be fed into the wider grid. Grid operator should coordinate with other sources of electricity supply. Prices received may fluctuate with the prices of other sources of energy.
Energy – steam and hot water (generated in waste-to-energy plants or from biogas)	Domestic – local to generating plant	Local sources of demand may be seasonal or otherwise intermittent. Multiple demand sources might be needed, increasing the costs of distribution infrastructure. Prices received may fluctuate with those of other energy sources. In the absence of demand, waste heat will need to be rejected.
Processed biowaste – digested or composted waste	Domestic – local to processing plant	Stored product might be used in agriculture, for land reclamation, capping residual waste landfill sites, and in parks and other green spaces. It is unlikely that producers will receive much if any payment. Producers will need to promote the benefits of its use and undertake quality assurance. If demand is absent the processed waste may be landfilled.

90 World Bank Group (2018). Decision Maker's Guides for Solid Waste Management Technologies.

Waste Recovery Stream	Market Outlets	Demand Considerations
Food waste from public catering and institutions	Domestic	Waste food is allowed to be used as feed for livestock subject to its refrigerated storage and (for fattening pigs) thermal sterilisation. Disease transmission is a risk if food waste is not treated appropriately.
Materials recovered from end-of-life vehicles	Domestic and export	Road vehicles consumed by the population and business sectors are mostly manufactured elsewhere and imported into Uzbekistan. Consequently the opportunity to recover materials from end-of-life vehicles and to reintroduce them into Uzbekistan's productive sectors as feedstock may be limited. The substantial development of capacity in Uzbekistan's manufacturing sector might relieve this constraint. But a more realistic objective may be to expand and develop operations for vehicle dismantling and material recovery in Uzbekistan (at least in the major conurbations). And to export recovered materials to countries where large-scale manufacturing sectors already exist.
Materials recovered from end-of-life electronic equipment (WEE)	Domestic and export	As above but concerning WEE.
Paper and cardboard	Domestic and export	Established practice and currently promoted and supported by the ban on the export of wastepaper, cardboard and recovered paper, and by the ban on disposal of wastepaper to landfill. Prices paid in the market for all of these separated waste streams will fluctuate with changes in market demand and will depend on contamination levels. For instance, clear glass attracts a higher price than does coloured glass, so their mixing reduces the price to the lower level.
Plastics	Domestic and export	
Metals	Domestic and export	
Glass	Domestic and export	
Timber and hardboard	Domestic and export	
Aggregates	Domestic	

7.7 Institutional Capacity

The institutional challenges involved in moving from a waste management system in which much of the collected waste is dumped, to one in which materials and energy recovery play full and integral roles is respected, should not be underestimated. Waste management organisations need to have adequate capacity in terms of staff numbers, skills and experience. Cities that already have functioning segregated waste collection and recovery operations are likely to be better positioned than others. It may be beneficial, therefore, to make an appraisal of existing institutional capacities nationally and in the regions and large cities, to determine the specific needs for capacity strengthening across the Republic.

More generally, the sustainable adoption of SCP requires that all producers and consumers are aware of the benefits that SCP can bring and have the capability to identify SCP measures. Raising awareness and the development of capability is essential, therefore, and requires concerted efforts over some years. Chapter 8 develops this further, arguing that an SCP Support Mechanism (SCP-SM) will be needed to establish this aspect of an SCP enabling environment.

8. A MECHANISM TO HELP STIMULATE SCP UPTAKE

8.1 Why a Mechanism is Needed

The national SCP Action Plan has, at its heart, further effort by central Government to strengthen Green Policies and ensure that both existing and strengthened policies are applied in practice by regional governments and all relevant stakeholders. Such policies may involve implicit requirements that the productive sectors of the economy make greener investments. For instance, as a result of a Government's application of BAT to large combustion plants, stricter pollutant emission limit values may be set, to be complied with by a specific date; requiring that existing installations make appropriate investments. Table 14 presents a range of areas where 'hard-edged' policy adjustments could be beneficial. Several, such as the economic pricing of consumed resources and an extension of the producer and supplier responsibility, would act to strengthen the enabling environment for SCP without necessarily requiring major investments. Figure 32 represents the twin-track approach of the SCP Action Plan regarding national policy development and its application, including an SCP support mechanism.

Table 14 'Hard-Edged' Areas for Policy Development to Support SCP Uptake

Areas for Further Development of 'Hard-Edge' Policies to Support SCP	
Pricing of consumed resources – Energy, Water, Materials, Landfill volume	Limits on annual volumes of freshwater abstraction – Specific to water-stressed basins
Extended Producer Responsibility – Producers and suppliers of manufactured products such as electrical and electronic goods, motor vehicles, refrigerators, etc. – Facilities for receiving end-of-useful-life goods and their dismantlement to enable material resources to be recovered and returned to market	Green Products in the Marketplace – Mandatory minimum product performance standards (e.g. energy and water efficiency) for specified types of goods to be sold in the market – Ecolabelling of goods, enabling consumer choice – Green purchasing codes
Cost-recovery financing of solid waste management operations – from collection through to treatment and disposal – Consistent with resource recovery	Applying BAT as a regulatory principle in specified sectors, e.g. – Energy; Chemicals; Metallurgical; Food, Drink and Milk industries; Textiles
National emission inventories, projections and commitments – GHGs and Air Pollutants – Ratify CLRTAP Gothenburg Protocol	Decarbonising the energy system in the long-term – Use of renewable energy resources – Carbon capture and storage (CCS) – Hydrogen (blue and green)

Noted in Chapter 2 and developed in Chapter 7, there are several strands to an SCP enabling environment, the most notable being a consistent legislative and regulatory framework, institutional capacity and capability, operational infrastructure, sustainable finance, a culture of compliance, and efficient and supportive markets/outlets. All apply strongly when considering SCP in the context of resource recovery from solid waste, but their relative significance in other cross-sectoral areas and in different value chains depends on sector-specific characteristics.

Common to all, though, is the need for adequate institutional and stakeholder capability and capacity. This itself comprises many aspects, but critical to SCP uptake is the stimulation of behavioural change, whether of people acting as householders or in an enterprise or institutional setting. The importance of behavioural change stems from the fact that the application of SCP in practice depends often on stakeholders and actors taking *voluntary action*. Hence people first must first be *aware*, and then *motivated*, and *have practical tools and guidance tailored to their specific needs*. In the short-to-medium term, a mechanism to stimulate behavioural change is needed – distinct from a regulatory approach mandating stakeholder action.

This may be complemented by adjusting the curricula of primary, secondary and tertiary levels of education – this would feed through to longer-term awareness. SCP could be introduced into curricula through, for instance, including appropriate examples to illustrate aspects of physical and life-science subjects.

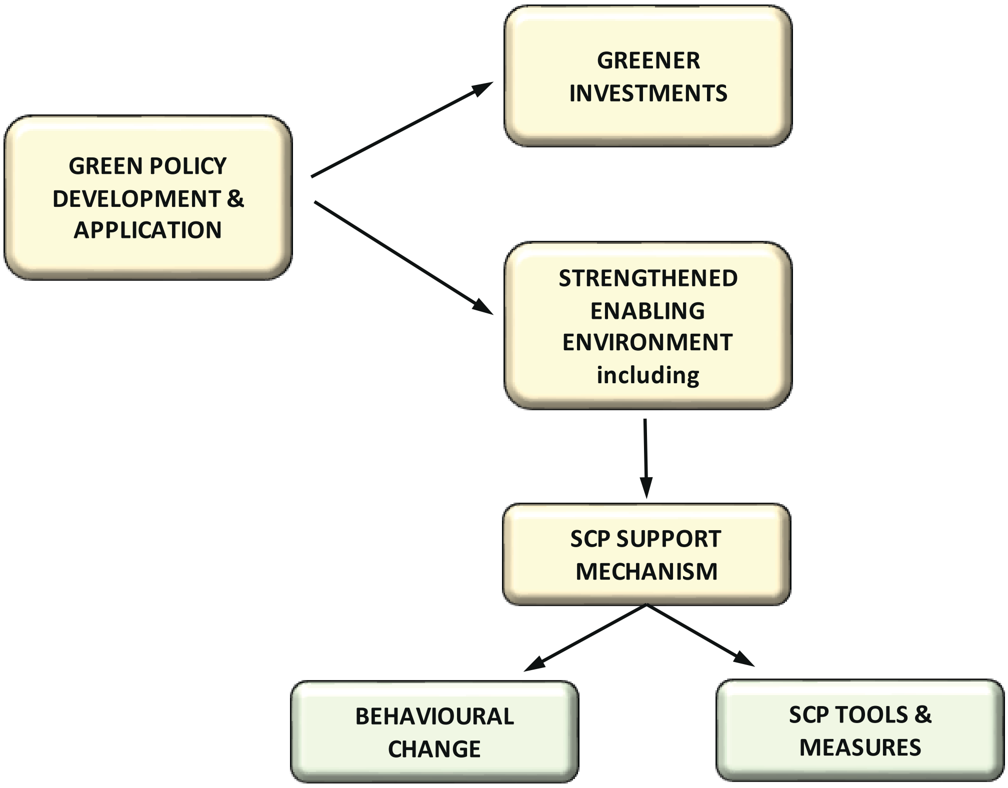


Figure 32 Twin-track representation of the SCP Action Plan, indicating the role of an SCP Support Mechanism

Prompting behavioural change is not easy. For every individual in a household, business or institution that is aware and mindful of the need to change from the old ways of doing things, many more may see no need for change or are unwilling to do so. And simply telling them that change is needed may not work. People can be stubborn. In tackling this resistance to change, effective and sustained communication in which people's concerns are identified and addressed with practical arguments and clear messages is an essential tool. Effective communication can also mean the provision of practical guidance, information and support to motivated consumers and producers. This can help to shift them from a situation in which they are aware but unsure what they can do, or how to do it, to one where they are not only aware but feel empowered.

Many models of behavioural change exist, but all share the same or similar characteristics. A useful illustration is provided in Figure 33. The green buttons represent five behavioural states on a pathway ranging from unawareness on the far left through to fully empowered and active on the far right. Progression along this behavioural pathway is not automatic, however; effort is required to help people move along it. The kinds of action needed to drive this progression – essential for voluntary SCP action to follow – is indicated in the boxes above the curve.

Making this effort requires that senior managers in enterprises and institutions, and the heads and or influencers within households, are aware of SCP and either drive or are supportive of efforts to adopt an SCP approach. But even being aware and supportive not enough. Without appropriate external support, there are limits to what they can do. An external mechanism that can inject enthusiasm, stimulate action and provide support, is needed. The underlying principles for such a mechanism are provided in section 7.2 below. The national Government should apply these when considering their options in determining an appropriate mechanism and its institutional 'home'.

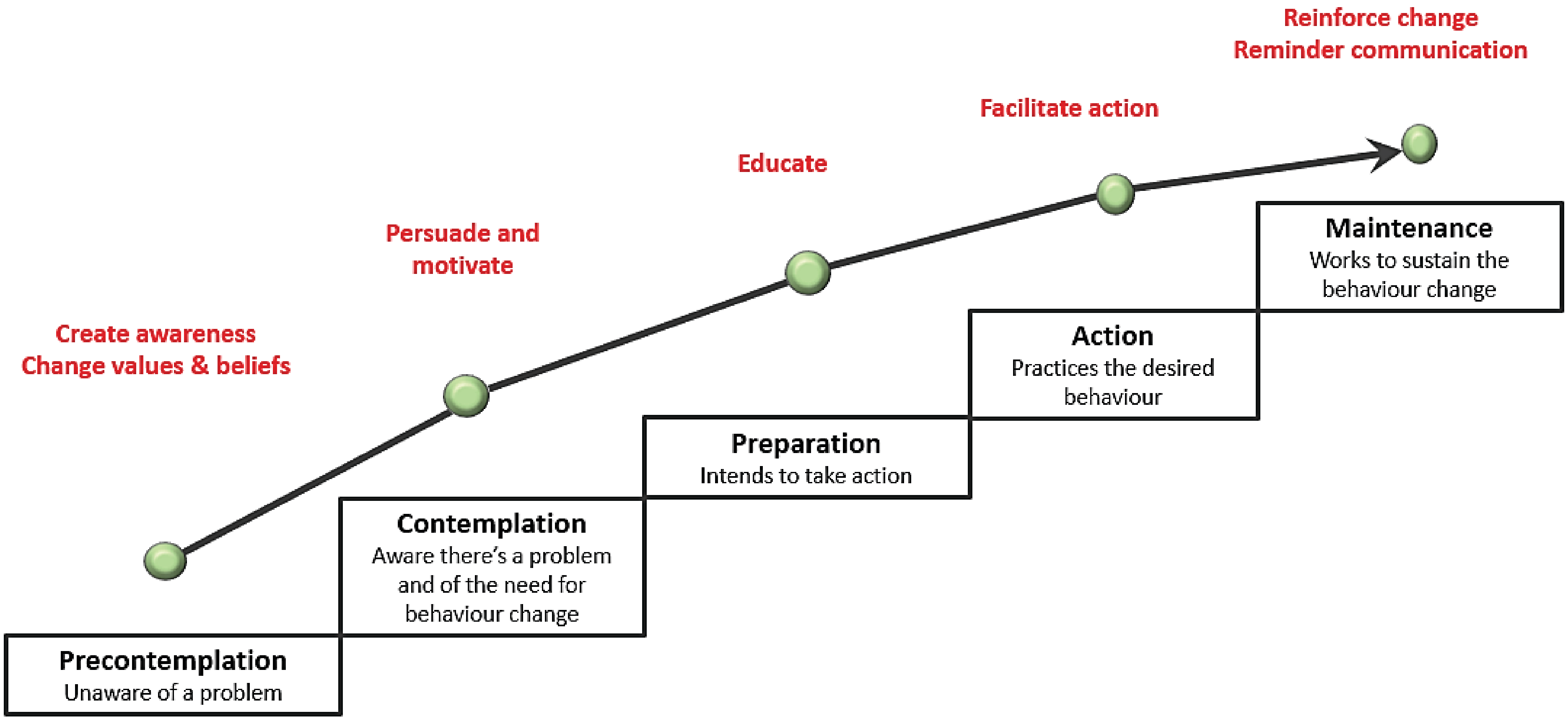


Figure 33 A model for promoting behavioural change that may be adopted to stimulate SCP action

8.2 SCP Support Mechanism: Principles for Effectiveness and Good Governance

An SCP Support Mechanism, effective in raising awareness and stimulating both behavioural change and the active adoption of an SCP approach, should rest on the following principles.

1. The mechanism should receive the full endorsement of the national Government and, ideally, regional governments.
2. Its goals should be to raise awareness of SCP, to stimulate SCP action by stakeholders in the production and consuming branches of the economy, and to transmit SCP tools, information and guidance to stakeholders – thereby enabling their adoption of SCP.
3. The mechanism adopted should focus on promoting the uptake of SCP in the areas covered by the present SCP Action Plan, phased in recognition of Government priorities and initial capacity and capability constraints, i.e. (i) agriculture and agri-products, energy, and metals value chains; and (ii) the cross sectoral areas of freshwater conservation and efficiency of water use, reducing GHG emissions, ambient air quality, and the recovery of resources from municipal solid wastes.
4. Sufficient time will be needed for the mechanism to achieve the goals set. Assuming its establishment in 2022-2023, the mechanism should be operational until 2030 – coincident with the time limit for STRUGE – at which time consideration may be given to its potential extension and expanding/ revising its remit.
5. Applying the mechanism will require the commitment of financial and human resources. In principle these might be provided via a network of national experts, partially supported perhaps by national and international donors. But the formation, management and financing of that network would be challenging and the risks of waning initial enthusiasm and financial disruptions might be considerable. A more sustainable commitment of resources to enable a functioning mechanism might be to establish an SCP support mechanism within an existing institution – governmental or otherwise – funding and human resources to be 'guaranteed' by central Government so far as that is possible. The institutional 'home' for such a mechanism would need to be determined by Government.
6. If Government decides to establish an SCP support mechanism within an institutional home, it will need to establish management and operational procedures that allow Government Ministries to exercise strategic supervision without becoming involved in day-to-day management.
7. Engaging international donor support (Technical Assistance) for establishing an SCP support mechanism, and developing both the SCP capability and capacity of the mechanism, would accelerate the national uptake of SCP.

Annex D provides examples of how SCP and SCP-related support mechanisms have evolved in one European country (the United Kingdom) and summarises their remits. It also provides indicative Terms of Reference for an institutional unit – should that be the route that Government wishes to pursue – and indicative human resourcing levels. Through the Switch-Asia programme, much experience has been gained in East and South-East Asia also, which could help inform the Government's decision making.

The Institute of Forecasting and Macroeconomic Research (IFMR) under the Ministry of Economic Development and Poverty Reduction has recently established a 'Green Hub' to study and develop the green economy and Green growth in Uzbekistan. This may provide a suitable institutional 'home' for the envisaged SCP-SM, although the capability to engineer behavioural change might need to be grafted on through association with other Uzbek entities.

9. SCP ACTION PLAN: 2022–2030

The SCP Action Plan adopts the principles set out in Chapter 2 and, regarding an SCP Support Mechanism, the principles set out in Chapter 8. Hence the Action Plan shown schematically in Figure 34, and elaborated in Sections 9.1, 9.2 and 9.3, comprises three components:

- National Government policy development
- Value-Chain actions
- Cross-Sectoral actions

Also shown in Figure 34 is the role of regional governments, enterprises, institutions and households in taking SCP action as prompted by the roll-out of SCP-SM thematic strategies and other routes. Some actions are identified in the SCP Action Plan, although the need for others may become apparent as time goes by.

9.1 National Government Policy Development

Actions of the national Government are presented in Table 15. They comprise the following:

1. SCP awareness raising and capacity development for Government officials, building on the introduction provided in June 2022 (Action 0.1);
2. Integrating the SCP approach into a STRUGE Action Plan (Action 0.2);
3. Policy areas for national Government consideration, where policy development and amendment could strengthen the enabling environment for SCP uptake, and help to reinforce the incentives for consumer and producer stakeholders to take action. Chief among these are:
   - Commitment to establishing an SCP Support Mechanism (SCP-SM) in line with the principles stated in Chapter 6, for which advice via international Technical Assistance would be beneficial (Actions 0.3 and 0.4)
   - Ensuring the effective operation of the SCP-SM until 2030, subject to performance review. Dependent on the situation prevailing in 2030, the Government may then decide either to extend the SCP-SM's operation or terminate it (Actions 0.5 to 0.8)
   - Policy analyses whose recommendations, if acted upon, could further incentivise changes in consumption and production behaviour in line with the SCP approach; Table 14 in Chapter 8 and Table 15 below identify the policy areas of current potential significance, where effort might be focused (Action 0.9)
4. Government to amend legislation, if and where necessary, to enable the implementation of SCP actions in the value chains and cross-sectoral areas presented in Chapters 3 to 6 inclusive; the thematic activities of the SCP-SM would be one way to identify further barriers to SCP uptake - potentially solvable by legislative amendment (Action 0.10)
5. Inclusion of SCP-related topics in educational curricula, tailored for use in primary, secondary and tertiary settings to raise the awareness of the coming generations (0.11)

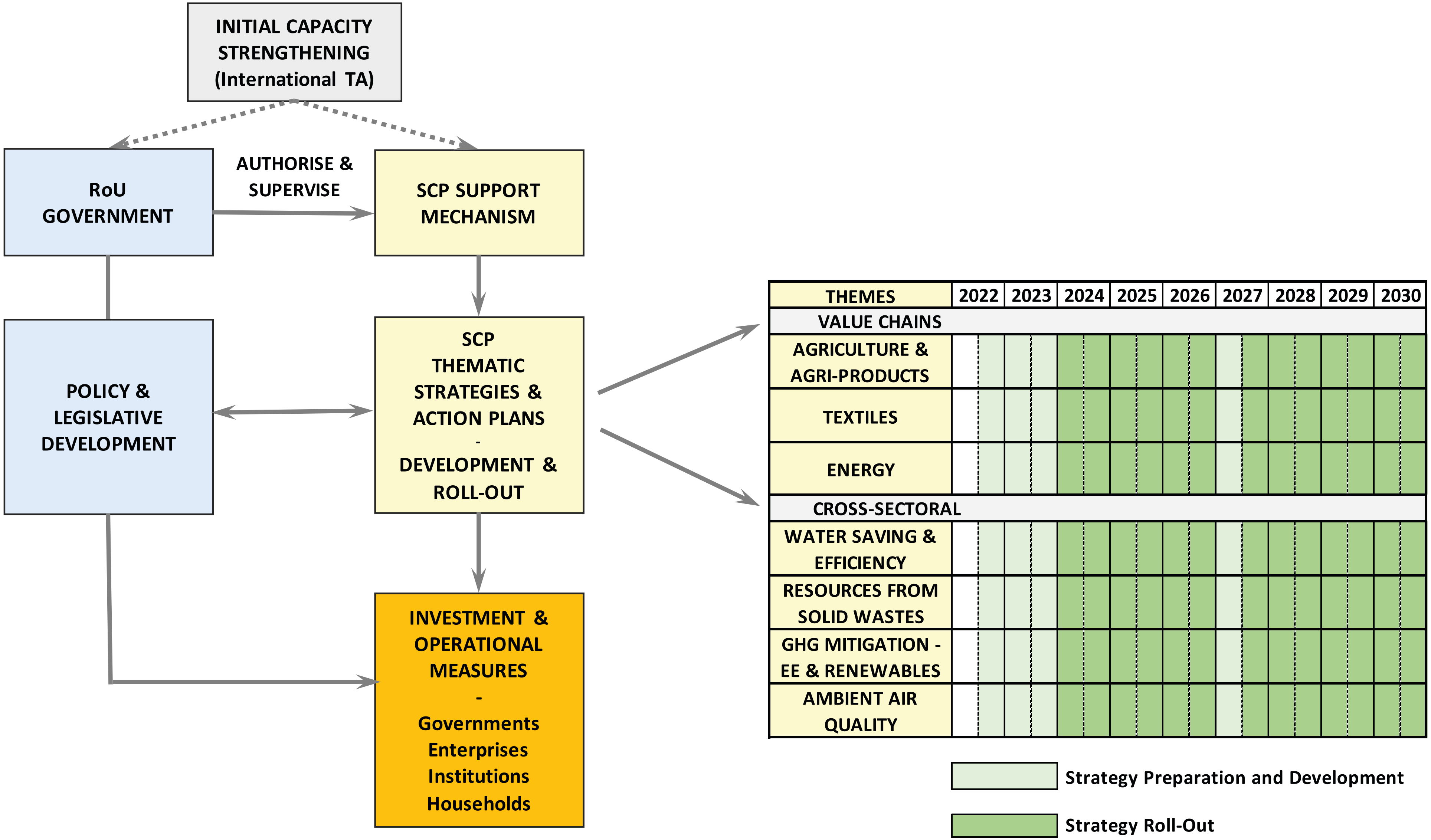


Figure 34 Scope and Structure of the SCP Action Plan

Table 15 National SCP Action 2022-2030 – National Government Policies

No.	ACTIONS – NATIONAL GOVERNMENT POLICY	RESPONSIBLE INSTITUTION/S	PERIOD
0.1	Capacity building for the Government to enhance government's understanding of the SCP approach, supported by international Technical Assistance.	MEDPR (with the support of other relevant Ministries)	2022
0.2	Integrate the SCP approach and action plan into the action plan for STRUGE implementation.	MEDPR (with the support of other relevant Ministries)	2022
ESTABLISH AND MAINTAIN A MECHANISM FOR PROMOTING SCP AND ITS ADOPTION			
0.3	Commit to establishing a funded national SCP Support Mechanism (to promote and enable SCP action in themes 1 to 5 inclusive, and to ensure its funding over the period 2023 to 2030 inclusive, subject to a performance review midway (2026/27) through the period.	MEDPR (with the support of other relevant Ministries)	2022
0.4	Secure international assistance to: (i) help prepare detailed Terms of Reference for a SCP-SM that reflect international good practice, (ii) identify in detail its staffing and budget needs, and (iii) provide targeted capacity building for staff in relevant Ministries and the SCP-SM.	MEDPR (with the support of other relevant Ministries)	2022-2024
0.5	Establish a funded national SCP-SM, to promote and enable SCP action in the targeted value chains and cross-sectoral themes. The SCP-SM will provide a focus for raising awareness and the development of knowledge and tools on SCP and their communication. It will engage with sources of practical experience and knowledge in Uzbekistan, Central Asia, and worldwide.	MEDPR (with the support of other relevant Ministries)	2023
0.6	Provide regular strategic supervision of the SCP-SM's operation and progress.	MEDPR (with the support of other relevant Ministries)	2023-2030
0.7	Decide whether to (i) split the SCP-SM into two parallel differentiated operating mechanisms having distinctive themes and (ii) add further, additional themes for action.	MEDPR (with the support of other relevant Ministries)	2026
0.8	Review the performance of the SCP-SM up to 2030 inclusive and decide whether there is then value in extending the programme or, if not, to close it down.	MEDPR (with the support of other relevant Ministries)	2030
POLICY ANALYSIS AND DEVELOPMENT			
0.9	Further analysis with the objective of recommending policy measures to stimulate actors to make sustainable changes in consumption and production behaviour, such changes to result in improved resource efficiency and conservation. Suggested policy areas are: – Pricing of freshwater abstraction for the use of agriculture, industry, power generation, and public supply utilities. Also, the potential roles that other financial instruments might play. – Setting volumetric limits on the annual volumes of freshwater abstracted from respective water basins whose conservation is under threat. – Adoption of the BAT principle as a basis for the environmental regulation of industrial installations potentially capable of causing significant air, water and land pollution – these could be applied, for instance, to textiles production, the production and refining of oil and gas, thermal power plants of a minimum capacity (≥ 50 MWth), and large-scale metallurgical installations.	Ministry of Economy supported by other Ministries (as relevant) (to either undertake the analysis or commission it)	2022-2028

No.	ACTIONS – NATIONAL GOVERNMENT POLICY	RESPONSIBLE INSTITUTION/S	PERIOD
0.9	– Strengthening the financing of MSW management systems in order that modern systems for collection, resource recovery, processing and residual waste disposal may be conducted in a sustainable manner and consistent with household affordability. – Scope for introducing or strengthening green product procurement practice, including the labelling of appliances according to energy efficiency and or water use efficiency, and prohibiting the sale of appliances that fail to meet minimum technical performance criteria regarding energy efficiency, water efficiency, recyclable content, etc.; – Adoption of an Extended Producer Responsibility (EPR) obligation on producers and importers of specified manufactured goods, and establish an EPR operator in Uzbekistan. – Measures to stimulate the formation and/or development of facilities in large conurbations to (i) receive and dismantle end-of-life vehicles and waste electronic equipment, (ii) recover materials, and (iii) the utilisation of such recovered materials, whether in Uzbekistan or by exporting to third-party countries where they may be used as feedstock in the productive sectors. – The potential for using financial instruments, including a landfill tax, to support the delivery of the Government's objectives regarding waste management; and the conditions necessary for their successful introduction to deliver results. – Pricing of energy (electricity, natural gas, hot water) supplied to consumers (industry, tertiary business sectors, institutions and households) and its potential to stimulate consumers to use energy wisely. And other financial instruments that may help to overcome potential associated household affordability issues. – The long-term future of the fossil-fuel extraction and power/ heat generating sectors and how they may be integrated into a carbon-neutral future, including decarbonisation of energy use, consistent with meeting international Climate Change commitments. – Transitioning to decarbonised road transport – electricity and or hydrogen-powered vehicles; – Ratification of the protocols to the Convention on Long Range Transboundary Air Pollution (CLRTAP) and the Gothenburg Protocol. Committing to the preparation of annual national emissions inventories for GHGs and air quality pollutants ($PM_{2.5}$, SO_2, NOx, NMVOCs, NH_3), and biennial emission projections for the same.		
LEGISLATIVE DEVELOMENT			
0.10	Amend legislation as required: (i) to enable the implementation of agreed actions in the thematic strategies developed for each value chain and cross-sectoral area, (ii) in response to findings from implementing the action plan, and (iii) to implement agreed policy measures identified from the policy analysis undertaken in action 0.9.	Relevant Ministries	2022-2028
EDUCATION			
0.11	Develop educational curricula and teaching materials tailored for use in primary, secondary and tertiary education, with the aim of informing future generations on the significance of SCP, the need to adopt SCP practices, and how individuals can contribute.	MHSSE & MPE	2025-2030

9.2 Value-Chain Actions

Value-Chain actions are presented in Table 16. They comprise actions to prepare and deliver thematic strategies to promote SCP and achieve SCP uptake in three value chains. The SCP-SM would play a major role in this. Other actions would flow from the roll-out of the strategies. There are three groups of actions:

- Actions A.1 to A.13 in the agriculture and agri-product value chain
- Actions T.1 to T.11 in the textiles value chain
- Action E.1 in the energy value chain: SCP actions regarding energy efficiency and renewable energy are covered in the cross-sectoral action plan, given in Section 9.3

9.3 Cross-Sectoral Actions

Cross-Sectoral actions are presented in Table 17. They relate to the preparation and delivery of four thematic strategies to promote SCP and achieve SCP uptake. The SCP-SM would play a major role in this. Other actions would flow from the roll-out of the strategies. The four groups of actions are:

- Actions WE.1 to WE.10 concerning water use efficiency and saving
- Actions RW.1 to RW.11 concerning resource recovery from municipal solid waste
- Actions GHG.1 to GHG.10 concerning the mitigation of GHG emissions through improving energy efficiency and greater use of renewable energy
- Actions AAQ.1 and AAQ.2 concerning ambient air quality improvement

Table 16 National SCP Action Plan – Value Chain Actions

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
AGRICULTURE AND AGRI-PRODUCTS			
FIRST SCP THEMATIC STRATEGY			
A.1	Collate and review published benchmark information, good practice documentation, guides, and SCP case studies that may be relevant to the agricultural value chain in Uzbekistan. Also establish contact with organisations active in this field in other countries.	SCP-SM (with international assistance)	2022-2023

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
A.2	Develop the value chain in a quantitative sense based on the prepared qualitative description and on information held by the MoA, MWR and other bodies. Use this analysis, together with the material collated in action A.1, as a basis for preparing an initial, priority-driven 3 to 4-year thematic strategy to promote and facilitate the application of SCP tools and measures. Its scope may include guidance on, and examples of, good practice; addressing each of the primary, secondary, tertiary and consumption stages of the value chain; and adoption of features of the EU's Farm-to-Fork Strategy appropriate to Uzbekistan's situation. Suggested priority areas are: – Water demand in crops production – making the best use of the available resources; – Food waste – minimising waste arisings at all stages of production and consumption; and, for those wastes that do occur, giving guidance on the necessary infrastructure (and its operation) for their collection, treatment, storage and beneficial use; – GHG emissions from crop growing and animal rearing, and digestion of wastes to produce biogas; – Nutrients (N, P) management in the primary production stage – growing crops & animal rearing; – Pesticides use – to be minimised; and fewer hazardous substances to be used where possible; – Organically produced food; – Packaging of food and drink products – to be reduced and made more recyclable; – Citizen behaviour change.	SCP-SM – calling on Uzbek centres of knowledge, and international assistance MEDPR, MoA, MWR, SCEEP and others – to review and approve proposed programme of work	2023
A.3	Engage with third parties to prepare benchmark reports, good practice guides, case studies, market intelligence reports, etc. as identified in the thematic programme (action A.2). SCP-SM staff to review, edit and require revisions as appropriate before approving a final output. SCP-SM to disseminate outputs through a tailored communication programme.	SCP-SM – commissioning and production External bodies – prepare drafts	2023-2026
A.4	Prepare impact assessments on the uptake and effectiveness of major thematic outputs, reporting the assessments back to the MEDPR, MoA, SCEEP and to the SCP-SM.	External institutions	2024-2026
SECOND SCP THEMATIC STRATEGY			
A.5	Prepare a second-stage, prioritised 3 to 4-year thematic strategy to further promote and facilitate the application of the SCP approach in this value chain; for review and, after necessary revisions, Government approval. Some continuation of first-stage activity may be undertaken but new areas not covered in the first stage may also be addressed.	SCP-SM MEDPR, MoA and SCEEP	2026-2027
A.6	Implement the second-stage strategy, disseminating outputs through a communication programme (as in action A.3), and conduct further impact assessments.	SCP-SM and external institutions	2027-2030
OTHER ACTIONS			
A.7	Undertake trials, as necessary, to evaluate and demonstrate the beneficial uses of treated food wastes in agriculture and other land-based applications; prepare code of good practice and promote its use to farmers and others.	Ministry of Agriculture with the assistance of the SCP-SM and technical institutes	2023-2030

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
A.8	Provide the necessary resources and infrastructure to enable: (i) the collection and processing of food wastes arising from households, the hospitality and food retail sectors, and food and drink production sectors; and (ii) and the beneficial use of treated food wastes.	City and Regional Governments	2023-2030
A.9	Enterprises engaged in the food and drink production and retail sectors to raise their individual and collective awareness of priority issues in the value chain - as identified in the thematic strategy. And establish voluntary business partnerships to take effective steps to achieve pre-set improvement targets concerning these issues. (This action to be stimulated by national and city/regional Government, the SCP-SM, the media, and the voices of citizens and citizen organisations.)	Advanced farms, major producers and retailers of food & drink products	2023-2030
A.10	Enterprises engaged in the hospitality sector (restaurants, hotels, etc.) to respond positively to Governmental, SCP-SM, media, and NGO messaging on the need to reduce food waste, how this can be done, and the changes in behaviour needed to achieve it. Take necessary practical steps, including investments if appropriate, to reduce food waste and collect efficiently wastes arising.	Hospitality Sector & City/Regional Governments	2023-2030
A.11	Households and Institutions (Hospitals, Educational establishments, Prisons, Government offices, Technical Institutes, etc.) where food and drink are consumed to respond positively to Governmental, SCP-SM, media and NGO messaging on the need to reduce food waste, how this can be done, and the changes in behaviour that can help the collection and treatment of the food wastes that do occur.	Consumers and Institutions	2023-2030
A.12	Engage actively in Citizen Behaviour Change initiatives in support of the SCP-SM, focusing on what individuals acting alone and as members of households, institutions and enterprises can do to minimise food waste.	NGOs and the Media	2023-2030
A.13	Provide training and capacity strengthening to all stakeholders in the Agriculture and Agri-products value chain	SCP-SM, NGOs and Training Institutions (with international assistance)	2024-2030
TEXTILES			
TEXTILE CLUSTER ACTIONS			
T.1	Develop and implement integrated pest management (IPM) plans for primary natural fibre production, for cotton production especially.	Textile Clusters	2023-2025
T.2	Elaborate and implement environmental management system (EMS) covering all production stages (including fibre production) of the textile value chain within a Cluster's control. Regarding its secondary production processes, the EMS should include the following aspects: (i) an inventory of inputs and outputs, (ii) a water management plan, (iii) an energy efficiency plan, (iv) a chemicals management plan, and (v) a waste management plan. The IPM plan should form an integral aspect of the EMS.	Textile Clusters	2023-2025
T.3	Review the range of available BAT and adopt appropriate operational and investment techniques when practicable and feasible to do so.	Textile Clusters	2023-2030
T.4	Adopt cleaner design practices for textile product manufacture in collaboration with the retail sector in Uzbekistan, taking into consideration also the demand trends in export markets. Objectives should include minimising all forms of waste and the substitution of fewer potentially harmful chemical agents where practicable.	Textile Clusters	2024-2030

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
T.5	Receive training in the use of SCP Tools recommended for application in the secondary production stages of textiles production, and adopt these tools in the textile production mills so as to improve resource use efficiency.	Textile Clusters	2024-2030
FIRST SCP THEMATIC STRATEGY			
T.6	Collate and review published benchmark information, good practice documentation, guides, and SCP case studies that may be relevant to the textiles value chain in Uzbekistan. Also establish contact with organisations active in this field in other countries as the basis for forming potential cooperative partnerships in future.	SCP-SM (with international assistance)	2022-2023
T.7	Develop the value chain in a quantitative sense based on information held by the MEDPR, MoA, MWR and other bodies. Use this analysis, together with the material collated in action T.6, as a basis for preparing an initial, priority-driven 3 to 4-year thematic strategy to promote and facilitate the application of SCP good practice in textile clusters, retail outlets and the consumers of textile products. Suggested areas for action include: – SCP tools applicable to textiles production and the provision of training to personnel in the textile clusters – making the best use of the available resources; – Minimising the losses as waste of textile fabrics and textile products – in part through cleaner design – and developing initiatives that encourage retailers and customers to engage in product reuse and recycling in line with the waste management hierarchy; – Behavioural change programmes addressing members of the public (identifying how they as individuals can make a difference), retail sector personnel, and personnel in textile clusters – whether they work in natural fibre production or in a factory environment.	SCP-SM – calling on Uzbek centres of knowledge, and international assistance MEDPR, MoA, MWR, SCEEP and others – to review and approve proposed programme of work	2023
T.8	Engage with third parties to prepare benchmark reports, good practice guides, case studies, market intelligence reports, etc. as identified in the thematic programme (action T.7). SCP-SM staff to review, edit and require revisions as appropriate before approving a final output. Outputs to be marketed through a tailored communication programme by the SCP-SM.	SCP-SM – commissioning and production External bodies – prepare drafts	2023-2026
T.9	Prepare impact assessments on the uptake and effectiveness of major thematic outputs, reporting the assessments back to the MEDPR, MoA, SCEEP and SCP-SM.	External institutions	2024-2026
SECOND SCP THEMATIC STRATEGY			
T.10	Prepare a second-stage, prioritised 3 to 4-year thematic strategy to further promote and facilitate the application of the SCP approach in this value chain; for review and, after necessary revisions, Government approval. Some continuation of first stage activity may be undertaken but new areas not covered in the first stage should also be addressed.	SCP-SM MEDPR, MoA, SCEEP	2026-2027
T.11	Implement the second-stage strategy, marketing the products through a communication programme (as in action T.8), and conduct further impact assessments.	SCP-SM and external institutions	2027-2030

No.	VALUE-CHAIN ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
ENERGY			
ADOPTION AND APPLICATION OF BEST AVAILABLE TECHNQUES (BAT)			
E.1	Consider the adoption of BAT as a regulatory basis for governing the environmental performance of gas, oil and coal extraction, the refining of gas and oil, large-scale combustion (≥50 MWth) plants, and heavy industry such as acid and fertiliser production. And, if BAT is to be adopted, develop BAT Reference documents tailored to the Uzbek industrial status and conditions; and roll-out the issue of operating permits with conditions, and operate, maintain and self-monitor installations in accordance with permit conditions.	MEDPR, SCEEP Permitting Departments Enterprises	2022-2030

Table 17 National SCP Action Plan – Cross-Sectoral Actions

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
WATER SAVING AND EFFICIENCY			
FIRST SCP THEMATIC STRATEGY			
WE.1	Collate and review published benchmark information, good practice documentation, guides, and SCP case studies that may be relevant to the efficient use of water by consumers (households and institutions), in primary and secondary production and in tertiary business sectors. Water use in agriculture to be considered in parallel in agriculture value-chain actions. Establish contact with organisations active in this field in other countries.	SCP-SM (with international assistance)	2022-2023
WE.2	Prepare an initial, priority-driven 3 to 4-year thematic strategy to promote and facilitate the application of SCP tools and measures to conserve water and use it efficiently. The thematic strategy should complement and parallel that for the Agriculture and Agri-products value chain, addressing water use in the primary, secondary, and tertiary business sectors and for household and institutional consumption. (Water use for crop growing may be handled within the thematic strategies for agriculture and textiles.)	SCP-SM – calling on Uzbek centres of knowledge, and international assistance MEDPR and SCEEP – to review and approve the thematic programme	2023-2024
WE.3	Engage with third parties to prepare benchmark reports, good practice guides, case studies, etc. as identified in the thematic programme (action WE.2). SCP-SM staff to review, edit and require revisions as appropriate before approving a final output. SCP-SM to disseminate outputs via a tailored communication programme.	SCP-SM – commissioning and production External bodies – prepare drafts	2023-2026
WE.4	Prepare impact assessments on the uptake and effectiveness of major thematic outputs, reporting the assessments back to MENR, the Ministry of Industry and to the SCP-SM.	External institutions	2024-2026
SECOND SCP THEMATIC STRATEGY			
WE.5	Prepare a second-stage, prioritised 3 to 4-year thematic strategy to further promote and facilitate the application of SCP for improved water use efficiency; for review and Government approval. Some continuation of first stage activity may be undertaken but new areas not covered in the first stage may also be addressed.	SCP-SM MEDPR, SCEEP, MHCS, MWR	2026-2027

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
WE.6	Prepare new and revised products, disseminate them through a communication programme (as in action WE.3), and conduct further impact assessments.	SCP-SM and external institutions	2027-2030
OTHER ACTIONS			
WE.7	Enterprises engaged in the processing and manufacturing industries (secondary production) to: (i) raise their awareness of the need to use water wisely and efficiently, as identified in the thematic strategy, and (ii) adopt available SCP tools to help them identify water saving and efficiency measures. (This action to be stimulated by national and city/regional Governments, the SCP-SM, the media, and the voices of citizens and citizen organisations.)	Enterprises	2023-2030
WE.8	Households, institutions (Hospitals, Educational establishments, Prisons, Government offices, Technical Institutes, etc.), enterprises engaged in the hospitality sector (restaurants, hotels, etc.), all business offices, and such like, to respond positively to Governmental, SCP-SM, media, and NGO messaging on the need to improve water use efficiency, how this can be done, and the changes in behaviour that may achieve it. Take necessary practical steps, including investments where appropriate, to reduce water waste.	All consumers of water - households, institutions, and enterprises in tertiary business sectors	2023-2030
WE.9	Engage actively in Citizen Behaviour Change initiatives in support of the SCP-SM, focusing on the promotion of the actions that individuals acting alone and as members of households, institutions and enterprises can take to use water wisely.	NGOs and the Media	2023-2030
WE.10	Provide training and capacity strengthening on why and how to save water: targeted at users of water in the primary, secondary and tertiary business sectors and in institutions.	SCP-SM, NGOs and Training Institutions (with international assistance)	2024-2030
RESOURCE RECOVERY FROM MUNICIPAL SOLID WASTES			
THEMATIC STRATEGY ACTIONS			
RW.1	Collate and review published benchmark information, good practice documentation, guides, and case studies relevant to SCP and resource recovery from the integrated management of MSW, biodegradable waste, waste electrical and electronic equipment (WEEE) and end-of-life vehicles. Also, establish contact with organisations active in this field in other countries and keep up-to-date with developments in the EU's Green Deal and Circular Economy Action Plan.	SCP-SM (with international assistance)	2022-2023

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
RW.2	Prepare an initial, priority-driven 3 to 4-year thematic strategy to promote and facilitate the application of the SCP approach and use of good practice to reduce the net disposal of MSW to landfill. To be achieved mainly through maximising the recovery of recyclable materials (and or energy) – including potentially the separate collection of waste electrical and electronic devices and their deposition at large-scale community sites. But also through reducing packaging use and other measures to minimise MSW generation. This strategy will need to take into consideration the outcome of a review of 'wet waste' collection and management (action RW.1). The initial strategy might need to be amended, consequent on the findings of the policy analyses undertaken as suggested in action 0.9; or, the results of policy analysis might be incorporated in a second-stage strategy, 2026-2030 (action RW.4). In developing the solid waste thematic strategy, consideration should also be paid to the ongoing EU's Green Deal and Circular Economy Action Plan, especially: – Sustainable Product Policy Framework – Policy Initiative: Less Waste, More Value – Farm to Fork Strategy	SCP-SM – calling on Uzbek centres of knowledge, and international assistance MEDPR, MHCS, MWR - to review and approve the thematic programme.	2023-2024
RW.3	Implement the strategy and undertake independent impact assessments	SCP-SM supported by external institutions	2023-2026
RW.4	Prepare and implement a second-stage thematic strategy, incorporating independent assessments of the impacts of key outputs - as in the initial strategy (actions RW.2 and RW.3)	SCP-SM	2026-2030
OTHER ACTIONS			
RW.5	Subject to the adoption of IPR obligations, support the development of infrastructure to disassemble WEEE and recover reusable and recyclable components, for use as raw materials in domestic consumer goods production and or for export	MEDPR	2024-2030
RW.6	Provide the necessary resources and infrastructure to enable: (i) the separate collection of wet wastes, dry wastes and end-of-life equipment arising at households, institutions and tertiary business sectors; (ii) the processing of each separate waste stream; (iii) the transfer of recovered resources to markets for recycling or use; and (iv) the disposal of residual wastes to engineered landfill	City and Regional Governments	2024-2030
RW.7	Enterprises engaged in the processing and manufacturing industries, including those engaged in waste recycling, to raise their individual and collective awareness of priority issues in solid waste management - as identified in the thematic strategy. And to take effective steps to achieve voluntarily-set improvement targets (these actions to be stimulated by national and city/regional Government, the SCP-SM, media, and the voices of citizens and citizen organisations)	Enterprises	2024-2030
RW.8	Tertiary sector businesses, and institutions, to respond positively to Governmental, SCP-SM, media, and NGO messaging on the need to reduce MSW arisings, SCP's role in achieving this, and the necessary changes in behaviour: take practical steps, including investments where appropriate, to reduce waste and to collect efficiently such wastes that do arise	Tertiary Enterprises, Institutions & City/Regional Governments	2024-2030

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
RW.9	Households to respond positively to Governmental, SCP-SM, media and NGO messaging on the need to reduce solid waste arisings, how this can be done, separate wastes at source, and the changes in behaviour that can help achieve this	Consumers	2024-2030
RW.10	Engage actively in Citizen Behaviour Change initiatives in support of the SCP-SM, focusing on the promotion of what individuals acting alone and as members of households, institutions and enterprises can do to minimise the generation of MSW, its effective separation at source into distinct fractions, and to maximise the recovery and recycling potential of all wastes	NGOs and the Media	2024-2030
RW.11	Provide training and capacity strengthening for all stakeholders on why and how to minimise waste arisings and maximise the recovery of resources form those wastes that do arise	SCP-SM, NGOs and Training Institutions	2024-2030
CLIMATE CHANGE: MITIGATION OF GREENHOUSE GAS EMISSIONS			
THEMATIC STRATEGY: ENERGY EFFICIENCY			
GHG.1	Collate and review published benchmark information and good practice documentation on energy efficiency in the processing and manufacturing industries, energy-using appliances, district heating systems, and buildings. Collate case studies on how energy efficiency can be increased. Establish contact with organisations active in this field in other countries and keep abreast of ongoing developments in the EU's Green Deal and Circular Economy Action Plan.	SCP-SM (together with international assistance)	2023-2025
GHG.2	Prepare and implement a priority-driven thematic strategy to promote energy efficiency and energy conservation to all consumers. The strategy should take into account ongoing action GHG.3, the proposed preparation of an energy efficiency road map, developments in the EU's Green Deal and its implementation, and energy efficiency action planning in other Central Asian Republics.	SCP-SM – partnering as appropriate with Uzbek centres of knowledge MEDPR, MoE, SCEEP – to review and approve the thematic programme	2024-2030
GHG.3	Develop and implement a national energy efficiency road map, consistent with the SCP-SM and thematic strategy (action GHG.2).	MoE	2024-2030
GHG.4	Households, institutions (Hospitals, Educational establishments, Prisons, Government offices, Technical Institutes, etc.), enterprises engaged in the tertiary business sectors including retail outlets, hospitality (restaurants, hotels, etc.), and all business offices, to respond positively to Governmental, SCP-SM, media, and NGO messaging on energy conservation and efficiency. Take practical steps, including investments where appropriate, to reduce energy waste.	Households, Institutions, Tertiary sector Businesses, and all offices - consumers of energy	2024-2030
GHG.5	Engage actively in Citizen Behaviour Change initiatives in support of the SCP-SM, focusing on the promotion of actions that individuals can take to use energy more efficiently – whether acting alone or as members of households, institutions and enterprises.	NGOs and the Media	2024-2030
GHG.6	Provide training and capacity strengthening on energy conservation and improving energy efficiency, targeting users of energy in primary, secondary and tertiary businesses and institutions.	SCP-SM, NGOs and Training Institutions (with international assistance)	2024-2030

No.	CROSS-SECTORAL ACTIONS	RESPONSIBLE INSTITUTION/S	PERIOD
THEMATIC STRATEGY: RENEWABLE ENERGY RESOURCES			
GHG.7	Collate and review published benchmark information, good practice documentation, and case studies on how renewable energy resources (including food wastes and other bio-wastes) may be developed and used. Establish contact with organisations active in this field in other countries and keep abreast of ongoing developments in the EU's Green Deal and Circular Economy Action Plan and elsewhere in Central Asia.	SCP-SM (together with international assistance)	2023-2025
GHG.8	Prepare and implement a priority-driven thematic strategy to promote the use of renewable energy resources where available and appropriate. The strategy should consider ongoing developments in the EU's Green Deal and its implementation, elsewhere in Central Asia, and other countries as appropriate.	SCP-SM –with Uzbek centres of knowledge MEDPR, MoE, SCEEP – review & approve the thematic programme	2024-2030
OTHER ACTIONS: GHG EMISSION INVENTORIES AND PROJECTIONS			
GHG.9	Building on national emissions inventories to date, prepare annual national inventories for GHG emissions (to include CO_2, CH_4, N_2O and others). Adopt and implement a policy of continuous improvement of the inventory should be adopted, incorporating planned methodological improvements. If needed, seek capacity strengthening support from international sources.	Uzhydromet	2023-2030
GHG.10	Building on action GHG.9, prepare national emissions projections to 2030 and beyond for GHGs. Projections should be prepared biennially (e.g. 2024, 2026, etc.) for defined scenarios including at least (1) assuming existing policies and measures and (2) assuming additional policies and measures to meet environmental goals and objectives. Inter-Ministry cooperation and collaboration will be needed to develop robust emissions reduction plans. Seek further capacity strengthening support from international sources for undertaking this activity, if appropriate.	Uzhydromet	2024-2030
IMPROVING AMBIENT AIR QUALITY			
	AIR POLLUTANT EMISSION INVENTORIES AND PROJECTIONS		
AAQ.1	Building on national emissions inventories undertaken to date, prepare annual national inventories for air pollutant emissions ($PM_{2.5}$, SO_2, NOx, NMVOCs, NH_3). Also prepare separate emissions inventories for Tashkent and other substantial cities and towns whose populations could be exposed to air pollution. In addition to the annual updating, adopt a policy of continuous improvement of the inventory, incorporating planned methodological improvements. If needed, seek capacity strengthening support from international sources to assist undertaking this activity.	Uzhydromet	2023-2030
AAQ.2	Building on action AAQ.2, prepare national emissions projections to 2030 and beyond for air quality pollutants and consider doing the same for Tashkent and other populous cities. Projections should be prepared biennially (e.g. 2024, 2026, etc.) for defined scenarios including at least (1) assuming existing policies and measures and (2) assuming additional policies and measures to meet environmental goals and objectives. Inter-Ministry cooperation and collaboration is needed to develop robust emissions reduction plans. Seek further capacity strengthening support from international sources for undertaking this activity, if appropriate.	Uzhydromet	2024-2030

ANNEX A: National Policies, Regulations, International Commitments and Institutional Arrangements Relevant to the Strategy for Transition Republic of Uzbekistan to a Green Economy, 2019-2030 (STRUGE)

A.1 Concept for the Strategy for Transition of the Republic of Uzbekistan to a Green Economy, 2019-2030 (STRUGE)

The main national strategic document relevant to SCP is the Concept for the ‘Strategy for the Transition of the Republic of Uzbekistan to a Green Economy, 2019-2030’ (STRUGE). This Strategy was approved by the Resolution of President of the Republic of Uzbekistan No. PP-4477 dated 04.10.2019. The authorised body is the Ministry of Economic Development and Poverty Reduction of the Republic of Uzbekistan.

Prerequisites, Objectives and Targets for 2030

The strategy has been developed in order to fulfil Uzbekistan’s commitments under the Paris Agreement on Climate Change with the objective of achieving sustainable economic development. Major strategic targets are that, by 2030:

- Emissions of greenhouse gases (GHG) per unit GDP are reduced by 10% from the 2010 level. This in line with the UN Framework Convention on Climate Change in 2010, and implies that Uzbekistan’s GHG emissions should reduce from 199 to 179 million t CO_2-eq between 2010 and 2030.
- Energy efficiency indicators are increased by twofold - meaning that the energy consumption per unit of production will be halved – from the 2019 level by 2030, and the carbon intensity of GDP is reduced.
- Renewable energy sources (RES) to provide at least 25% of the total electricity produced, the current share being 10%.
- The entire population and all sectors of the economy have access to a reliable power supply.
- Energy efficiency of industrial enterprises increases by at least 20% relative to 2019.
- Development of electric vehicles is promoted.
- Drip irrigation technology is introduced, covering an area of at least 1 million hectares, and the crop yield of irrigated land is enhanced by 20–40% relative to that in 2019.
- Achieve a neutral balance of land degradation, i.e. land use results in no net degradation.
- The average productivity of basic food agricultural products is increased by 20–25% relative to that in 2019

Strategic Priorities

Six strategic priorities are identified and summarised below:

1. Improving the energy efficiency of the basic sectors of economy
2. Diversification of energy consumption and developing the use of renewable energy sources
3. Adapting and mitigating the effects of climate change, improving the efficiency of natural resource use, and preserving natural ecosystems
4. Development of financial and non-financial mechanisms to support the green economy
5. Implementation mechanisms

1. Improving the energy efficiency of basic sectors of the economy

Power industry

- modernisation of generating capacities of existing power plants with introduction of highly efficient combined cycle gas turbine units
- modernisation of main power transmission lines to increase the stability of energy system
- reduction of electricity consumption during transportation and distribution
- introduction of an automatic control and metering system for electricity consumption

Heat and Power Industry

- introduction of new cogeneration technologies for heat energy generation
- modernisation of outmoded boiler equipment
- modernisation of heating networks
- the use of modern insulating materials in the modernisation of heating networks
- automation of generation and transportation of heat energy, considering the number of consumers
- equipping consumers with modern metering devices
- introduction of solar collectors for heating water in boiler rooms

Oil and Gas industry

- reduction of losses of natural gas during the extraction, processing, transportation and distribution by the modernisation of compressor stations, gas distribution networks, and gas transmission system with the introduction of effective SCADA hydrocarbon resource control technologies
- introduction of modern technologies for gas supply distribution and metering
- reduction of greenhouse gas emissions during the processing and storage of oil and oil products
- reduction of greenhouse gas emissions from the combustion of associated petroleum gases
- introduction of alternative energy sources at oil and gas production facilities
- utilisation of waste gas heat for power generation

Chemical Industry

- modernisation and creation of new energy efficient capacities for the production of ammonia, nitric acid and mineral fertilisers
- the use of technologies on utilisation of heat of energy-intensive chemical processes for production of electrical energy
- Large-scale use of industrial waste as raw materials for industrial production.

2. Diversification of energy consumption and developing renewable energy use

Renewable energy sources

- development of technologies for energy storage with connection to power systems
- localisation of equipment production for the generation of energy from renewable energy sources (to create new production facilities and reduce reliance on imports)
- modernisation of existing generating capacities of the HPP
- construction of small hydroelectric power plants and related infrastructure
- development of state programs for introduction of solar systems for generation of electric and thermal energy in rural areas and remote regions of the republic
- wide awareness of population in matters of energy efficiency and renewable energy sources

Construction and maintenance of buildings

- revision of building codes and regulations at least once every 5 years in direction of strengthening energy efficiency requirements during construction and capital reconstruction
- revision of existing and adoption of new norms and standards for thermal insulation building materials

- development of ‘green’ mortgage loans a system
- improvement of building construction technologies using double-glazed windows, modern heat-insulating materials
- development of technologies for production of engineering equipment, thermal insulation materials, heating systems, air conditioning based on ‘green’ standards

Transportation

- expanding the production of vehicles with improved energy efficiency and environmental friendliness in accordance with Euro-4 and higher standards
- production of motor fuel with improved characteristics
- development of an incentive program for the disposal of old and purchase of new, more environmentally friendly cars
- ensuring the phasing out of the use of hydrocarbon fuels and stimulating the development of electric transport

Building materials production

- an increase in use of recyclable resources and waste in production of building materials
- introduction of cement production technologies (dry method) with the use of heat recovery technologies to generate electricity

3. Adapting and mitigating the effects of climate change, improving the efficiency of natural resource use, and preserving natural ecosystems

Water economy

- increasing the efficiency of water resources use and preventing further salinisation and deterioration of land quality
- construction and reconstruction of hydraulic structures, pumping stations and reservoirs
- widespread use of energy-efficient and water-saving technologies for irrigation of crops, improvement of mechanisms for stimulating water saving
- development of mechanisms for sustainable management of water resources

Agriculture

- restoration of degraded pastures
- attracting investment in production and processing, as well as creating value chains for agricultural and food products
- prevention of pollution of water sources with agricultural waste

Forest sector

- restoration of forests and preservation of natural vegetation cover in all natural zones of the country
- increasing the area of forests in the mountainous, foothill and desert zones of the country, as well as ensuring their conservation, protection and sustainable development
- the process of landscaping with varieties of plants from the local flora, resistant to salinisation and drought
- awareness of population on the issues of forest protection and restoration, including through the mass media

Municipal solid waste (MSW)

- development of sanitary cleaning infrastructure aimed at ensuring full coverage of population with services for collection and removal of solid waste
- creation of a modern solid waste processing system
- reduction of volume of solid waste for disposal in landfills, the creation of modern solid waste landfills that meet the requirements of sanitary and environmental standards
- the use of solid waste objects in the form of sources of alternative energy

Measures to mitigate the negative impact of the environmental crisis in the Aral Sea region

- implementation of large-scale measures to implement forest plantations on the drained bottom of the Aral Sea and prevent desertification in the region

4. Development of financial and non-financial mechanisms to support the green economy

Developing an institutional framework for the implementation of 'Green technologies'

- assessment of technological needs, identification of priorities and selection of key technologies, assistance in their development

Improving the regulatory framework in the field of 'green' economy

- development of economic measures and levers, including the introduction of fees for reduction of greenhouse gas emissions

Develop mechanisms for the regulation and control of energy efficiency

- energy management and audit of energy-intensive enterprises

Integration of green economy principles into education and science

- improving the curriculum of higher and secondary education using the topic of 'green' economy, introduction of renewable energy sources, development of 'clean' transport and energy conservation objectives

Capacity building and creation of an enabling environment for the transition to a green economy

- creation of a monitoring, reporting and verification (MRV) system on greenhouse gas emissions for tracking in accordance with the Paris Agreement and ensuring reporting of greenhouse gas emissions
- development of a climate monitoring system
- developing the potential of public-private partnerships to promote green technologies
- providing support to private investors, including small businesses, in the implementation of 'green' innovations
- professional development of personnel, formation of a culture of careful attitude to energy and resources
- introduction of the foundations of a 'green' economy in the development of state educational programs in the preparation and retraining of personnel
- strengthening cooperation between national and foreign scientific organisations in the field of promoting 'green' technologies

Supporting Green Investments

- introduction of a 'green' loan system
- creation of 'green' funds, special funds for energy conservation and other similar mechanisms
- activation of private sector in financing projects for transition to a 'green' economy
- support of sustainable growth of 'green' economy by the State through fiscal policy

5. Implementation mechanisms

The main tasks and priority areas of the Strategy will be implemented through the activities identified in national, sectoral, sectoral plans and development strategies.

All stakeholders will be involved in the implementation of the Strategy, including state and economic management bodies, executive authorities, civil society institutions, international organisations, the private sector, as well as the population.

To implement measures for the transition to a 'green' economy, funds from the Green Climate Fund, the Adaptation Fund, foreign investment, loans and grants from international financial institutions, foreign government financial organisations and other foreign donors can be attracted.

A.2 International Commitments

The main international conventions/protocols/agreements in the field of environmental protection that have been signed or ratified by the Republic of Uzbekistan are noted below.

No.	Convention, protocol and agreement	Document of the Republic of Uzbekistan on accession/ratification
1	Convention on Long-range Transboundary Air Pollution (Geneva, 13 November 1979)	Not ratified
2	Vienna Convention for the Protection of the Ozone Layer (Vienna, 22 March 1985)	Entry into force 18 May, 1993
3	Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal, September 16, 1987)	Accession 18 May, 1993
4	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel, March 22, 1989)	Resolution of Parliament of Uzbekistan №188-I dated December 22, 1995. Came into force 7 May, 1996
5	Convention on Environmental Impact Assessment in a Transboundary Context. Espoo (Finland, February 25, 1991)	Not ratified. The convention is being considered by the State Committee on Ecology and Environment Protection
6	The International Convention on Civil Liability for damage from pollution by oil in 1992 city of (the Convention on responsibility of 1992)	Uzbekistan is not a party of Convention
7	Framework Convention for the OH on Climate Change of 9 May 1992	Came into force 21.03.1994
8	Convention on Biological Diversity (Rio de Janeiro, June 5, 1992).	Resolution of Parliament of Uzbekistan №82-I dated May 6, 1995. Came into force 17.10.1995
9	Convention I of the United Nations to Combat Desertification (Paris, June 17, 1994)	Resolution of Parliament of Uzbekistan №125-I dated August 31, 1995. Came into force 26.01.1996
10	Energy Charter Treaty (Lisbon, December 17, 1994)	Resolution of Parliament of Uzbekistan №192-I dated December 22, 1998. Came into force 16.04.1998
11	The Kyoto Protocol to the Framework Convention on Climate Change, Kyoto, 11 December 1997	Ratified by Resolution of Parliament of Uzbekistan dated August 20, 1999, №834-I.
12	Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus, 25 June 1998)	Not ratified
13	Cartagena Protocol on Biosafety to the Convention on Biological Diversity (Montreal, January 29, 2000)	Adopted by the Legislative Chamber on October 9, 2019. Approved by the Senate on October 11, 2019. Law of the Republic of Uzbekistan dated October 14, 2019, No. ZRU-569
14	Stockholm Convention on Persistent Organic Pollutants (Stockholm, May 22, 2001)	Ratified by Law of the Republic of Uzbekistan dated May 8, 2019, No. ZRU-535. Came into force 26 September 2019
15	Framework Convention for the Protection of the Marine Environment of the Caspian Sea (Tehran, November 4, 2003)	Uzbekistan is not a party to the Convention

No.	Convention, protocol and agreement	Document of the Republic of Uzbekistan on accession/ratification
16	Agreement on Cooperation in the Field of Environmental Protection of the Member States with NG (Minsk, May 31, 2013)	Signed
17	Paris Agreement (Paris, 12 December 2015)	Adopted by the Legislative Chamber on September 25, 2018. Approved by the Senate on September 27, 2018. Law of the Republic of Uzbekistan dated October 2, 2018, No. ZRU-491

Convention on Long-range Transboundary Air Pollution

In 1979, the Convention on Long-Range Transboundary Air Pollution was signed in Geneva. The objective of the Convention is to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution. Although Uzbekistan is not a Party to the Convention, the country's leadership expresses interest in becoming a participant. On this issue, preparatory work is underway. In particular, changes and amendments have been made to the Law 'On the Protection of Atmospheric Air', which are preconditions for accession to the UNECE Convention.

Paris Agreement

The Paris Agreement was adopted by the Uzbekistan Legislative Chamber on September 25, 2018, approved by the Senate on September 27, 2018, and ratified by Law of the Republic of Uzbekistan dated October 2, 2018, No. ZRU-491.

In accordance with this agreement, Uzbekistan has committed to reducing carbon dioxide emissions by 10%, as well as increasing resilience to climate change by 2030. To this end, the Government has developed a National Strategy on transition to a 'Green' economy, which is aimed to reducing emissions into the atmosphere, efficient use of natural resources, energy efficiency, introduction of renewable energy sources, water saving technology, etc.

Biodiversity

Uzbekistan joined the UN Convention on Biological Diversity in 1994. In 2010, in Nagoya, Japan, the parties to the convention adopted the Strategic Plan for Biodiversity Conservation and Sustainable Use, including the 20 Aichi Biodiversity Targets 2011–2020. The countries of the convention were obliged to develop revised and updated national strategies and action plans for biodiversity conservation within two years on the basis of a common international framework.

The Republic of Uzbekistan joined the Convention on Biological Diversity as stated in the above Table (Commitment No. 8). As a first step, the 'National Strategy and Action Plan for Biodiversity Conservation' was developed and approved by the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 139 of April 1, 1998 (expired on June 12, 2019).

In 2010, in the city of Nagoya, (Aichi Prefecture, Japan), at the 10th meeting of the Conference of the Parties, the New Strategic Plan for Biodiversity Conservation was approved, which included 5 Global Strategic Goals and 20 Targets for the period 2011-2020. According to the New Strategic Plan, all parties to the Convention were required to update their Biodiversity Strategies and Action Plans.

In 2012, the Government of the Republic of Uzbekistan, in cooperation with the GEF and UNDP, launched a project to develop national strategic goals and objectives in line with Aichi's global goals. Four national strategic goals and nine target tasks were formulated, and indicators were developed to assess the results of their implementation:

Strategic goal 1. Inclusion of the topic of biological diversity in the activities of public authorities and administration and the whole society

Strategic goal 2. Reduction of direct pressures on biodiversity, sustainable use of its components in productive landscapes

Strategic goal 3. Development of a system of protected natural areas, increasing the volume of benefits provided by ecosystem services

Strategic Objective 4. Increase the efficiency of conservation and sustainable use of biological diversity through participatory planning and capacity building

The above goals and objectives became the basis for the revision of the new National Strategy and Action Plan for the conservation of biodiversity, which was approved by the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated June 11, 2019, No. 484: *Strategy and Action Plan for the conservation of biological diversity in the Republic of Uzbekistan for the period 2019–2028*. Its targets and expected results are:

- expanding the area of protected natural areas to 12% of country's territory
- afforestation of the drained bottom of the Aral Sea, bringing the forest area to 1.2 million hectares
- breeding gazelles in Bukhara specialised nursery 'Jeyran' with an increase in their number to 1,000 individuals
- creation of a unified system for monitoring biodiversity components with a central link - reference ecosystems of state reserves
- creation of a unified information database of state monitoring and state cadastre of biodiversity based on modern geoinformation technologies (GIT technologies)
- conducting an annual geobotanical survey of vegetation of natural pastures and hayfields in the amount of 2 million hectares
- integrating biodiversity conservation issues into all sectors of the economy
- creation of a website **www.biodiversity.uz**, functioning in three languages (Uzbek, Russian and English)
- carrying out an annual census of the number of hunting bird species in the reservoirs of Uzbekistan
- preparation and organisation of transfer, in accordance with established procedure, of materials on the inclusion of the Kuimazar and Tudakul reservoirs in the list of wetlands of international importance (Ramsar Convention)
- creation of a system for monitoring fishing and the state of biological resources of fishery reservoirs
- reducing pressure on biodiversity
- providing the necessary financial support
- the adoption and effective implementation of appropriate integrated solutions based on scientific knowledge and a proactive approach

Cooperation with the EU

Relations between the EU and Uzbekistan have significantly strengthened since Uzbekistan gained independence in 1991 and since the Partnership and Cooperation Agreement (PCA) was signed by both parties in Florence in 1996. The PCA expanded cooperation from development to political, commercial and economic issues. The EU opened its diplomatic mission in Tashkent in 2011. Within the framework of PCA, the European Union and Uzbekistan have held regular political meetings and cooperate in the fields of trade, investment, intellectual property, legislation, human rights and culture. The PCA currently regulates trade relations between the EU and Uzbekistan, in particular the provision of most favoured nation treatment between EU and Uzbekistan in relation to:

- customs duties and taxes applied to imports and exports
- direct and indirect taxes applied to imported goods
- rules concerning the sale, purchase, transportation, distribution and use of goods in the domestic market

The Republic of Uzbekistan and the EU have been negotiating since 2019 to agree on a bilateral Enhanced Partnership and Cooperation Agreement (EPCA). In June 2021, the 8th round of negotiations was held, at which issues on strengthening bilateral cooperation were discussed. After signing by the two parties, EPCA will replace the current PCA. The issue of signing the Agreement is in process. EPCA aims to strengthen bilateral political, trade, economic and cultural interactions. It will become one of the tools for attracting European investments, as well as the EU's experience in such areas as intellectual property, trade and sustainable development, technical, sanitary and phytosanitary regulation and other areas.

Sustainable Development Goals (SDG)

The Sustainable Development Goals are a universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere. These 17 goals were adopted by all UN member states in 2015 as part of the 2030 Agenda for Sustainable Development. Annex C details those SDGs whose implementation require SCP action.

To monitor and review the implementation of 17 Goals and 169 targets of the new agenda, a system of global indicators developed by the Inter-Agency and Expert Group on Sustainable Development Goals Indicators (IEG-SDGs) is used. In order to facilitate the implementation of monitoring progress in achieving the goals and objectives of the SDGs at the national level, each Member State of the UN may establish national indicators in addition to the global indicators.

In accordance with the resolution of the United Nations General Assembly No. 70, adopted at the UN Summit on Sustainable Development in September 2015, as well as in order to organise systematic work on the consistent implementation of the Sustainable Development Goals of the UN Global Agenda 2030 (the SDGs) Cabinet Ministers adopted Resolution No. 841 'On Measures to Implement National Goals and Objectives for Sustainable Development for the Period until 2030'.

Within the framework of this decree, the National Goals and Objectives in the field of sustainable development for the period up to 2030 were approved, 16 goals (SDGs) and 125 objectives to be achieved by 2030 were identified. Additionally, the Coordination Council for the implementation of the National Goals and Objectives in the field of sustainable development was formed for the period up to 2030. It approved the 'Roadmap' for the implementation of the National Goals and Objectives in the field of sustainable development for the period up to 2030.

On the basis of the global system of indicators, in close interdepartmental cooperation with the ministries and departments responsible for the implementation of the SDGs, as well as with UN agencies, Goskomstat has formed a national list of SDG indicators. The list includes indicators proposed at the global level and reflecting national development priorities. The main tool for monitoring and disseminating data on SDG indicators is the national SDG reporting platform (http://nsdg.stat.uz). The platform is a single centre for collecting and summarising information on the current situation in achieving the SDGs in the country.

The Voluntary National Review (VNR) is the process by which countries assess and present progress made towards the global SDGs and the Commitment to Leave No One Behind. On July 15, 2020, the first Voluntary National Review (VNR) of Uzbekistan on progress in implementing the SDGs was presented at the High-Level Political Forum under the auspices of the UN Economic and Social Council (ECOSOC). The presentation was held via videoconferencing, with participation by UN member states that have made commitments to the SDGs. The presentation addressed the achievements of Uzbekistan regarding its national SDGs. They include:

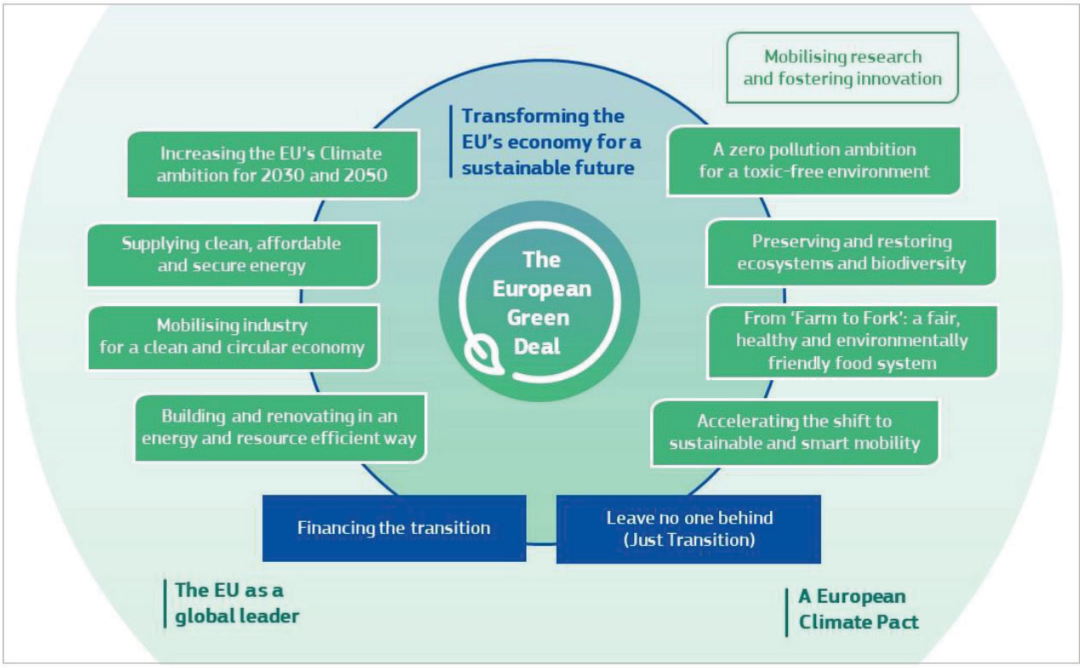
- the share of the poor population decreased from 12.8% in 2015 to 11.4% in 2018
- the growth in the coverage of children with preschool education increased from 27.7% in 2017 to 52% in 2019
- according to the rule of law index compiled by the international organisation World Justice Project, in 2020, Uzbekistan took 92nd place among 128 countries. During the year, the country has risen by four positions
- gender-oriented laws of the republic have been adopted, such as 'On guarantees of equal rights and opportunities for men and women' and 'On the protection of women from oppression and violence'
- the share of women has reached 33% in leadership positions and 45% in the total working-age population

- access to electricity in rural areas increased from 74% to 78%, access to natural gas from 62 to 67%, and access to drinking water from 62.6% to 64.1%
- Uzbekistan improved its position in the global ranking for doing business ‘Doing business’ from 141st place in 2015, to 76th in 2019, and to 69th in 2020
- the country has risen from 100th place in 2014 to 81st in 2018 (out of 193 countries) in the UN e-government index
- an increase in the average annual rate of gross investment to 12.0% over the period 2017–2018

ANNEX B: Comparative Analysis – the EU's Circular Economy Action Plan (CEAP) and Green Deal (EGD) vs the Republic of Uzbekistan's Concept for Transition to a Green Economy, 2019-2030

B.1 The EU's CEAP is a Component of the EU Green Deal

Establishing a Circular Economy is a major aspect of the EU's ambitious European Green Deal (EGD), which was published in December 2019 as the **'Communication on the European Green Deal' (EGD), COM/2019/640 final** (Communication).[91] The EGD is a wide-ranging strategy addressing the climate and environment-related challenges that are defining tasks of the present generation. It aims to transform the EU's economy so that (i) economic growth is decoupled from resource use, (ii) net emissions of greenhouse gases (GHGs) are zero in 2050, (iii) the EU's natural capital is protected, conserved and enhanced, and (iv) and the health and well-being of citizens are protected from environment-related risks and impacts.



The EGD builds upon a comprehensive, existing set of environment-related policies and measures (the *acquis*), whose full and effective implementation by EU Member States (MS) is assumed. The 2019 Communication notes, therefore, that the European Commission (EC) will work with MS to step up their efforts to enforce and implement all current legislation and policies relevant to the EGD. And it states that delivering the EGD will require the development and implementation of **transformative policies in eight areas**:

- **EGD 2.1.1 Increasing the EU's climate ambition for 2030 and 2050**: transitioning to a net-zero GHG emissions economy by 2050, noting that the policies in place in 2019 would only reduce GHG emissions by 60% (relative to 1990) by 2050. Based on scenario analyses, the EU has identified strategic pathways and seven priority building blocks for achieving its ambition:[92]
    1) Maximise the benefits from energy efficiency including zero-emission buildings
    2) Maximise the deployment of renewable energy sources and the use of electricity to fully decarbonise Europe's energy supply
    3) Embrace clean, safe and connected mobility
    4) A competitive EU industry and the circular economy as key enablers to reduce GHG
    5) Develop an adequate smart network infrastructure and inter-connections

91 https://ec.europa.eu/info/sites/default/files/european-green-deal-communication_en.pdf
92 'A Clean Planet for All': available at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0773&from=EN

6) Reap the full benefits of bio-economy and create essential carbon sinks

7) Tackle remaining CO_2 emissions with Carbon Capture and Storage (CCS)

Additional, related proposals are (i) to establish a carbon border adjustment mechanism, for selected sectors, to reduce the risk of carbon leakage – this will be dependent on the level of climate ambition shown worldwide, and (ii) adopting a new, more ambitious EU strategy on adaptation to climate change.

- **EGD 2.1.2 Supplying clean, affordable and secure energy**: involving action in five key fields:
  1) Further decarbonising the energy system is critical
  2) Member States to present revised energy and climate plans, setting out ambitious national contributions to EU-wide targets
  3) Involving consumers in the clean energy transition, and ensuring the transition is beneficial to consumers
  4) Addressing the risk of energy poverty
  5) Use of smart infrastructure to enable the transition to climate neutrality

- **EGD 2.1.3 Mobilising industry to achieve a clean, climate neutral and circular economy**: resource extraction and the processing of materials, fuels and food account for about 50% of total GHG emissions and over 90% of biodiversity loss and water stress. Industry in the EU accounts for 20% of the EU's GHG emissions while only 12% of the materials it uses come from recycling. Noting that it takes a generation (25 years) to transform an industrial sector and all its related value chains, the Communication stated that, to be ready in 2050, decisions and actions would need to be taken in the next five years regarding:
  1) Adoption by the EC of an **EU industrial strategy** to address the identified challenges, noting that the transition to a climate-neutral and circular economy presents an opportunity to expand sustainable and job-intensive economic activity
  2) Development of a new **circular economy action plan** (CEAP)[93] and its implementation, noting that energy-intensive industries such as steel, chemicals and cement supply several key value chains and therefore, it is stated, are indispensable. Key points flagged by the Communication included:
     - Inclusion of a 'sustainable products' policy to support the circular (cleaner) design of products based on a common methodology and principles and strengthening of the existing 'extended producer responsibility'
     - While the CEAP will guide the transition of all sectors, action will focus on resource-intensive sectors - such as textiles, construction, electronics and plastics
     - Measures to encourage businesses to offer, and to allow consumers to choose, products that reusable, durable and repairable
     - The EC's commitment to propose further legislation and guidance on green public purchasing
  3) Promoting new forms of **collaboration** with industry **and investments in strategic value chains**
  4) Exploring the potential of **digital technologies** such as artificial intelligence, 5G, cloud and edge computing, and the internet of things to accelerate and maximise the impact of policies dealing with climate change and environmental protection.

- **EGD 2.1.4 Building and renovating in an energy and resource efficient way**: noting that (i) the building sector (construction, use and renovation) consumes significant energy and mineral resources – e.g. 40% of the EU's energy consumption, (ii) annual rates of renovation of the building stock in MS range from 0.4% to 1.2%, and that this rate needs to double, at least, to reach the EU's energy efficiency and climate objectives, while (iii) 50 million consumers struggle to keep their homes adequately warm. Addressing the challenges of energy efficiency and affordability will require action:
  1) MS should engage in a 'renovation wave' of public and private buildings

93 https://ec.europa.eu/environment/pdf/circular-economy/new_circular_economy_action_plan.pdf

2) EC rigorous enforcement of the legislation related to the energy performance of buildings, starting with an assessment of MS national long-term renovation strategies, launching work on the possibility of including emissions from buildings in European emissions trading, and a review of the Construction Products Regulation to ensure that the design of new and renovated buildings is in line with the circular economy

3) The EC to work with stakeholders on a new renovation initiative. Aims would include the organisation of renovation efforts into larger blocks to benefit from better financing conditions and economies of scale, paying particular attention to the renovation of social housing to help households who struggle to pay their energy bills and the renovation of schools and hospitals – enabling the financial savings from improving energy efficiency to be diverted to support education and public health

- **EGD 2.1.5 Accelerating the shift to sustainable and smart mobility**: noting that a 90% reduction in transport emissions is needed for the EU to achieve climate neutrality by 2050, and that road transport contributes substantially to ambient air pollution, especially in cities. Proposed actions include:
    1) Adoption of a strategy for sustainable and smart mobility: putting users first and providing them with more affordable, accessible, healthier and cleaner alternatives to current mobility practice
    2) Boosting multimodal transport: involving (i) a substantial shift from inland freight transport away from roads onto railways and navigable waters, and (ii) an increasing role for automated and connected systems, such as smart systems for traffic management and infrastructure, to reduce traffic congestion and air pollution, especially in cities
    3) Ensuring that the price of transport reflects its impacts on the environment and on health: involving (i) an end to fossil-fuel subsidies, (ii) a proposal to adjust the scope of the EU Emissions Trading System (to include the maritime sector) and reduce the allowances allocated free to airlines, and (iii) fresh consideration to be given to how effective pricing for road use may be achieved in the EU
    4) Ramping-up the production and deployment of sustainable alternative transport fuels
    5) A combination of measures will be required for transport to become drastically less polluting, especially in cities. Measures proposed may include more stringent pollutant emissions standards for combustion-engine vehicles and revision of the legislation on CO_2 emission performance standards for cars and vans

- **EGD 2.1.6 From ‘Farm to Fork’: designing a fair, healthy and environmentally-friendly food system**: an aim is for European food to become the global standard for sustainability. Key actions and aspects include:
    1) The Commission to present the ‘Farm to Fork’ Strategy as a platform for stakeholder debate, paving the way to formulating a more sustainable food policy
    2) The Commission to work with Member States and stakeholders ensure that national strategic plans for agriculture fully reflect the ambition of the EGD and the Farm to Fork Strategy
    3) National strategic plans will need to reflect an increased level of ambition to reduce significantly the use and risk of chemical pesticides, and the use of fertilisers and antibiotics
    4) **Contributing to developing a circular economy** through actions to reduce resource consumption and environmental impacts in the (production), transport, storage, packaging and waste of food
    5) Stimulate sustainable food consumption and promote affordable, healthy food for all

- **EGD 2.1.7 Preserving and restoring ecosystems and biodiversity**: ecosystems provide essential services such as food, fresh water, clean air and shelter but the EU is not meeting important objectives such as the Aichi targets under the Convention on Biological Diversity (CBD). Commitments and actions to be taken under this component include:
    1) The Commission to prepare an EU Biodiversity Strategy to 2030 and present this to the 15th Conference of the Parties to the CBD, to be followed up by specific actions[94]
    2) All EU policies should contribute to preserving and restoring Europe’s natural capital: this includes

94 EU Biodiversity Strategy to 2030. Communication from the European Commission COM (2020) 380 final 20 April 2020.

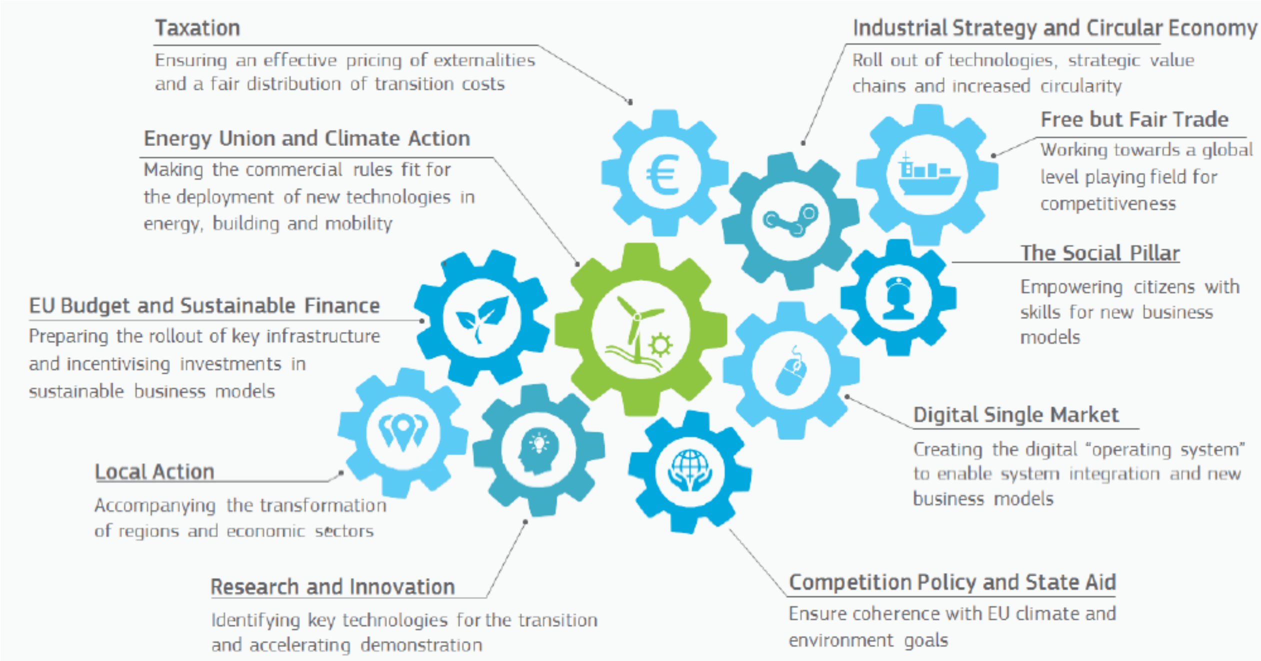
the **Farm to Fork Strategy** which, among other things, addresses the use of pesticides and fertilisers in agriculture

3) A new EU forest strategy whose key objectives will be effective afforestation, and the preservation and restoration of Europe's forests

- **EGD 2.1.8 A zero pollution ambition for a toxic-free environment**: noting more action is needed to prevent pollution from being generated - in addition to measures to clean and remedy pollution. Among other things this will involve better monitoring, reporting, prevention and remedial actions, which will require the EU and MS to look more systematically at all policies and regulations. Commitments and actions to be taken under EDG component 2.1.8 include:
    1) The Commission's adoption of a zero-pollution action plan for air, water and soil
    2) Restoration of the natural functions of ground and surface water in order to preserve and restore biodiversity and to prevent and limit damage from floods:
        - Implementation of the Farm to Fork Strategy will contribute to this aim through reducing nutrient inputs to these waters.
        - The Commission will propose measures to address pollution from urban runoff and from pollutants such as micro plastics and chemicals including pharmaceuticals
    3) Drawing on the lessons learnt from the evaluation of current air quality legislation the Commission will propose strengthening the provisions for air quality monitoring (including digital opportunities), air quality monitoring and air quality plans to help local authorities achieve cleaner air. Notably, the Commission will propose to revise ambient air quality standards to align them more closely with World Health Organization (WHO) recommendations
    4) The Commission will review EU measures to address pollution from large industrial installations. The sectoral scope of the legislation will be examined and opportunities to make it fully consistent with climate, energy and circular economy policies will be explored
    5) The Commission will present a chemicals strategy for sustainability, of which one aspect will be to simplify but strengthen the legal framework

Additionally, the EGD sets out a number of **proposals (EGD 2.2) for mainstreaming sustainability in all EU policies**. These include:

- EGD 2.2.1 Pursuing green finance and investment and ensuring a just (equitable) transition
- EGD 2.2.2 Greening national budgets and sending the right price signals
- EGD 2.2.3 Mobilising research and fostering innovation
- EGD 2.2.4 Activating education and training
- EGD 2.2.5 A green oath: 'Do no harm'



B.2 Scope of the EU's Circular Economy Action Plan (CEAP)

Forming a significant component of the Green Deal, the EU's CEAP makes the case for two major policy initiatives. First, a ***Sustainable Product Policy Framework*** that addresses (i) designing sustainable products, (ii) empowering consumers and public buyers, and (iii) circularity in production processes. Action on key product value chains is integral to the practical implementation of this policy. ***Key value chains*** identified in the CEAP are ***electronics and ICT***; ***batteries and vehicles***; ***packaging***; ***plastics***; ***textiles***; ***construction and buildings***; and ***food, water and nutrients*** to which the Farm-to-Fork strategy (EGD 2.1.6) is expected to make a significant contribution.

CEAP's second major policy initiative concerns ***Less Waste, More Value***. This focuses on (i) enhancing waste policy in order to support waste prevention and circularity, (ii) enhancing circularity in a toxic-free environment, (iii) creating a well-functioning market for secondary raw materials, and (iv) addressing waste exports, with the aim of ensuring that the EU does not export its waste challenges to third countries.

The above policy initiatives are explained below. CEAP also proposes actions to ensure that circularity works for people, regions and cities; and to develop and adopt crosscutting measures for strengthening the role of circularity in achieving climate neutrality, getting the economics right, and driving the transition through research, innovation and digitalisation.

Policy Initiative: Sustainable Product Policy Framework

<u>*Designing sustainable products*</u>

Since up to 80% of a product's environmental impacts are determined at the design phase, a key plank of the proposed policy framework is to strengthen the drivers for designing sustainable products. This will build on existing legislation such as the Ecodesign Directive that regulates the energy efficiency and some circularity features (resource efficiency and waste reduction) of a range of energy-related products placed on the commercial market. It will also build on instruments such as the EU Ecolabel and green public procurement (GPP) that are broader in scope but whose overall impacts are limited owing to their adoption being voluntary. Accordingly, <u>***sustainable product policy legislation***</u> is proposed with the aim of establishing a comprehensive set of requirements ***to ensure*** that ***all products placed on the EU market become*** increasingly ***sustainable and 'circular'***. In essence, the legislative package aims to:

- Widen the scope of the Ecodesign framework beyond energy-related products to the broadest possible range of products and to ensure that circularity is developed, i.e. to ensure the default adoption of cleaner design principles
- Establish, after due consideration, sustainability principles to enable regulation and to ensure:

- Improving product durability, reusability, upgradability and repairability while increasing their energy and resource efficiency and addressing (reducing) the presence of hazardous substances in products
- Increasing the recycled content in products while ensuring performance and safety
- Enabling remanufacturing and high-quality recycling
- Reducing carbon and environmental footprints
- Restricting single-use and countering premature obsolescence
- Banning the destruction of unsold durable goods
- Incentivising product-as-a-service and other models where producers retain ownership of a product or responsibility for product performance through its lifecycle
- Mobilising the potential of product information digitalisation
- Rewarding products based on their different sustainability performance

Action will prioritise product groups in the key value chains identified in CEAP (see above) but will also address furniture and high-impact intermediate products such as steel, cement and chemicals.

Empowering consumers and public buyers

The empowerment of consumers and their access to trustworthy, relevant information prior to purchase is seen as ***a key building block*** of the sustainable product policy framework. The CEAP proposes two main strands. One that addresses consumer rights in general, and another that utilises the major purchasing power of public authority procurement – representing 14% of the EU's GDP.

Regarding ***consumer rights***, the European Commission is proposing to:

- Revise EU consumer law to ensure that consumers receive trustworthy and relevant product information at their point of sale, such information to include and cover:
  - Product lifespan
  - Availability of repair services, spare parts and repair manuals
- Consider further strengthening consumer protection against premature obsolescence. And to set minimum requirements for sustainable labels/logos and information tools in order to safeguard against 'greenwashing'
- Work towards establishing a new 'right to repair' and consider new consumer rights regarding, for instance, the availability of spare parts and access to repair

Regarding ***green public procurement***, the EC proposes to:

- Introduce minimum, mandatory GPP criteria and targets in sectoral legislation
- Phase in compulsory reporting to monitor the uptake of GPP while not creating unjustified administrative burdens on public buyers
- Continue to support capacity building with guidance, training and the dissemination of good practices
- Encourage public buyers to participate in a 'Public Buyers for Climate and Environment' initiative, which will facilitate exchanges among buyers committed to the implementation of GPP

Circularity in production processes

In synergy with the objectives laid out in the EU's Industrial Strategy, the EC proposes to enable greater circularity (of resource use) in industry by:

- Assessing options for promoting circularity in its review of the Industrial Emissions Directive. Options include integrating circular economy practices in Best Available Techniques reference documents
- Developing an industry-led reporting and certification system to enable industrial symbiosis
- Using Bioeconomy Action Plan implementation to support the sustainable and circular bio-based sector

- Promoting the use of digital technologies for tracking, tracing and mapping of resources
- Registering the EU Environmental Technology Verification scheme as an EU certification mark

The new SME Strategy will foster circular industrial collaboration among SMEs building on training, advice under the Enterprise Europe Network on cluster collaboration, and on knowledge transfer via the European Resource Efficiency Knowledge Centre.

Policy Initiative: Less Waste, More Value

Despite all efforts to date, the quantities of waste generated are not going down and the decoupling of waste generation from economic growth will require significant additional effort across all value chains and in every home. Complementing the sustainable product policy, the EU aims to strengthen its waste laws and their implementation. Proposals include:

- Revision of EU legislation on batteries, packaging, end-of-life vehicles, and hazardous substances in electronic equipment to better prevent waste, increase recycled content, promote safer and cleaner waste streams, and ensure high-quality recycling which relies on the effective separate collection of waste
- Aiming to halve the amount of residual (non-recycled) municipal waste by 2030 through:
    - Declaring waste reduction targets for specific waste streams
    - Enhance implementation of recent requirements for extended producer responsibility schemes
    - Incentivise and encourage the sharing of information and good practice in waste recycling
- Harmonise separate waste collection systems in order to help the better separation of waste for recycling, considering:
    - The density and accessibility of separate collection points
    - Regional and local conditions
    - Harmonised bin colours and product labelling
    - Information campaigns and economic instruments
    - Standardised use of quality management systems to assure the quality of collected waste streams destined for use in products

Noting that the safety of secondary raw materials (recovered from waste streams) can be compromised by hazardous substances in the recycled feedstock, CEAP proposes to improve confidence in the use of secondary materials through a range of other legislative amendments, administrative and technical measures.

Farm to Fork Strategy (EGD 2.1.6)

Agriculture, food and drink processing, retailing, consumption and the management of residual wastes forms one of the key value chains envisaged in the CEAP. The EU's 'Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system'[95] targets actions at this value chain and complements the broader scope of CEAP. The strategy published in May 2020 is outlined below.

Agriculture, food and drink processing, retailing, consumption and the management of residual wastes forms one of the key value chains envisaged in the CEAP. The EU's 'Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system'[96] targets actions at this value chain and complements the broader scope of CEAP. The strategy published in May 2020 is outlined below.

Though the transition to more sustainable systems has begun, food production still results in air, water and soil pollution. This:

- Contributes to the loss of biodiversity and climate change;
- Consumes excessive amounts of natural resources.

95 https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_en
96 https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_en

At the same time, significant quantities of food are wasted while low-quality diets contribute to obesity – with associated health impacts that include a susceptibility to Covid-19 and diseases such as cancer. Forming part of the EU's Green Deal, it is the EU's ambition that the 'Farm to Fork' strategy will enable European food (production and consumption) to become the global standard for sustainability, by:

- Strengthening the efforts of European farmers and fishers to manage the transition, noting that the Commission's proposals for the common agricultural policy (CAP) for 2021 to 2027 stipulate that at least 40% of the CAP's overall budget would contribute to climate action;
- Ensuring that national strategic plans for agriculture fully reflect the ambition of the Green Deal and the Farm to Fork strategy;
- National strategies for agriculture that reflect an increased level of ambition to reduce significantly the use and risks associated with chemical pesticides, and the use of fertilisers and antibiotics;
- Contributing to achieving a circular economy through the food processing and retail sectors taking action on transport, storage, packaging and food waste; and
- Striving to stimulate sustainable food consumption and promote affordable, healthy food for all – noting that food imports that do not comply with relevant EU environmental standards are not allowed on EU markets.

The principal scope of the Farm to Fork strategy is given below.

1. Ensuring sustainable food production

- Human and financial investment
- New, green business models
- Circular bio-based economy
- Production of renewable energy and investing in anaerobic digesters for biogas production from agricultural wastes
- Taking additional action to reduce by 50% the overall use of chemical pesticides and, also by 50%, the use of more hazardous pesticides by the year 2030
- Enhance the provisions on integrated pest management (IPM)
- An integrated nutrient management action plan
- Take measures to reduce GHG emissions from agriculture, primarily generated by the animal sector
- Take action to reduce overall sales of antimicrobials for farmed animals and in aquaculture by 50% by 2030
- Better animal welfare on farms
- Seed security and diversity including access to quality seeds for plant varieties adapted to the pressures of climate change
- Promotion of organic farming
- Resourcing and implementation of 'eco-schemes'

2. Ensuring food security

- Ensuring that the key principles enshrined in the European Pillar of Social Rights are respected
- Stepped-up coordination of a common European response to crises affecting food systems
- Develop a contingency plan for ensuring that food supply and security are in place at times of crisis.

3. Stimulating sustainable food processing, wholesale, retail, hospitality and food services practices

- Develop an EU Code of conduct for responsible business and marketing practice, accompanied by a monitoring framework
- Prepare an initiative to improve corporate governance framework, which will include a requirement for the food industry to integrate sustainability into corporate strategies

- Seek opportunities to facilitate the shift to healthier diets and stimulate the reformulation of products, including by establishing nutrient profiles to restrict the promotion (via nutrient or health claims) of foods high in fat, sugars and salt
- Scale-up and promote sustainable and socially responsible production methods and circular business models in food processing and retail – including for SMEs especially
- Revise the legislation concerning food contact materials to improve food safety and public health and to support the use of innovative and sustainable packaging solutions using environmentally friendly, reusable, and recyclable materials
- Revise marketing standards to provide for (i) the uptake and supply of sustainable agricultural, fisheries and aquaculture products and (ii) reinforce the role of sustainability criteria to consider the possible impacts of these standards on food loss and waste
- Strengthening the legislative framework on geographical indications to include, where appropriate, specific sustainability criteria

4. Promoting sustainable food consumption and facilitating the shift to healthy, sustainable diets

- Reversing the rise in the rates of overweight and obesity across the EU may be helped by moving to a more plant-based diet with less red (beef, lamb/mutton, pork, deer meat) and processed meat, and more fruits and nuts, because this would reduce risks to life from unhealthy diets
- Empowering consumers to make informed, healthy and sustainable food choices
- Improve the availability and price of sustainable food and promote healthy and sustainable diets in institutional catering
- Tax incentives to drive the transition to a sustainable food system and encourage consumers to choose sustainable and healthy diets

5. Reducing food loss and waste

- Tackling food loss and waste is key to achieving sustainability while the recovery and redistribution of surplus food has an important social dimension
- The Commission is committed to halving per capita food waste at retail and consumer levels by 2030; it will set a baseline and propose legally binding targets to reduce food waste across the EU
- The Commission will integrate food loss and waste prevention in other EU policies including a review of date marking (‘use by’ and ‘best before’ dates) that can lead to food waste

B.3 Comparison: STRUGE vs the EU’s EGD and CEAP

Introduced in Annex A, the Strategy for the Transition of the Republic of Uzbekistan’s Green Economy identifies five strategic priorities. Combining the first two strategic priorities, and the last two, STRUGE’s focus may be presented as:

- Energy conservation and energy efficiency in basic sectors of the economy and the use of renewable energy sources (RES)
- Adaptation to and mitigating the effects of climate change; increasing the efficiency of natural resource use; and conserving natural ecosystems (habitats and biodiversity)
- Mechanisms to support the green economy and the implementation of STRUGE

STRUGE’s scope in each of the above areas are compared below with the scope of the EGD including CEAP. This forms the basis for a gap analysis and identifying specific issues where effective SCP actions could complement STRUGE and help to increase the effectiveness and impacts of its implementation. Section B.3.4 collates the proposed specific issues for SCP action.

Energy conservation, efficiency and renewable energy resources

STRUGE calls for a comprehensive range of investments in new and modernised productive and infrastructural assets, the major sectors cited include:

- Power generation and transmission
- Heat and power generation, including heating networks, consumer metering, and use of solar energy for heating water in boiler rooms
- Oil and gas industry, covering all stages from extraction, processing, and transport through to distribution, including measures to reduce emissions from these stages
- Chemical industry, the production of ammonia, nitric acid and mineral fertilisers especially, and the use of industrial wastes and heat
- Buildings, covering their design and construction, the materials used (including recycled resources), cement production (dry method), building codes and regulations, 'green mortgage' loans, and the development of production capacity for products based on 'green standards'
- Road transport, addressing vehicle types, energy efficiency and emissions, fuel quality, a scrappage program to incentivise the substitution of newer, more environmentally friendly cars for old, and the phased replacement of hydrocarbon-fuelled vehicles by electrically-powered vehicles;
- Renewable energy sources, covering the production of technologies, power generation, power storage, and the use of RES at small-scale and in rural and remote regions. Also included here – although it applies generically, not only with regard to RES - is a call to raise public awareness on matters of energy efficiency and RES

STRUGE's call for sectoral investments to improve energy efficiency, reduce GHG emissions, promote the use of RES, and phasing-out of hydrocarbon fuelled cars are consistent with short-term goals of the EU's EGD and CEAP. As is noting the need to raise public awareness on energy efficiency and the use of RES. However, some gaps are apparent and are noted below:

a) While STRUGE presents indicator for 2030, it sets no long-term goals akin to the net-zero GHG emissions by 2050 of the EU's EGD

b) There is no explicit consideration of the design of sustainable products or of empowering consumers and public buyers – both key aspects of the sustainable product policy framework of the EU's CEAP

c) The potential roles of effective, tailored communication targeted at producers and consumers in key sectors of the economy is not emphasised

d) STRUGE doesn't address specific issues such as household attitudes and behaviour (regarding heating and the use of energy-related and energy-consuming appliances), driver behaviour on the roads, energy pricing and other financial instruments to stimulate energy conservation, energy efficiency, and RES uptake – other than 'green mortgage' loans

e) Specific measures for strengthening energy monitoring and auditing in industrial enterprises are not detailed. However, Chapter 3, par. 2, clause 18 of STRUGE concerns non-financial mechanisms to regulate and control energy efficiency in order to support a green economy. It states the following mechanisms should be developed and implemented:

    - target indicators for energy saving and energy efficiency and implementation of a monitoring, verification and reporting system
    - energy management and audit of energy-intensive enterprises
    - state automated electricity consumption metering system for all categories of consumers, including industrial and energy facilities

f) While improving ambient air quality and public health are not specified as goals of STRUGE, in contrast with their inclusion in the EU's EGD, the signalled investments should help deliver these as co-benefits of reducing the emission of air pollutants and GHGs. Functional national emissions inventories – for GHGs and major air pollutants – ought to be able to capture the trend in national emissions, year-by-year. Coupling a reliable historic emissions inventory with the ability to project emissions into the future provides a powerful policy tool. Such a tool enables government to better examine the effects of alternative or complementary policies and measures to achieve energy efficiency and emission reduction goals. Hence, action to strengthen the national emissions inventories and the capacity for preparing emissions projections is recommended for inclusion as a cross-cutting measure in the SCP action plan for Uzbekistan. This is an instance where the EU's EGD and CEAP assume the environment *acquis* as a given: while emissions inventories and projections contribute to underpinning the EGD, the EGD and CEAP don't mention them - nor do they mention other specific aspects of the *acquis*.

g) In the medium to long-term, many countries are looking to the increased use of all-electric cars, phasing out the production of diesel and petrol-fuelled cars, which should result in cleaner air. Analysis of scenarios for what that shift might mean for Uzbekistan in terms of vehicle imports, air pollutant emissions and air quality could usefully be included as an action in the SCP action plan, i.e. to prepare a policy guidance note to the Government.

Climate change adaptation and mitigation, improving natural resource use efficiency, and conservation of natural ecosystems

STRUGE considers a disparate range of sectors and measures in this priority area, the major sectors cited include:

- Water resources: making better use of water through the deployment of water efficient techniques in crop production and in other economic sectors; construction and repair of hydraulic structures and associated assets; and improved mechanisms for stimulating water saving and sustainable water resource management, and to prevent further soil salinisation and deterioration of land quality
- Agriculture: creating value chains for agricultural and food products and attract investment into all stages of the value chain, to prevent the pollution of water resources from agricultural operations; and to restore degraded pastures
- Forestry: preservation of natural cover and restoration of forests, increasing coverage in mountainous, hilly and desert zones, landscaping with local plant species resistant to drought and salinisation, foresting the dry area of the **Aral Sea** in order to prevent the desertification of this region, and raising public awareness of forest protection and restoration measures
- Municipal Solid Waste: development of infrastructure to ensure the whole population is provided with services to collect and remove solid waste to facilities – including landfills - designed and operated to meet sanitary and environmental standards, the creation of a modern system for solid waste processing, reducing the quantity of solid waste disposed of to landfill sites, and to use solid waste as an alternative energy resource

Water Resources

The EGD does not address the water resources sector specifically as existing EU policies, exemplified by the Water Framework Directive, substantially address this sector. However, efficient water use is implicit in the Farm to Fork strategy (EGD 2.1.6) and in the preservation and restoration of ecosystems and biodiversity (EGD 2.1.7). Also, the CEAP identifies food, water and nutrients as a key value chain, noting that the new Water Reuse Regulation[97] will encourage circular approaches to the reuse of treated wastewater in agriculture; and that the European Commission will facilitate water reuse and water efficiency in all other sectors, although details as to how the Commission will facilitate these aspects are not available at present.

Agriculture, including the cultivation of cotton, is the major sectoral user of water in Uzbekistan, accounting for about 90% of the annual volume of abstracted water, with industry accounting for a little over1% of the total. Distribution losses are understood to be considerable and water prices low.

Generically, the EGD identifies consumers as having a significant role to play as members of value chains - including food, drink and their waste – while its cross-cutting proposals EGD 2.2.1 to EGD 2.2.4 inclusive seek to mainstream sustainability in all EU policies. Among other things, these proposals cover sending the right price signals (market-based instruments), research and innovation, and education and training.

While STRUGE calls for widespread use of water saving and energy technologies, it is relatively light on the detail of how such techniques will be promoted and it is unclear whether water pricing as a mechanism

97 Regulation (EU) 2020/741 of the European Parliament and of the Council of 25 May 2020 on minimum requirements for water reuse. Available at: https://ec.europa.eu/environment/water/reuse.htm

to encourage water saving should eb considered. The role of water pricing, incentivising the take-up of water saving techniques, good practice and technology transfer, the role of the consumer in contributing to water saving, and the roles that may be played by communication and marketing activities could be further emphasised. All these issues should be addressed in Uzbekistan's SCP Action Plan.

Policy measures concerning the setting of limits on the volume of water abstracted from defined river basins, catchments and groundwater aquifers also appear to absent from STRUGE. This issue should also be considered in a holistic SCP action plan.

Agriculture

STRUGE notes the creation of value chains for agricultural and food products, and water saving techniques, yet appears not to address raw cotton production and textiles value chain. Both value chains should be emphasised in the SCP Action Plan.

It appears that STRUGE does not give explicit consideration to GHG and ammonia emissions to air from agricultural practices, nutrient (N and P) pollution of surface water and groundwater from the use of fertilisers and the management of animal manures (although water pollution by agriculture is noted), pesticide use, or other impacts of agriculture on biodiversity. All these issues should be addressed in a holistic SCP action plan.

Forestry

Uzbekistan's Concept for the Development of Forestry has a time horizon of 2030 and there is a Forestry Management Committee. STRUGE includes action to raise public awareness of forest protection and restoration, an issue that could be addressed in the SCP Action Plan as a communication and marketing activity. Also, the issue might be broadened to cover associated biodiversity issues. If commercial forestry was developed (it is not at present) the use of 'forestry stewardship' systems to promote sustainable forestry and forestry product value chains should be considered.

Management of MSW

The scope of STRUGE regarding solid wastes management is rather conventional. Although some of the issues addressed in the EU's EGD and Circular Economy Action Plan are considered, many are not, at least not to any significant extent. The CEAP is comprehensive and launched two major policy initiatives.

First, the *Sustainable Product Policy Framework* which includes the design of sustainable products, empowering consumers and public buyers, and ensuring greater circularity in production processes. The CEAP also identifies the *key value chains* where EU policy implementation should focus: electronics and ICT; batteries and vehicles; packaging; plastics; textiles; construction and buildings; and food, water and nutrients. The EGD also includes the Farm to Fork Strategy, separate to the CEAP, but supportive of the CE approach applied to the food, water and nutrients value chain.

Less Waste, More Value is the second policy initiative of CEAP. Its objective is to strengthen existing waste laws and their implementation with the aims of (i) ensuring high quality, cleaner waste streams for recycling, (ii) halving the quantity of residual municipal solid waste for disposal, (iii) harmonising separate waste collection systems in order to improve the separation of waste for recycling, and (iv) other legislative and administrative measures to improve the confidence of producers in the quality of recycled feedstocks.

There is considerable scope, therefore, for introducing selected ideas from CEAP into an action plan for SCP in Uzbekistan, thereby complementing and strengthening STRUGE's effectiveness. The areas where SCP and measures in the EU's CEAP could strengthen and broaden the impacts of STRUGE are given below.

Mechanisms to support the green economy and STRUGE implementation

Summarised in Annex A.1, STRUGE identifies several non-financial mechanisms to support the development of a green economy, reinforced by the introduction of financial incentives and fees to encourage behavioural change. The broad range of non-financial mechanisms identified in outline span from facilitating the implementation of green technology through developing an appropriate institutional framework, through to energy management and audits at energy-intensive enterprises, integration of green economy concepts into secondary and higher education curricula, awareness raising and capacity building at many levels and branches in how to apply green economy concepts in practice.

What is perhaps less clear is how these mechanisms may be developed and implemented coherently, and by whom. This an area where establishing a SCP Support Mechanism, dedicated to promoting and facilitating the implementation of SCP and STRUGE, could be very useful. There is considerable, positive international experience of the establishment and operation of such Support Units. A focused Support Unit may also be well-placed to attract international assistance funding to support its development, strengthen its capacity and maximise the impacts of STRUGE implementation.

STRUGE correctly identifies that all stakeholders ranging from members of the public through to state and economic management bodies will have to be involved in implementing the strategy. And that major tasks will be undertaken through the activities identified in national and sectoral plans and strategies. Were a SCP Support Mechanism be formed, its activities should target all stakeholders in a tailored, appropriate way.

The strategy also identifies a range of potential sources for the investments that will be needed for its implementation. It would be appropriate to include in the role of a SCP Support Mechanism the provision of advice to stakeholders on the green economy and SCP criteria to be addressed when seeking funding from identified sources.

Recommended Areas that the SCP Action Plan should Address

Issues identified in the gap analysis presented above are collected together in the Table below.

STRUGE Priority	Recommended areas for SCP Action
Energy Saving, Energy Efficiency and Renewable Energy Sources *(cross-sectoral)*	– Transfer and introduction of good practice techniques (including BAT) for energy conservation, energy efficiency and RES use: BAT to comprise investment and operational/management techniques – Energy pricing and financial instruments – considering all major energy consuming sectors – Energy auditing and benchmarking of energy consumption (electricity, fuel, steam, hot water, etc.) in significant economic sectors and branches – including the use of monitoring and targeting techniques to set internal benchmarks – Energy labelling of consumer appliances – Public procurement procedures to favour energy efficient appliances – Communication and marketing tailored to major energy consuming sectors, including households; marketing of products to include awareness raising, information sheets, good practice guides, benchmarking and case studies, promotion via media – Communication and marketing to promote the use of renewable energy sources in rural and remote regions and at small-scale – Extend the proposed communication and marketing activities to address air quality and human health: ▪ Raise awareness of air quality and its links to human health ▪ How behavioural change by households, industry and vehicle drivers may help achieve cleaner air – Analyse the implications for Uzbekistan of the expected international shift to all-electric powered vehicles, using the analysis as a basis for preparing policy guidance to Government – Develop and strengthen national inventories of emissions to air (GHGs and air pollutants) – extending also to capacity for making emission projections, an essential aid to policy setting and tracking the impacts of energy saving and emissions reduction measures

Water Resources *(cross-sectoral)*	– Policy and limits on water abstraction at Basin/catchment level – Water pricing and financial instruments – considering all major water consuming sectors – Incentivising the adoption of water saving techniques – Transfer and introduction of good practice techniques – Benchmarking of water consumption in significant sectors and branches – including the use of monitoring and targeting techniques to set internal benchmarks – Consumer awareness and motivation – Communication and marketing of awareness raising events, information sheets, good practice guides, benchmarking and case studies, promotion via media
Agriculture, & Rural Economy	– Exploiting the value-chain approach from food crops production and animal rearing, through to food processing, retail, hospitality and household consumption, to wastes management (crop residues, manures, food wastes) – Transfer and introduction of good practice techniques and innovative research regarding agricultural crop selection, water saving, animal rearing and manure management, use of fertilisers, pesticides and herbicides – Benchmarking of water consumption (in significant economic sectors and branches – including setting internal benchmarks through the use of monitoring and targeting – Consumer awareness and motivation – Communication and marketing (awareness raising events, information sheets, good practice guides, benchmarking and case studies) tailored to significant segments of the food and drink value chain, promotion via media
Textiles	– Exploiting the value-chain approach from raw cotton production, through to cotton processing, textiles production, retail and household use, to end-of-life wastes management including recycling – Transfer and introduction of good practice techniques and innovative research regarding cotton crop selection, water saving, and the of fertilisers and herbicides – Benchmarking of water consumption in significant branches of the value chain – including setting internal benchmarks through the use of monitoring and targeting – Consumer awareness and motivation – Communication and marketing (awareness raising events, information sheets, good practice guides, benchmarking and case studies) tailored to significant segments of the textiles value chain, and promotion events

Waste Management *(cross-sectoral)*	– Identify key value chains in Uzbekistan – to include textiles – Strengthen existing legislation, if and where appropriate – to stiffen the requirements to reduce waste minimisation at source and to facilitate and improve waste reuse and recycling – Set targets for reducing biodegradable waste quantities disposed of the landfill, monitor performance and enforcement – Introduce producer responsibility obligation, where appropriate, on manufacturers in key value chains – For products not manufactured in Uzbekistan, explore the options for recovering clean waste streams for export as feedstock for production elsewhere – Set targets for waste reuse and recycling in key value chains – Introduce a widely-drawn Ecodesign framework for products placed on the market – Good practice guidance on applying cleaner design principles and the circular economy approach in practice – including case studies – Develop and introduce or strengthen green public procurement (GPP) requirements, criteria and targets – Appropriate pricing and financial instruments to help achieve the waste reduction goals set by government/s – Communication and marketing activity tailored to significant segments of key value chains, household, public and other consumers, the waste management industry, and all levels of government - content to include awareness raising activity/information sheets, good practice guides, benchmarking and case studies
Education – Secondary and Higher (cross-sectoral)	– Curricula for use in secondary schools and higher levels of learning that include green economy and SCP concepts – Develop the capacity of schoolteachers and lecturers such that they may teach to their respective curriculum effectively ('teach the teachers')
Non-Financial Mechanisms (cross sectoral)	– Establishment of a funded SCP Support Mechanism whose role would be to undertake cross-sectoral and sectoral actions to facilitate and stimulate activity in all of the above-mentioned areas

ANNEX C: UN Sustainable Development Goals Relevant to SCP

In accordance with the resolution of the General Assembly No. 70/1 'Transforming our world: the 2030 Agenda for Sustainable Development', adopted on September 25, 2015, the Republic of Uzbekistan has undertaken to implement the Sustainable Development Goals (SDGs) by 2030, developed by the UN as a 'Plan for a better, more sustainable future for all' (17 goals and 169 related targets). In this regard, the following resolution of the Cabinet of Ministers was adopted:

Resolution of the Cabinet of Ministers of the Republic of Uzbekistan 'On measures to implement National goals and targets in the field of sustainable development for the period up to 2030' No. 841 dated 20/10/2018.

This Resolution:

- Approved the National Goals and Targets in the field of sustainable development for the period up to 2030
- Identified 16 goals (SDGs) and 125 targets to be achieved by 2030
- Formed the Coordination Council for implementation of National Goals and Targets in the field of sustainable development for the period up to 2030
- Approved the 'Roadmap' for the implementation of National Goals and Targets for Sustainable Development for the period up to 2030

The principal SDG of relevance to an SCP is Goal 12, '*Ensure the transition to sustainable (responsible) consumption and production*'. However, others are also relevant, as indicated in Table 18. Regarding Goal 12, though, the main indicators of achievement in Uzbekistan as of 26.03.2021 are presented below. In order to monitor the implementation of SDG indicators in the Republic of Uzbekistan, a special website was launched (nsdg.stat.uz) with the support of UNDP. The main targets and indicators of Goal 12 are:

1. Implement the 10-year action strategy for sustainable consumption and production (Rio + 20 2012)
2. By 2030, achieve the environmentally sound management of chemicals and all wastes throughout their entire life cycle in accordance with agreed international principles and substantially reduce their release to air, water and soil in order to minimise their negative impact on human health and the environment
3. By 2030, substantially reduce the volume of waste by taking measures to prevent, reduce, recycle, and reuse waste
4. Encourage companies, especially large ones, to adopt sustainable production practices and to reflect sustainability information in their reports
5. Expand the use of environmental standards in public procurement
6. By 2030, provide the population with relevant information on sustainable development and lifestyles in harmony with nature
7. Develop and implement tools to monitor the sustainable development impact of tourism that contributes to job creation, local culture and production
8. Rationalise inefficient and wasteful subsidies for fossil fuels by addressing market imbalances in the light of national circumstances, including by reforming taxation and phasing out subsidies where they exist to account for their environmental impacts fully taking into account the special needs and conditions of the country and minimising possible negative consequences for their development in such a way as to protect the interests of the needy and socially vulnerable segments of the population

Table 18 Sustainable Development Goals (SDGs) and Specific Targets Relevant to STRUGE and SCP

Sustainable Development Goal and Selected Targets	
SDG.02	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
SDG.03	Ensure healthy lives and promote wellbeing for all at all ages
3.9	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.
SDG.06	Ensure availability and sustainable management of water and sanitation for all
6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4	By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
6.5	By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
6.6	By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
6.a	By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
SDG.07	Ensure access to affordable, reliable, sustainable and modern energy for all
SDG.08	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
8.4	Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead
SDG.09	Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
9.2	Promote inclusive and sustainable industrialisation and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries
9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries acting in accordance with their respective capabilities
9.5	Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
9.b	Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities
SDG.11	Make cities and human settlements inclusive, safe, resilient and sustainable
11.6	By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
11.b	By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels
SDG.12	Ensure sustainable consumption and production patterns

Sustainable Development Goal and Selected Targets	
12.1	Implement the 10-year framework of programmes on sustainable consumption and production, all countries acting, with developed countries taking the lead, considering the development and capabilities of developing countries
12.2	By 2030, achieve the sustainable management and efficient use of natural resources
12.3	By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses
12.4	By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimise their adverse impacts on human health and the environment
12.5	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
12.6	Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
12.7	Promote public procurement practices that are sustainable, in accordance with national policies and priorities
12.8	By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature
12.a	Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production
12.b	Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products
12.c	Rationalise inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimising the possible adverse impacts on their development in a manner that protects the poor and the affected communities
SDG.13	Take urgent action to combat climate change and its impacts
13.2	Integrate climate change measures into national policies, strategies and planning
13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
SDG.15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification; halt and reverse land degradation, and halt biodiversity loss

ANNEX D: International Experience of SCP Support Mechanisms and Illustrative Terms of Reference

Three examples of good international practice are summarised below. They illustrate the evolution of operational SCP-related support mechanisms (units) in the UK since the first of these mechanisms was established in the 1990s. Each aimed to stimulate producers and, increasingly, consumers to adopt an SCP-related approach. Their remits initially were rather technocratic and narrow in scope, confined first to energy efficiency and then to waste reduction. But in the past decade and more the scope of the remaining mechanism now extends to cover broader aspects of SCP, the Circular Economy and climate neutrality (net-zero GHG emissions). Its role in catalysing informal group activity and voluntary partnerships has grown also.

D.1 UK 1: Energy Efficiency Best Practice Programme (EEBPP)

The UK Government initiated the EEBPP to encourage the spread of energy efficient technologies and techniques throughout UK industry and the national building stock. By the year 2000 it had stimulated annual savings worth EUR 957 million (1990 prices[98]) – equivalent to a reduction in carbon dioxide emissions of about 18 million t/year. This represented excellent value for an annual expenditure of only EUR 24 million of public money.

The EEBPP formed a bridge across which knowledge and application experience passed effectively from the 'haves' to the 'have nots', adopting a systematic approach that:

– Identified the relevant knowledge needed by the target audience or audiences
– Prepared, packaged and disseminated the knowledge appropriately for that audience
– Continually assessed the programme's impact, making changes as necessary

Technical input on all aspects relating to buildings was provided by the UK's Building Research Establishment (BRE), and by the UK's Energy Technology Support Unit (ETSU) for industrial energy use. Where lack of knowledge was the primary barrier to improved performance – delivering higher profits for business, or providing affordable warmth for low-income households - the Best Practice approach was shown to play a key role. It provided help and advice through telephone helplines, the internet, publications[99], seminars, workshops and conferences, site energy surveys, and building design advice consultancies. The programme made it easier for those responsible for energy use and energy efficiency to get the information needed to save energy, money, and carbon dioxide emissions. Typical examples of how organisations and individuals in the buildings sector benefitted from the programme included:

– A local government's investment in energy efficiency measures for their housing stock improved living conditions and reduced tenants' heating bills by 45%
– A city general hospital saved EUR 83,700 a year by using combined heat and power (CHP)
– Industrial buildings in the UK saved an additional 0.5 million t of carbon a year as a result of the programme

The EEBPP was successful mainly because it formed a cooperative partnership with business sector associations, professional institutions and the many consultants and sub-contractors who worked on the programme. Other reasons for success included:

– The approach appealed to senior management as structured, effective, and complementary to good management practice
– The information provided was useful, impartial, authoritative, and available free of charge
– It provided a route whereby good Research and Development (R&D) projects were supported and then encouraged to market

The power of the Best Practice approach was confirmed by the fact that other sectors in the UK economy, such as the construction industry, adopted this method of improving their performance. As did other countries,

98 Adopting a GB Pound to Euro exchange rate of EUR 1 to £0.83605 (17 January 2022)
99 https://www.cibse.org/knowledge/knowledge-items-(1)/knowledge-archive/energy-efficiency-best-practice-programme-archive

including Canada, South Africa, New Zealand, and Australia. By 2004, responsibility for the EEBPP in the UK transferred to the Energy Saving Trust[100] (for housing issues) and the Carbon Trust[101] (for all other areas).

D.2 UK 2: Envirowise

Jointly funded and overseen by two Government Departments, one responsible for the Environment, Food and Rural Affairs (DEFRA) and the other for Trade and Industry, the UK Government established the Environmental Technology Best Practice Programme – later rebranded as 'Envirowise' – in 1994. Its initial remit was to achieve the goal of delivering annual savings of EUR 191 million for industry within six years. Total funding for the period 1994-2000 was set at about EUR 19 million at 1994 prices.

Designed along similar lines to the EEBPP, the Envirowise Programme was hosted by ETSU and implemented under contract to the UK Government. Quarterly progress reports were prepared for Departmental representatives, and meetings held at which proposals for new thematic strategies and deliverable outputs were also reviewed. The programme was dedicated to putting the sustainable use of resources at the heart of UK business practice. Envirowise provided free practical advice to help UK businesses increase profits and reduce their environmental impact. The promoted benefits to business of increasing resource use efficiency included:

- Increased productivity
- Greater return on investment
- Staying competitive
- More effective use of resources to generate profits
- Reduced operating costs
- Improved environmental performance

Envirowise offered a range of free services to help companies improve their resource efficiency, including free advice from Envirowise experts through a Help Line; best practice events and practical workshops that offer an ideal way to examine resource efficiency issues and discuss opportunities; and a variety of publications that provided up-to-date information on resource efficiency issues, advice and successes. Over the years until 2009 when it was subsumed into the Waste and Resources Action Programme (WRAP), Envirowise addressed many business sectors. They ranged from those engaged in manufacturing and food processing, for instance, to the retail supply chain and offices. In parallel, generic cross-sectoral themes were also covered, including solid waste minimisation, packaging, water saving, and cleaner design.

D.3 UK 3: Waste and Resources Action Programme (WRAP)

Established as a not-for-profit company in 2000, WRAP became a charity in 2014, its goal, 'a world where resources are used sustainably'.[102] Based in the UK and with projects around the world it works with businesses, governments, citizens and charities to make the planet a healthier, safer place. WRAP's evidence-based approach inspires action in areas that create the most waste. In striving for a circular economy, it works with like-minded partners to cut waste, promote sustainability, and share knowledge.

The 2008/2009 financial crisis resulted in operational budget cuts leading to the Envirowise Programme and other DEFRA funded 'green' programmes[103] to be subsumed in 2009 into WRAP. Thus streamlining operations and achieving economies of scale in backroom (overhead) activities. WRAP's core funding is from the UK's DEFRA (Department for Environment, Food and Rural Affairs), the devolved governments of Northern Ireland, Scotland, and Wales, and from the EU. Also, some of the revenues raised from the UK's Landfill Tax (see section 5.3) have been allocated to WRAP. And further funding is provided by Charitable Trusts and initiative-based corporate sponsorship and partnership working.

100 https://energysavingtrust.org.uk/
101 https://www.carbontrust.com/
102 https://wrap.org.uk
103 Other programmes subsumed into WRAP were the National Industrial Symbiosis Programme (NISP), the Centre for Remanufacturing and Reuse, the Construction Resources and Waste Platform, Action Sustainability, and the Business Resource Efficiency and Waste (BREW) centre for local authorities.

Aspects of WRAP's approach and activities are rooted in the earlier work of EEBPP and Envirowise, but the approach has been modernised and greater emphasis is now placed on citizen and corporate behaviour and rather less on the relatively more technocratic stance of earlier programmes. Table 14 provides a profile of WRAP's current activities, sectors, services, and the resources it makes available.[104] A good example of WRAP's approach is its toolkit to help businesses implement 'Whole Chain Food Waste Reduction Plans' (WCPs), a key deliverable of a Food Waste Reduction Roadmap and contributing to meeting Target 12.3 of the UN's Sustainable Development Goals (Annex C). Figure 35 indicates the systematic, cyclical approach.

Figure 35 Five-stage process for WCPs and developing a culture of continuous approval – food waste

Table 19 Profile of WRAP's target sectors, services, activities, and the resources it makes available

Sectors	Issues - Taking Action
Farmers and Growers	Climate Change – Circular Economy
Hospitality & Food Services	
Local Authorities (Governments)	Plastic Packaging
Manufacturers	
National Governments & Departments	Food and Drink
Non-Governmental Organisations (NGOs)	
Packaging Producers	Textiles
Retailers & Brands	
Textile Producers & Designers	Waste Collection & Recycling – Delivering for Government, Key Operational Areas, Collection Consistency, Markets & Materials, Technical Support
Trade Associations	Citizen Behaviour Change – Clear on Plastics, Love Food Hate Waste, Love Your Clothes, Recycle Now
Waste Management & Reprocessors	

104 The WRAP website provides full details.

WRAP Works By	Services Provided	Resources Made Available by WRAP
Gathering evidence	Business Voluntary Agreements	Reports
Collaboration	Citizen Behaviour Change	Guides
Facilitation and delivery	Technical Support	Case Studies
Evaluation	Grants and Investments	Tools
	Policy and Insights	Campaign Assets

D.4 Indicative Terms of Reference for SCP Support Mechanism

A national SCP Support Mechanism should promote the SCP approach and stimulate SCP action in priority value chains and cross-sectoral areas. Targeting the Government's priorities, the SCP-SM will provide a focus for the development of knowledge and tools relevant to SCP and their communication. The Unit will engage with sources of practical experience and knowledge in Uzbekistan, the Central Asia region, and worldwide, to identify and develop SCP know-how, which will be communicated and applied through (renewable) three-to-four-year thematic strategies. Each thematic strategy should include the preparation of materials and undertaking of activities selected from the following indicative, non-exclusive list:

- Web-pages on an SCP-SM website
- Benchmark reports on resource consumption and resource efficiency – within Uzbekistan (anonymising the information) and between Kazakh and international performance levels
- Guides to good practice in key areas
- Guides to the practical use of selected, relevant SCP tools, including step-by-step tuition manuals on how to apply the techniques
- Short, practical training sessions in the use of selected SCP tools
- Case studies that demonstrate where good practice techniques and SCP tools have been applied in Uzbekistan or, failing that, in other countries – preferably those having broadly similar and relevant characteristics
- SCP awareness raising for producers, consumers, and institutions
- Updated thematic intelligence reports, e.g. on markets for recovered waste materials, and legislative status and changes affecting consumers and producers
- Digital videos demonstrating the use of selected guides and tools
- A 'Helpline' that might be manned by members of staff (on a rota) of the SCP-SM, providing a means for consumers and producers make contact with the SCP-SM: to raise questions, seek information, and request publications (ideally downloaded from the SCP-SM website)
- Access to limited staff advice and support to stakeholders on request
- Marketing and disseminating thematic 'products' through tailored communication activities, e.g. website, newsletter, news updates, 'information flyers' alerting stakeholders to the availability of Guides, etc., promotion via seminars, workshops, roundtables, training and other physical or virtual events
- Impact assessment made by an independent body to estimate uptake and resource savings made, etc., identify lessons learnt, and provide feed-back to the responsible Ministries

The SCP-SM should report on a regular basis to the Ministry of Economy, perhaps providing progress reports on a quarterly or half-yearly frequency. Prior to undertaking work on a thematic strategy, the SCP-SM should prepare a draft proposal for the scope of the strategy and submit it to the Ministry of Economy (and other relevant Ministries), for review; only starting work once approval has been granted.

The preparation of thematic products such as indicated above (good practice guides and case studies, benchmarking reports, digital videos, awareness raising, and training) may be undertaken by third-party institutions (businesses, consultants, R & D institutions, NGOs, etc.) under contract to the SCP-SM. In which case, the SCP-SM occupies the role of commissioner and editor. If third-party preparation is not feasible in practice, the SCP-SM will need to undertake such activity in-house, its capacity first bolstered through international Technical Assistance.

Indicative Staffing Needs

SCP-SM staffing levels will depend on the scope of its remit - the number of themes covered and whether materials are developed in-house or externally. Table 20 indicates staffing levels based on the assumption that five thematic strategies are covered and that dissemination materials are commissioned and edited by SCP-SM staff but drafted externally by institutions having specific sectoral expertise. Actual staffing and budgetary needs will need to be identified through detailed analysis. An action to make this analysis is included in the SCP Action Plan.

Table 20 Illustrative initial staffing levels for an SCP Support Mechanism

Staff	Numbers
Manager	1
Deputy Manager	1
Technical Officers	6
Marketing & Communication Officers	3
Website development and management	1
Support Staff: Secretarial, IT, technical editing, general	3

Future Arrangements and Scope of a SCP Support Mechanism

After an initial operational period of, say, four years, allowing the growth of SCP experience and development of SCP capacity, it might be appropriate to split the Mechanism's operation in two. The areas of responsibility might then be sub-divided as shown in Table 21 below: provision for a decision point in 2026 is included in the action plan. Potentially, subject to need and the availability of funding, the remit of the Mechanism/s could be expanded at any time to address other sectors of the economy.

Table 21 Potential future sub-division of an SCP Support Mechanism

Themes Covered	Government Sponsoring Ministries
Agriculture and Agri-products value chain Water Use Efficiency & Conservation Use Waste Management	Ministries of: Economy; Ecology, Geology and Natural Resources; Agriculture; Industry
Energy value chain GHG emissions reduction – cross-sectoral Air quality - cross-sectoral Metals value chain	Ministries: Economy; Ecology, Geology and Natural Resources; Energy; Industry; Transport

Annex: E Textiles Industry – Development Strategy, 2017-2020

E.1 Major Role of the Textiles Industry

Introduction

A retrospective analysis of the structure of production of textile and garment and knitwear products in 1991-2020 showed that during the period 1991-2005 there was a noticeable decrease in the contribution of the production of finished products - clothing made of fabric and knitwear to the production volume of the industry, the recovery of which began in subsequent years.

However, the textile garment and knitwear industry of Uzbekistan is now one of the dynamically developing sectors of the country's economy, largely facilitated by the presence of its own raw material base and the constantly growing demand for manufactured products. Due to its competitive potential, it occupies a leading position in attracting foreign investment when creating new enterprises, providing employment to the population, exporting products, and is also considered one of the strategically important areas in the global specialisation of the country's national economy.

Of the five priorities for action in Uzbekistan's development strategy, one was to increase the competitiveness of the national economy by deepening structural transformations, modernising and diversifying its leading industries. The textile industry is now one of the drivers of this transformation and increasing the textile industry's share of the economy is a priority.

Modernisation and diversification required that industry shifted to a qualitatively new level, increasing the processing of local raw materials, mastering the production of fundamentally new types of products, increasing the competitiveness of domestic goods in foreign and domestic markets, localising production and import substitution. Work to achieve this outcome was undertaken in the textile industry.

Timely measures taken by the Government along with the sustainable development of the industry in recent years, in the face of worldwide restrictions due to the COVID-19 pandemic, made it possible to prevent a large-scale decline in production, exports and layoffs of workers, and to increase development compared to the previous year. Thus light industry, including the textile and clothing industry, ended the year 2020 with a production growth rate of 112.0%, compared with 100.7% for all industry.

The textile industry's contribution to the total volume of industrial production ranged from 15.5% to 17.2% over the period 2016-2020, amounting to 17.2% in the reporting year (2020). In 2020, the production of products in kind by large enterprises increased: knitted outerwear almost doubled, cotton yarn - 1.7 times, cotton fabrics - 1.5 times, knitted fabric - 1.2 times.

According to the State Statistics Committee of the Republic of Uzbekistan, investments of more than 32.4 trillion soums were made in the fixed capital of the textile and garment and knitwear industries of the republic in 2017-2020:

- Investments in 2020 of 12.3 trillion soums were 2.5 times those in 2016
- New facilities have been created and existing facilities have been modernised
- At the end of 2020, the share of clothing production, being the final link in the value-added production chain, reached the fairly high value of 25.7%

Development Measures Undertaken

Within the framework of the annual state programs for the implementation of the strategy until 2021, measures undertaken to develop the textiles industry during this period were:

- Reforming the management system of the textile industry with the introduction of advanced management technologies
- Introduction of a cluster development model based on the integration of production, starting with the cultivation of raw cotton and ending with the production of final textile products with high added value

- Expansion of production of products with high added value due to diversification and reduction of exports of raw materials and semi-finished products
- Increasing the level of processing of cotton fibre and a gradual reduction in its export
- Ensuring the competitiveness of products and expanding sales markets
- Further harmonising the standardisation and certification system in the field of the textile industry in accordance with international requirements and standards
- Ensuring a balanced distribution of raw materials and the location of the established enterprises of the industry in conjunction with the development of logistics and engineering infrastructure
- Widespread introduction into the production process of advanced ICT, innovative technologies, know-how, design developments, and localising the manufacture of production equipment and components
- Improving the system of training, retraining and advanced training of personnel for the textile industry
- Creation of new jobs, especially for women, given the labour intensity of this industry and its potential for providing employment

E.2 Reforms - Legislative, Organisational And Economic Support

Aimed at developing the industry during this period, the Presidential Decree ‘On the Program of Measures for the Further Development of the Textile and Garment and Knitting Industry for 2017-2019’, was adopted on December 21, 2016. Knitted goods were provided with tax and customs privileges. These included exemption from the payment of income and property taxes, by micro-firms and small enterprises, customs payments for imported equipment, components, raw materials and materials not produced in the republic.

The key program document adopted as part of the Action Strategy and aimed at a new stage in the development of the industry during this period was the Presidential Decree ‘On measures for the accelerated development of the textile and garment and knitwear industry’ dated December 14, 2017. Within the framework of this Decree, a specific mechanism for the development of the industry was developed - the ‘Road Map’ for the accelerated development of the textile, garment and knitwear industry. The roadmap provides for measures to improve the management and training system, modernise production and technological processes, develop the infrastructure of the textile industry, and enhance foreign economic activity. It also calls for the introduction of international production standards, specifically:

- An increase in the number of internationally accredited laboratories
- The Introduction of modern quality management systems at textile industry enterprises

The decree also provided benefits in the form of exemption until 2021 from customs payments (except for VAT and customs clearance fees) for imported cotton, artificial and synthetic fibre, wool, raw materials and other materials necessary for production and not produced in the republic.

By the Decree of the President of the Republic of Uzbekistan dated December 14, 2017. № DP-5285 JSC ‘Uzbekengilsanoat’ was liquidated and the Association ‘Uztukimakhiliksanoat’ (‘Uztekstilprom’) was created. Reforms, a correctly chosen strategy and competent management of the Association allowed domestic textile companies to demonstrate positive growth dynamics.

By the Decree of the Cabinet of Ministers of the Republic of Uzbekistan ‘On improving the mechanism for the sale and settlement of cotton fibre produced by the enterprises of Uzpakhtasanoat JSC dated February 12, 2018, a new procedure for the sale of cotton fibre using the exchange trading mechanism and a new settlement procedure were introduced. This contributed to the stable supply of the textile enterprises with the necessary raw materials.

Starting from 2017, a cluster system for the development of textile industries began to be introduced through the adoption of the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan ‘On measures to introduce modern forms of organisation of cotton and textile production’ on January 25, 2018. This serious step towards a radical reform of the industry organisation system became an impetus for the formation of unified production chains from raw materials to finished products. Over recent years the cluster model has shown its effectiveness. This form of organisation can significantly reduce the transaction costs of farmers and producers, thereby contributing to an increase in the price competitiveness of textile products.

By the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan ‘On measures for the further development of cotton and textile industries’ on March 18, 2019, further actions for the development of clusters were initiated and additional market mechanisms were introduced to develop the industry. In particular, a procedure was established according to which the organisers of cotton and textile industries have the right to freely dispose of the funds allocated to them on preferential loans within the framework of approved agro-technological cards. It was also decided that fuels and lubricants, mineral fertilisers, plant protection products, plant development regulators, defoliants and other chemical agents transferred by the organisers of cotton and textile production to farms would not be subject to taxation.

In 2020, at a time when all sectors of the economy faced the pandemic crisis, special attention was paid to the textile industry. So, in order to mitigate the negative impact of the crisis in connection with the coronavirus pandemic, on May 5, 2020, a Presidential Decree ‘On urgent measures to support the textile and garment and knitwear industry’ was adopted.

One of the support measures was the extension from 90 to 150 days of the period during which the final settlements for cotton fibre sold to domestic textile enterprises at exchange auctions for the national currency until April 1, 2020, are carried out. Also, certain types of imported raw materials and materials were exempted from customs duties until January 1, 2022. In addition, from May 1 to December 31, 2020, a simplified procedure for refunding value added tax was established. According to this procedure, the amount of value added tax payable (paid) on actually received goods (services) used for exported textile and sewing and knitwear goods (services) - excluding yarn and fibre - are accepted for offset. This is regardless of the amount of foreign exchange earnings received on the accounts of the textile and garment-knitwear industry in the commercial bank of the Republic of Uzbekistan. The offset must be returned on the basis of the exporter’s application submitted in accordance with the established procedure.

E.3 Main Results of Strategy Implementation

The main results of implementing the Strategy concerning the textile industry are:

- Significantly advancing the development of the industry
- Creation of a single chain from raw materials to finished products, organisation of clusters
- Major advances in expanding the export potential of textile products
- Strengthening the social significance of the industry as a labour-intensive production and the creation of new jobs

Advanced Development of the Textile Industry

The role of the textile and garment and knitwear industry in the macroeconomic complex of Uzbekistan can be judged by the following data: today about 28% of all workers employed in the manufacturing industry of the republic are concentrated in it, its share in the output of the manufacturing industry at the end of 2020 amounted to more than 15.2%, and it accounts for over 30% of the volume of manufactured consumer non-food products. Production capacities for the main product range are:

- yarn – 705 thousand tons
- fabrics – 1.2 billion m2
- knitted fabric – 140 thousand tons
- finished products – 2.2 million pieces
- hosiery – 132 million pieces

In total, 14,447 enterprises were operating in the textile and garment and knitwear industry of Uzbekistan as of 1 October 2020. Their number has more than doubled compared to 2016. During the analysed period, the volume of production in the industry increased by 137.6%. The textile industry has become a driver of economic development.

Cluster Reform

Carrying out cluster reform in Uzbekistan for the first time in February 2017 was proposed by the President of the Republic during his visit to the Bukhara region as part of the consistent implementation of measures to form market relations between farms and textile enterprises. The development of industrial clusters that process local raw materials is one of the ways to mobilise resources in the regions to increase economic growth.

The clusters successfully solve the problem of creating cooperative ties between textile enterprises and farms, organised on the basis of the conclusion of direct contracting agreements for the cultivation of raw cotton by farms and its supply to a textile enterprise for further deep processing at their own production facilities and make their important contribution to socio-economic development both regions and the country as a whole.

Formation of Cotton and Textile Clusters to 2020

By the end of 2020, ninety-six cluster projects were being implemented in 117 regions of the republic, on an area of 907.783 thousand hectares. The largest number of clusters operated in Andijan (12 units), Samarkand (11 units) and Khorezm (10 units) regions. Clusters were established within the framework of the Resolutions of the President of the Republic of Uzbekistan:

- Dated 05.19.2017. No. PP-2978 ‘On measures to create a modern cotton-growing and textile cluster in the Bukhara region’
- Dated 15.09.2017. No. PP-3279 ‘On measures to create a modern cotton-textile cluster in the Syrdarya region’
- Resolution of the Cabinet of Ministers dated January 25, 2018, No. 53 ‘On measures to introduce modern forms of organising cotton-textile production’

In 2020, according to the Uztekstilprom Association, more than 90 percent of the country’s total cotton crop was harvested in clusters. The yield in clusters has increased by 6.2 centners over the past four years. At the end of 2020, except for seven clusters, all the rest have already established the production of products of higher value added:

- 83 produce yarn
- 46 produce fabrics, fabrics, hosiery
- 40 produce finished garment and knitted products

The most important area of using the internal reserves and capabilities of the industry was the gradual increase in the depth of processing of domestic raw materials, as well as the expansion of the volume and range of production of products with high added value. If earlier a noticeable share of cotton fibre was exported, then by the end of 2020, the fibre was completely processed into cotton yarn by domestic enterprises. As a result, yarn production in physical terms increased almost 3 times compared to 2016.

A great achievement of the textile workers of Uzbekistan, thanks to the help of the state, is the restoration of the production of cotton fabrics. Thus, the production of fabrics containing 85 wt.% or more of cotton fibres during the analysed period increased by 3.47 times and amounted to 118.8 million m^2 against 34.2 million m^2 in 2016. The production of knitted fabric has increased more than 3 times. At the same time, there is an increase in the production of finished products. The production of knitted underwear increased 1.9 times, and knitted outerwear - by 115.9%.

Significant Growth in Product Exports

The textile and garment and knitwear industry is the most export-oriented among other industries. In terms of the share of exports in the volume of industrial production - an indicator characterising the competitiveness of manufactured products - it is significantly ahead of other industries. This indicator has increased significantly from 25.7% to 45.5% over the period 2016–2020.

In recent years, the course towards the export orientation of the industry and the growth of the competitiveness of the products made it possible for it to become a driver for the export of industrial products. Today the textile industry exports an assortment of products - from yarn to ready-made garments and knitwear. At the end of 2020, the export of textile and clothing products in the amount of USD 1.87 billion was carried out, with an increase of 121.2% over the previous year, and almost 2.5 times as compared to 2016:

- The share of exports of textile and clothing products in the total volume of exports in the economy as a whole amounted to 12.7% in 2020, and 20% when excluding gold exports.
- Thanks to significant support from the Government, the industry managed to increase the internal processing of cotton fibre to more than 90%, significantly increasing the share of exports of products with higher added value.
- The deeper level of processing of raw materials in the textile industry made it possible to increase the export of cotton yarn in value terms compared to 2016 by almost 2 times and to bring the volume of its export in 2020 to 453 thousand tons.
- At the same time, against the background of a decrease in the volume of cotton exports, the export volumes of textile and garment-knitted products only grew.
- Export of cotton fabrics containing 85% cotton fibres or more by mass amounted to 274.1 million m2 in 2020, more than 2.1 times greater than in 2016.
- In 2020, among other types of finished products in value terms, the most noticeable increase was in the export of hosiery (by 142.8%) and knitted clothing (by 142.2%).
- The industrial policy of Uzbekistan in the field of the textile industry is characterised by a continuous improvement in the quality and technical parameters of manufactured products. Textile and garment products produced by domestic enterprises are in demand among buyers both in the domestic and foreign markets, and over the years are gaining more and more popularity among foreign consumers. Today, the export of textile and garment-knitted products is carried out to over 50 countries of the world. In 2016 the export of various textiles lay in the region of USD 1.1 billion, but by 2020 it was USD 2.1 billion.

Textile and garment products of Uzbekistan are supplied to many countries of the world, and the export geography is expanding annually. For example, in 2016 the products were supplied to about 60 countries, then by 2020 this had increased to 71 countries. The main consumers of Uzbek textile products included in the Top 4 at the end of 2020, accounting for about 85% of the supply volume (in value terms) are:

- Russia, accounting for 36.5%
- China, accounting for 21.6%
- Kyrgyzstan, accounting for 15.2%
- Turkey, accounting for 11.4%

However, Uzbekistan has the opportunity to become one of the important suppliers of textiles to Europe. In recent years, the leadership of the Uztekstilprom Association has been constantly working to attract a number of European large retailers and clothing brands to establish cooperation with textile companies in Uzbekistan. Actions contributing to achieving this objective include:

- Uzbekistan in cooperation with the Cotton Campaign coalition and the report of the International Labour Organization on the results of the harvest in 2020, which for the first time confirmed the absence of systematic forced labour during the cotton harvest in Uzbekistan.
- In Uzbekistan, more than 1,300 textile enterprises operate in accordance with international quality standards. It is expected that in 2022 this figure will reach 1650. Currently, international standards and certificates such as ISO 9001: 2015 are implemented in 1100 enterprises, 45 - OEKOTEX, 12 - BSCI, 6 - GOTS, 7 – SEDEX.
- In March 2021, thanks to the successful work on the implementation of international quality standards, the management of the Uztekstilprom Association was awarded the international certificate ISO 9001: 2015 by representatives of the Swiss certification company SGS.

The increase in export potential is facilitated by attracting new investments, combined with effective management, the introduction of the most modern equipment and innovative technologies using digital platforms.

In addition, to receive assistance not only in promoting Uzbek textiles to European markets, but also in the field of environmental protection, education, innovation, R&D, standards, industry and entrepreneurship, etc. cooperation with the EU Confederation of Apparel and Textile Associations EURATEX will help.

Jobs and Employment Growth

The employment of young people and women is one of the most urgent issues in Uzbekistan. The constantly growing demand both in the domestic and foreign markets for the products of the industry and the high labour intensity of production make it possible to provide employment for a large number of the population, primarily women, and testifies to the social orientation of the industry.

Sustainable and dynamic development of the country's textile and garment and knitwear industry makes it possible to solve the problem of employment, primarily in rural areas. This is largely facilitated by the presence of its own raw material base, high demand for sewing products in neighbouring countries, and non-capital-intensive sewing equipment. The presence of these factors makes it possible to solve the most important task of creating additional jobs, especially for women. So, in four years, the number of enterprises in the production of textiles increased by 1748 units, and in the production of clothing - by 4775 units.

At the same time, according to the State Statistics Committee of the Republic of Uzbekistan, in 2017-2020 the number of people employed in the textile industry increased by 36.0 thousand people, and in the production of clothes - by 28.1 thousand people. The development of the cotton cluster system in Uzbekistan greatly contributes to the growth of employment, contributes to the improvement of the social situation, primarily in the countryside and in small towns.

E.4 Main Strategic Priorities for Development

The further development of the textile and garment and knitwear industry depends on the growing demand of the sectors of the economy and the population for textile and garment production, the solution of a number of systemic problems reduced to integrated development, the introduction of digital technologies, increasing the level of competitiveness, and expanding export potential.

The main strategic priorities for the development of the textile and garment and knitwear industry in the next five years are:

- Development of a full cycle of technologies in the value chain for the in-depth processing of cotton fibre from the production of cotton yarn, ready-made fabrics for garment production and technical textiles to sewing products from knitwear and textiles
- Ensuring the production of a wide range of high-tech products, competitive in foreign markets, and meeting international standards
- Transformation of the Republic into a leading textile manufacturer in Central Asia
- Introduction of modern quality management methods and international standards, creation of a certification system for local products in accordance with international requirements
- Development of mutual cooperation ties between the light industry and other sectors of the economy and, on this basis, an increase in the level of localisation of the production of textile and clothing products
- An increase in the production and expansion of the range of ready-made fabrics, cotton, as well as non-cotton assortment (blended, synthetic, woollen, semi-woollen pile, blankets, furniture and decorative, technical, special fabrics with chemical fibres, with special types of finishes - low creasing and low shrinkage, increased dimensional stability and less material consumption)
- Production of garments and knitwear, considering:
    - An increase in the level of modelling and design of clothing through the creation and development of domestic brands of clothing
    - Strengthening the role of fashion designers and designers in creating industrial collections

- Increasing the production of clothing under licenses of world-renowned fashion designers
- Producing modern fashionable knitted clothing of various in style and shape using fabrics from new types of yarns, combined with a new generation of synthetic and artificial fibres and other factors

ANNEX F: Interim BAT Conclusions for the Textiles Industry

An abstract of the BAT Conclusions included in Chapter 5 of the draft first Revision of the BAT Reference Document for the Textiles Industry (December 2019) is given below. For details of each BAT Conclusion – specifically, descriptions of techniques and their applicability - Chapter 5 of the BAT document[105] (and updates on the European IPPC Bureau website, https://eippcb.jrc.ec.europa.eu/) should be consulted.

BAT	Technique
In order to improve the overall environmental performance, BAT is to	
1	***Elaborate and implement an environmental management system (EMS) that incorporates*** all of the following [20] features [details omitted] and, ***specifically for the textiles industry: (xxi) an inventory of inputs and outputs (BAT 2), (xxii) a water management plan (BAT 9), (xxiii) an energy efficiency plan (BAT 10), (xxiv) a chemicals management plan (BAT 13), and (xxv) a waste management plan (BAT 28)***
2	Establish, maintain and regularly review (including when a significant change occurs) an inventory of inputs and outputs, as part of the EMS, that incorporates all of the following features [7 are detailed]
3	Use advanced process monitoring and control systems
4	Use both of the following techniques: (a) Use of materials with low contents of contaminants [details omitted], and (b) Use of textile materials with reduced processing needs [details omitted]
Monitoring: BAT is to	
5	Monitor at least once every year [the annual consumption of water, energy and materials used, the annual amount of wastewater generated, materials recovered, waste generated, and waste sent for disposal]
6	For wastewater streams identified in BAT 2, monitor key parameters at key locations [details omitted]
7	Monitor emissions to water with at least the frequency given below [detail omitted] and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality
8	Monitor channelled emissions to air with at least the frequency given below [detail omitted] and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality
In order to reduce water consumption and wastewater generation, BAT is to	
9	Use all of the techniques given below: *Management techniques*: a) Energy efficiency plan and energy audits [detail omitted] b) Product optimisation [detail omitted] *Common techniques*: Water-free processes [detail omitted] twelve are noted [detail omitted] c) Optimisation of the amount of process liquor used [detail omitted] d) Optimised cleaning of the equipment [detail omitted] e) Optimised batch processing, washing and rinsing of textile materials [detail omitted] f) Optimised continuous processing, washing and rinsing of textile materials [detail omitted] *Reuse and recycling techniques*: g) Water reuse and/or recycling [detail omitted] h) Reuse of process liquor [detail omitted] [Table 5.1 in the BAT Conclusions gives BAT-associated environmental performance levels for specific water consumption (yearly average values of m^3 water/t of textile material) for ten wet processes. These are example (external) benchmark data.]
In order to use energy efficiently, BAT is to	

105 'Best Available Techniques (BAT) Reference Document for the Textiles Industry', Draft 1, December 2019. Available at: https://eippcb.jrc.ec.europa.eu/reference/

BAT	Technique
10	Use all of the techniques given below: *Management techniques*: a) Energy management plan and energy audits [detail omitted] b) Product optimisation [detail omitted] *Common techniques*: c) Twelve commonly used techniques listed [detail omitted] *Heat recovery techniques*: d) Recycling of warm cooling water [detail omitted] e) Reuse of warm process liquor [detail omitted] f) Heat recovery from wastewater [detail omitted] g) Reuse and/or recycling of warm air [detail omitted] h) Heat recovery from waste gases [detail omitted] i) Heat recovery from steam use [detail omitted]
11	When using compressed air, use all of the techniques given below: a) Optimal design of the compressed air system [detail omitted] b) Optimal use of the compressed air system [detail omitted] c) Control of leakages in the compressed air system [detail omitted] d) Reuse and/or recycling of warm cooling water or warm cooling air of air compressors (BAT 10d and 10g)
12	Use all of the techniques given below to increase the energy efficiency of thermal treatment Techniques for reducing the use of heating: a) Wet-on-wet dyeing or finishing of fabric [detail omitted] b) Mechanical dewatering of textile materials [detail omitted] c) Avoiding the over-drying of textile materials [detail omitted] Design and operating techniques: d) Optimising air circulation in stenters [detail omitted] e) Advanced process monitoring and control of drying [detail omitted] f) Microwave or radio-frequency dryers [detail omitted] Heat recovery techniques: g) Heat recovery from waste gases (BAT 10h) [Table 5.2 of BAT Conclusions gives BAT-associated environmental performance levels for specific energy consumption]
Chemicals: BAT is to	
13	Elaborate and implement a chemicals management system (CMS) as part of the EMS (BAT 1) that incorporates all of the following [7] features [detail omitted]
14	Elaborate and implement a [computer-based] chemicals inventory and tracking system as part of the EMS (see BAT 13) [detail omitted]
15	Use all of the techniques below to reduce the consumption of chemicals: a) Reduction of the need for process chemicals [detail omitted} b) Treatment of textile materials with enzymes [detail omitted] c) Automatic systems for preparation and dosing of process chemicals and process liquors [detail omitted] d) Optimisation of the quantity of process chemicals used [detail omitted] e) Reuse of process liquor [detail omitted] f) Recovery and use of leftover process chemicals [detail omitted].
16	Use all of the techniques below to reduce emissions to water of poorly biodegradable substances: a) Substitution of alkylphenols and alkylphenol ethoxylates [by biodegradable surfactants] b) Substitution of phosphorus- or nitrogen containing complexing agents [detail omitted] c) Substitution of mineral-oil-based antifoaming agents [detail omitted]

BAT	Technique
In order to reduce the wastewater volume, the pollutant loads discharged to the wastewater treatment plant and the emissions to water, BAT is to	
17	Use an integrated wastewater management and treatment strategy based on the information provided by the inventory in BAT 2, to include an appropriate combination of process-integrated techniques, techniques to recover and reuse process liquors, and treatment techniques – see BAT 18 and BAT 19.
18	(Pre)treat wastewater containing pollutants that cannot be treated adequately by a biological treatment [detail omitted]
19	***In order to reduce emissions to water***, BAT is to use an appropriate combination of techniques given below [detail omitted] ***Preliminary and primary treatment, e.g.*** a) Equalisation b) Neutralisation c) Physical separation (screens, sieves, grit separators, grease separators, oil-water separation, hydrocyclones, primary settlement tanks, etc.) ***Physico-chemical treatment, e.g.*** d) Adsorption e) Precipitation f) Chemical oxidation g) Chemical reduction h) Evaporation ***Biological treatment, e.g.*** i) Activated sludge process j) Membrane bioreactor k) Anaerobic treatment ***Nitrogen removal*** l) Nitrification/denitrification (when treatment includes a biological treatment) ***Solids removal, e.g.*** m) Coagulation and flocculation n) Sedimentation o) Filtration p) Flotation Tables 5.3 and Table 5.4 of the BAT Conclusions give BAT-associated emission levels (BAT-AELs) respectively for direct and indirect discharges to a receiving water.
In order to prevent or reduce emissions to soil and groundwater: BAT is to	
20	Use all of the techniques given below [detail omitted]: a) Techniques to reduce the likelihood and environmental impact of overflows and failures of process and storage tanks b) Regular inspection and maintenance of plant and equipment c) Optimised storage location of process chemicals d) Dedicated area for unloading hazardous process chemicals e) Segregated storage of process chemicals f) Return of unused pro9cess chemicals g) Handling and storage of packaging containing process chemicals
Emissions to air	
21	***In order to reduce diffuse VOC (Volatile Organic Compounds) emission to air from the use of organic solvents***, BAT is to collect diffuse emissions and send the waste gases to treatment [detail omitted].
22	***In order to facilitate the recovery of energy and the reduction of channelled emissions to energy***, BAT is to limit the number of emission points [detail omitted].

BAT	Technique
23	***In order to reduce channelled emissions of organic compounds (e.g. formaldehyde) to air***, BAT is to use one or a combination of the techniques given below [detail omitted]: a) Condensation b) Ionisation c) Thermal oxidation d) Wet scrubbing Table 5.5 of the BAT Conclusions gives BAT-associated emission levels (BAT-AELs) for channelled emissions of organic compounds (e.g. formaldehyde) to air.
24	***In order to reduce channelled dust emissions to air***, BAT is to use one or a combination of the techniques given below: a) Cyclone b) Electrostatic precipitator (ESP) c) Wet scrubbing Table 5.6 of the BAT Conclusions gives BAT-associated emission levels (BAT-AELs) for channelled dust emissions to air.
25	***In order to reduce channelled ammonia emissions to air***, BAT is to use wet scrubbing: Table 5.7 of the BAT Conclusions gives BAT-associated emission levels (BAT-AELs) for channelled ammonia emissions to air.
26	***In order to prevent emissions of organic compounds to air from dry cleaning***, BAT is to extract the air from dry cleaning, to treat it using adsorption with activated carbon and to fully recirculate it to dry cleaning.
27	***In order to reduce emissions of organic compounds to air from the thermal treatment of synthetic textile materials***, BAT is to wash them.
Waste	
28	***In order to prevent or reduce the quantity of waste, in particular of hazardous waste, sent for disposal***, BAT is to use all of the techniques given below [detail omitted]: a) Waste management plan b) Separate collection and storage of waste contaminated with hazardous chemicals c) Use of process chemicals before their expiry date d) Reuse of packaging.
BAT conclusions for the pre-treatment of raw wool fibres by scouring	
29	***In order to use resources efficiently, as well as to reduce water consumption and waste water generation***, BAT is to recover wool grease and recycle wastewater [detail omitted]. Table 5.8 of the BAT Conclusions gives BAT-associated emission levels (BAT-AELs) for the recovery of wool grease from the pre-treatment of raw wool fibres by scouring.
30	***In order to use energy efficiently***, BAT is to use all of the techniques given below [detail omitted]: a) Covered scouring bowls b) Optimised temperature of the last scouring bowl c) Direct heating.
31	***In order to use resources efficiently, and to reduce the amount of waste sent for disposal***, BAT is to biologically treat organic residues from the pre-treatment of wool by scouring (e.g. dirt, wastewater treatment sludge). ***Description***: The organic residues are treated by composting or anaerobic digestion.
BAT conclusions for the production of yarn and fabric	

BAT	Technique
32	***In order to reduce emissions to water from the use of sizing chemicals***, BAT is to use all of the techniques given below [detail omitted]: a) Selection of sizing chemicals b) Pre-wetting of the cotton yarns c) Compact spinning (Fibre strands are compressed by suction or by mechanical or magnetic compacting. This allows a reduction of the amount of sizing chemicals.)
33	***In order to reduce emissions to air and to water from the use of oils***, BAT is to avoid the use of mineral oils in spinning and knitting. ***Description***: Mineral oils are substituted by synthetic oils and/or ester oils, with improved environmental performance in terms of washability and biodegradability.
34	***In order to use energy efficiently***, BAT is to use technique 'a' and one or both of techniques 'b' and 'c' given below. a) Use of common techniques [detail omitted] b) Use of common techniques in spinning [detail omitted] c) Use of common techniques in weaving [detail omitted].
BAT conclusions for the pre-treatment of textile materials other than raw wool fibres	
35	***In order to use energy efficiently, as well as to reduce water consumption and wastewater generation***, BAT is to use both of the techniques given below: a) Combined pre-treatment of common textiles (e.g. desizing, scouring and bleaching carried out simultaneously) b) Cold pad-batch treatment of cotton textiles. (Desizing and/or bleaching are carried out with the cold pad-batch technique.) Applicability: only applicable to new plants or major plant upgrades.
36	***In order to use resources and energy efficiently, as well as to reduce water consumption and wastewater generation***, BAT is to use one of the techniques given below: a) Single desizing liquor [detail omitted] b) Recovery and reuse of water-soluble sizing chemicals [detail omitted].
37	***In order to prevent or reduce emissions to water of chlorine-containing compounds and complexing agents***, BAT is to use one or both of the techniques given below: a) Chlorine-free bleaching [detail omitted] b) Optimised hydrogen peroxide bleaching [detail omitted].
38	***In order to use resources efficiently and to reduce the amount of alkali discharged to wastewater treatment***, BAT is to recover caustic soda used (NaOH) for mercerisation. ***Description***: Caustic soda is recovered from the rinsing water by evaporation and further purified, if needed. Table 5.9 of the BAT Conclusions gives BAT-associated environmental performance level (BAT-AEPL) for the recovery of caustic soda used for mercerisation.
BAT conclusions for dyeing	
39	***In order to use resources efficiently and to reduce emissions to water from dyeing***, BAT is to use one or a combination of the techniques given below: ***Technique for batch and continuous dyeing*** a) Selection of dyes [detail omitted] ***Techniques for batch dyeing*** b) pH-controlled dyeing [detail omitted] c) Optimised removal of unfixed dyestuff in reactive dyeing [detail omitted].

BAT	Technique
40	***In order to use resources efficiently and to reduce emissions to water from the dyeing of cellulosic materials***, BAT is to use one or a combination of the techniques given below [details omitted]: ***Technique for dyeing with sulphur dyes*** a) Minimised use of sulphur-based reducing agents ***Technique for continuous dyeing with vat dyes*** b) Selection of vat dyes ***Techniques for dyeing with reactive dyes*** c) Use of high-fixation reactive dyes d) Use of cationic cotton e) Cold pad-batch dyeing f) Optimised rinsing ***Techniques for continuous dyeing with reactive dyes*** g) Use of concentrated alkali solution h) Steam-fixation of reactive dyes.
41	***In order to reduce emissions to water from the dyeing of wool***, BAT is to use one of the techniques given below in the following order of priority [detail omitted]: a) Chromium-free dyeing b) Optimised metal-complex dyeing c) Minimised use of chromates.
42	***In order to reduce emissions to water from the dyeing of polyester with disperse dyes***, BAT is to use one or a combination of the techniques given below [details omitted]: a) Batch dyeing without dyestuff carriers b) Optimised use of dyestuff carriers in batch dyeing c) Optimised desorption of unfixed dye in batch dyeing d) Supercritical CO_2 dyeing
BAT conclusions for printing	
43	***In order to reduce water consumption and wastewater generation, BAT is to optimise the cleaning of the printing equipment***. ***Description***: This includes: – Mechanical removal of the printing paste – Automatic start and stop of the cleaning water supply – Reuse and/or recycling of cleaning water.
44	***In order to use resources efficiently***, BAT is to use a combination of the techniques given below [details omitted]: ***Selection of printing technology*** a) Digital jet printing b) Transfer printing on synthetic textile materials ***Design and operation technique*** c) Optimised use of printing paste ***Recovery and reuse of printing paste*** d) Recovery of residual printing paste e) Reuse of residual printing paste.
45	***In order to prevent ammonia emissions to air, and to prevent the generation of urea-containing wastewater, from printing with reactive dyes on cellulosic materials***, BAT is to use one of the techniques given below [details omitted]: a) Increase of moisture content b) Two padding step printing.

BAT	Technique
46	***In order to reduce emissions to air of organic compounds (e.g. formaldehyde) and ammonia from printing with pigments, BAT is to use printing chemicals with improved environmental performance***. ***Description***: This includes: – Thickeners with no or low contents of volatile organic compounds – Fixation agents with low contents of formaldehyde-containing compounds – Binders with low contents of ammonia and without formaldehyde-containing compounds.
BAT conclusions for finishing	
47	***In order to reduce emissions of formaldehyde to air from <u>easy-care finishing of cellulosic materials</u>***, BAT is to use cross-linking agents with no or low potential for formaldehyde releases.
48	***In order to improve the overall environmental performance of <u>softening</u>***, BAT is to use one of the techniques given below [details omitted]: a) Low-volume application of softening agents b) Softening of cotton with enzymes.
49	***In order to improve the overall environmental performance of finishing with <u>flame retardants</u>***, BAT is to use one or both of the techniques given below, giving priority to technique 'a' [details omitted]: a) Use of textiles with inherent flame retardance properties b) Selection of flame retardants
50	***In order to improve the overall environmental performance of finishing with <u>oil-, water-, and soil-repellents</u>***, BAT is to use repellents with improved environmental performance. ***Description***: oil-, water-, and soil-repellents are selected by considering: – The risks associated with them (see BAT 13), in particular in terms of persistence and toxicity – The composition and form of the textile materials to be treated – The product specifications.
51	***In order to emissions to water from <u>shrink-proof finishing of wool</u>***, BAT is to use chlorine-free anti-felting. ***Description***: Inorganic salts of peroxymonosulphuric acid are used for shrink-proof finishing of wool.
52	***In order to reduce the consumption of <u>mothproofing</u> agents***, BAT is to use one or a combination of the techniques given below [details omitted]: a) Selection of dyeing auxiliaries b) Mothproofing in acidic conditions c) Blending of treated and untreated loose fibres d) Low-volume application of mothproofing agents.
BAT conclusions for reducing emissions of organic compounds to air from lamination	
53	BAT is to use hot-melt lamination instead of flame lamination [detail omitted]

ANNEX G: Reformation of the Gas and Oil Industry of Uzbekistan

G.1 Introduction – Why Reformation is Needed

By 2030, Uzbekistan's planned natural gas production and consumption are estimated at 66.1 billion m^3 and 56.5 billion m^3, respectively, and the industry transitioning to meet demand from domestic consumers, along with the deep processing of natural gas as a raw material as priorities. In order to achieve this goal, the Ministry of Energy of the Republic of Uzbekistan is gradually implementing large-scale projects for the deep processing of natural gas and coordinating the processes of reforming the industry in order to increase its efficiency and transfer to market relations.

The oil and gas industry employs about 1% of the working population, and provides opportunities for the development of the economy, and comfortable living for people, creating conditions for the normal functioning of priority sectors of the economy. However, maintaining the huge oil and gas infrastructure in normal working order, while increasing the volume of natural gas production and meeting the needs of the population and the economy, requires the reformation of this sector along the lines of a market economy. Development of this industry on market lines will:

- Create conditions for competition, making it possible to increase the efficiency of production, transportation, and processing
- Most importantly, ensure an uninterrupted supply of natural gas to consumers
- Make it possible to attract investors with modern technologies and experience, in addition to financing to enable the implementation of projects

G.2 Institutional Arrangements

Currently, the Ministry of Energy coordinates the development of the entire fuel and energy complex of Uzbekistan. The Ministry in its current form was established more than 2 years ago to address a lack of flexibility and inefficiencies in the previous structures regarding, for instance, a coordinated approach to the development of the fuel and energy complex; introduction of innovative management principles, building a healthy competitive environment, and creating an attractive investment climate. Fundamental changes in the fuel and energy complex required a radical reform of the entire structure, beginning in mid-2019 and now complete:

- A new organisational structure of Uzbekneftegaz has been formed, and redundant intermediate links in the company's management system have been eliminated.
- Uztransgaz has been removed from Uzbekneftegaz to form a single operator for the purchase of natural gas from gas production organisations for further distribution, including export and import, as well as sales to consumers connected to main gas pipelines.
- Based on the territorial branches of gas supply of Uztransgaz, Khududgaztaminot has been created to operate the gas distribution networks and supply natural and liquefied gas to the population and social facilities.

This reorganisation is expected to enable the transition to modern methods of organising the production, transportation, processing and marketing of natural gas.

G.3 Policy and Legislative Developments

The main goal is to provide the country with oil and gas products, creating the conditions such that both the population and the economy as a whole are uninterruptedly supplied with natural gas and oil products. This means increasing production, modernising the gas transmission system, and improving metering and consumption control. These tasks are considered challenging but doable. Since establishing the Ministry of Energy, a number of major policy and legislative changes have been made. In particular:

- The Draft Law of the Republic of Uzbekistan 'On Gas Supply', is nearing completion. It sets out to create a legal basis for the effective functioning of the oil and gas industry, the introduction of market mechanisms of relationships between market participants.
- The 'Concept for the provision of the Republic of Uzbekistan with oil and gas products for 2020–2030', approved in June 2020, was developed by the Ministry of Energy together with the involved ministries, departments and with the assistance of international consultants.
- The 'Strategy for the transformation of Uztransgaz and the gas industry', completed in June 2021, was developed by the Ministry of Energy together with the involved ministries and departments and with the assistance of international consultants.
- The Resolution of the President of the Republic of Uzbekistan was published on 9 July 2019, 'On measures for the stable provision of the economy and the population with energy resources, financial recovery and improvement of the oil and gas industry management system'.

G.4 Policy, Technological and Other Developments

Automation and Digitalisation

Digitalisation is seen as the main way to increase the competitiveness and profitability of the oil and gas business. Nearly all technological processes can be modelled, and the most appropriate scenario can be selected in advance rather than using trial-and-error testing. Several hours of simulation replace months of testing, while providing a more accurate analysis. As a result, years of labour are saved, and oil recovery is increased significantly.

In order to introduce modern information and communication technologies and ensure process automation, the Ministry of Energy, together with IKS Holding, is developing a Concept for the Comprehensive and Planned Development of Automation and Digitalization of the Fuel and Energy Complex of the Republic of Uzbekistan, considering the industry's current and long-term business goals. Concept approval and a start of implementation is expected in 2022.

Improving Drilling Efficiency

Uzbekneftegaz has implemented the first stage of the project 'Improving the operational efficiency of drilling and workover of wells: 'Diagnostics', with the participation of RLG International Inc. (Canada). In the first stage of this project, the activities of Uzneftgaz-Kudukta'mirlash JSC and Uzneftegaz Burgulash Ishlari LLC and their work on drilling and workover of wells in the fields were studied, critically analysed and assessed. Based on the analytical results, recommendations were developed to optimise production costs and improve financial performance. Currently, in order to implement the next project stage 'Implementation of a new system', work is underway to organise project teams for Well Drilling and Workover.

Modernisation of the Gas Transmission System

In order to reduce losses of natural gas, Uztransgaz began work on the modernisation of the existing gas transmission system of Uzbekistan. The 'Program for the modernisation and improvement of the efficiency of the gas transmission system of Uzbekistan for 2021–2022' has been approved. According to this program, in 2021, 275 km of trunk pipes will be modernised at a total cost of USD 300 million.

Hydrogen Energy

As the structure of the demand for energy resources is changing, in particular the transition from hydrocarbon resources to renewable energy sources, the development of hydrogen energy has become an urgent issue in Uzbekistan. At its point of combustion, hydrogen emits no GHGs and is a relatively clean fuel (although its combustion in air will generate NOx emissions). On a mass basis its heat of combustion is almost three times higher than that of oil and four times that of coal or natural gas on a mass basis, although on a volumetric basis the positions are reversed.

In order to increase the effectiveness of scientific and practical research in the fields of renewable and hydrogen energy, as well as to ensure the transition of the Republic of Uzbekistan to a 'green' economy, a resolution of the President of the Republic of Uzbekistan of 09.04.2021 was adopted. №PP-5063 'On measures for the development of renewable and hydrogen energy in the Republic of Uzbekistan'.

Together with the World Bank and international consultants, an assessment of the technical potential of the Republic of Uzbekistan for the production of 'blue' hydrogen is planned in 2022, in the context of its comparative advantages and disadvantages, as well as the expected development of regional and global demand for low-carbon hydrogen. Based on the results of the study, a 'Roadmap' will be developed for the development of 'blue' and 'green' hydrogen in Uzbekistan.

Also, in order to develop the hydrogen industry in 2022–2023, certain agreements were reached with foreign companies 'Air Products', 'Acwa Power' and 'Siemens Energy' on the implementation of pilot projects in the republic, as well as the organisation of short-term/long-term training programs with practical training in leading foreign technological objects of hydrogen energy.

Modern Corporate Governance and Access to International Financial Markets

Entering international financial markets is relevant not only to the ability to gain access to relatively inexpensive financial resources, but also to the need to implement modern corporate governance systems, transparency and management efficiency. In preparation for the initial public offering of Uzbekneftegaz shares on the international stock market (IPO), work has begun with international consultancy assistance to implement a modern corporate governance system. Also, the activities of compliance inspectors have been established at departments (plants), enterprises and oil depots. Furthermore, certification processes according to the international standard ISO 37001: 2016, are carried out for the implementation of an anti-corruption management system.

Corporate Credit Rating

In order to obtain a corporate credit rating, Uzbekneftegaz JSC, together with the international rating agencies Fitch, Moody's and Standard & Poor's and investment banks, have undertaken systematic work, resulting in:

- Uzbekneftegaz JSC received an international corporate credit rating for the first time at the BB-level, assessed by international credit agencies Fitch Ratings and S&P Global Ratings.
- On 9 November 2021, for the first time, Uzbekneftegaz JSC successfully placed Eurobonds on the London Stock Exchange in the amount of USD 700 million for a period of 7 years at 4.75%. The company's international bonds are distributed among more than 120 investors from the UK, USA, Germany, and Eurasian countries. To issue the bonds, the organising banks 'CITI Group', 'JP Morgan' (USA), 'Mitsubishi UFG' (Japan) and JSC 'Gazprombank' (RF) were attracted.

The funds received from Eurobonds will be directed primarily to events and promising projects aimed at increasing the volume of hydrocarbon production and processing.

Mining

Reforms in the oil and gas sector should be aimed at ensuring the growing needs of consumers in the oil and gas industry are met while maintaining a balance of economic interests of suppliers and consumers. Considering the forecast growth of natural gas consumption to 56.5 billion m^3 by 2030, the main task of the Ministry of Energy is to take a set of measures to meet the growing demand. For this, the following measures will be taken:

- Increasing the energy efficiency of the economy by stimulating the use of energy efficient technologies, machinery and equipment
- Further development of the introduction of market mechanisms and the creation of equal conditions for doing business for all market participants, regardless of the form of ownership
- Increasing the efficiency of work in the areas of geological exploration, production, transportation, processing and sale of hydrocarbons, through the introduction of innovative technologies, modern principles of corporate governance
- Development of the hydrocarbon-raw material base of the industry's enterprises due to the geologist's exploration work in the oil-and-gas regions of the country
- Maintaining the required volumes of hydrocarbon production through the introduction of new explored and previously mothballed fields

- Increasing the volume of hydrocarbon production at fields with long-term developed reserves, with the involvement of internationally recognised companies on the terms of a risk service contract

Processing

The petrochemical industry is characterised by significantly greater stability and growth rates compared to most other industries, and at this stage is one of the most strategic in terms of the economy of Uzbekistan. Expansion of natural gas processing will significantly increase profitability, will contribute to the introduction of modern technologies and the creation of new jobs. Large investment projects being implemented include:

- Commissioning of a plant for the production of synthetic liquid fuel based on purified methane from the Shurtan Gas Chemical Complex. As a result, capacities for the production of 311,000 t kerosene, 743,000 t diesel fuel, 435,000 t naphtha, and 53,400 t liquefied gas will be created (all capacities annual).
- The project continues to expand the production capacity of the Shurtan Gas Chemical Complex to 280,000 t polyethylene and 100,000 t polypropylene per year.
- In 2024, the production capacities of the Bukhara oil refinery will be modernised, which will make it possible to establish production of 1.75 million t petroleum products of Euro 5 standard.
- In 2026, through the implementation of the project for additional exploration and development of the Mutakillikning 25 Yilligi field, with the construction of a gas chemical complex in the Surkhandarya region, 500,000 t/y polymer products will be produced.
- Up to 2026, a gas-chemical cluster for the production of 1.1 million t/year of chemical products is planned.

ANNEX H: Infrastructure Needs for Recovering Resources from municipal solid waste (MSW)

Infrastructure needed to implement material and energy recovery from two alternative management systems

Materials Recovery and Landfill	Waste-to-Energy
Containers for collection of waste: Dry waste[a] Wet waste[b]	Containers for collection of waste: Dry waste[a] Wet waste[b]
Vehicles to collect and deliver dry waste	Vehicles to collect and deliver dry waste
Vehicles to collect and deliver wet waste	Vehicles to collect and deliver wet waste
Process wet waste: Anaerobic digestion or composting[c] Biogas recovery & use (digestion)	Process wet waste: Anaerobic digestion or composting[c] Biogas recovery & use (digestion)
Storage and the beneficial use of the processed wet waste[d]	Storage and the beneficial use of the processed wet waste[d], or its disposal to landfill
Sorting of mixed dry waste[e] to recover materials for which recycling markets may exist: Paper Cardboard Plastics Metals Glass	Sorting of mixed dry waste[e] to remove recyclable non-combustible materials, for which markets may exist: Metals Glass An alternative is to recover metals from the bottom ashes (note j)
Storage and transfer of recovered materials to recycling plants, in Uzbekistan or other countries[f], for their reintroduction to the productive sectors	Storage and transfer of recovered materials to recycling plants, in Uzbekistan or other countries[f], for their reintroduction to the productive sectors
Transfer and disposal of residual solid waste stream to an engineered landfill site equipped with: Impermeable lining[g] Leachate recovery and a system to treat and dispose of the leachate generated Capping of each cell once filled to prevent biogas leakage Biogas recovery system and facility to flare or beneficially use the gas produced[h] Monitoring of the site during its operation and after cell closures, reporting on environmental performance	Incineration of sorted dry waste[c], with: Energy recovery (as steam, electricity and hot watery) and its beneficial use[g] Bottom ash removal Flue gas treatment system to remove particulate matter (PM) [h] (electrostatic precipitators or bag filters, scrubbers); acid gases HCl, HF, SOx (alkaline scrubbers) and NOx (de-NOx processes); and residual volatile metals, Hg and Cd especially (activated carbon adsorption); Process and emissions monitoring & reporting
-	Fly-ash collection and its disposal to a hazardous waste landfill site[9]
-	Bottom ash removal and putting to beneficial use.[10] Alternatively, disposal to landfill.
Notes	
a. In addition to recyclable components, dry waste contains over 20 percent of non-classified material – potentially including hazardous household items. Inefficient arrangements for the separation and collection of wet wastes will result in their contamination of the 'dry' waste.	a. As note a, opposite. The inclusion of batteries and other items containing hazardous substances will result in the emission of metals from the boiler (as vapour and particulate matter). Contamination by wet waste will reduce the heating value of the burnt waste and might cause operational variability.
b. Wet waste comprises food waste, green waste and other organic components. Where its processing by digestion is planned, pre-treatment to remove bulky items may be needed.	b. As note b, opposite.

Materials Recovery and Landfill	Waste-to-Energy
c. The anaerobic digestion and composting of waste is a subject of the EC BAT Reference Document on Waste Treatment (2018).	c. As note c, opposite. In EU Member States, the BAT Reference Document on Waste Incineration (2019) also applies.[106]
d. Use of processed wet waste (subject to regulatory requirements) can include application to agricultural land, land reclamation and landfill cover. Disposal to engineered landfill is the default alternative option.	d. As note d, opposite.
e. Recovered materials will be contaminated – reducing the value of recovered materials –- to a much greater extent than if wastes are segregated into their components at source (by households) and collected as separate streams.	e. Sorting of dry waste prior to its combustion may be restricted to the recovery of non-combustibles such as glass and metal. Their recovery from bottom ash is an alternative option (note i).
f. In principle it is much better to recycle recovered materials in country, fostering such enterprises but, in the absence of economies of scale, the costs of recovery operations might lead to recovered materials being not competitive on price.	f. As note f, opposite.
g. Given wet waste contamination, high-strength organic leachate can be expected to form in the (anaerobic environment of the) landfill. This needs to be collected, treated and disposed of safely to avoid water pollution.	g. In addition to the preheating of the combustion air supply, surplus energy in the flue gases may be used to raise steam, generate electricity and produce hot water. Outlets for the recovered energy have to be secure as has payment in turn.
h. As above, the generation of biogas should be expected and the gas collected for use, or flared, to minimise GHG emissions and the risk of explosion.	h. Particulate emissions from the boiler stage include products of incomplete production, adsorbed metals (such as Cd, Pb, Zn) that, being relatively volatile, may volatilise in the combustion chamber. The operational parameters of the combustion stage (temperature, residence time, surplus oxygen levels) have to be appropriate to ensure maximal burn out of the waste. A comprehensive sequence of process clean-up steps is essential, nevertheless, to treat flue gases prior to their safe release to air, in order to protect human health. Care has to be taken to ensure that gas temperatures in the particulate material stages lie outside the range where dioxins & furans may form as a result of *de novo* synthesis.
-	i. Fly ash from waste incineration plants should be regarded as a hazardous waste. Disposal to landfill cells designed to receive such waste is the norm.
-	j. Metals may be recovered from bottom ash for transfer to recycling plants in Uzbekistan or other countries. Followed by storage for a further 6–20 weeks, bottom ash may then be used in road construction or as an aggregate for concrete.[107] Otherwise, disposal to landfill.

106 https://eippcb.jrc.ec.europa.eu/reference/
107 CEWEP Bottom Ash Fact Sheet. https://www.cewep.eu/wp-content/uploads/2017/09/FINAL-Bottom-Ash-factsheet.pdf

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