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Clean technologies and the Survey of Environmental Goods and Services: A technical reference guide

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Clean technologies and the Survey of Environmental Goods and Services: A technical reference guide

Overview

This reference guide is intended for users of the Survey of Environmental Goods and Services (SEGS). The SEGS measures revenues, employment and exports from the provision of environmental and clean technology goods and services. This guide provides an overview of the goods, services, and technologies that fall within the Government of Canada clean technology priorities, as defined by the clean technology (cleantech) taxonomy, and which were used to develop content for the SEGS.

The Canadian clean technology taxonomy was developed by Natural Resources Canada in conjunction with partners at Innovation, Science and Economic Development Canada; Global Affairs Canada; Agriculture and Agri-Food Canada; Fisheries and Oceans Canada; Environment and Climate Change Canada; and Statistics Canada.

About this product

The taxonomy detailed in the following tables represents the suite of products that are considered to be clean technologies, and which are either currently included or being considered for future inclusion, in Statistics Canada's estimates of economic activity in the environmental and clean technology sector.

The tables indicate which technologies and services were included in SEGS 2012, 2015, 2017, 2018 and 2019. They will be updated for future survey cycles as the scope of what is considered to be an environmental or clean technology good or service evolves.

Clean technology

Clean technologies are defined as follows:

- Any good or service designed with the primary purpose of contributing to remediating or preventing any type of environmental damage;
- Any good or service that is less polluting or more resource-efficient than equivalent normal products which furnish a similar utility. Their primary use, however, is not one of environmental protection.

Table 1 Environmental protection activities

**Table 1a
Protection of air and climate**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|---|---|--------------|--------------|--------------|--------------|--------------|
| Air, environment & remediation | | | | | | |
| Emission control | Emission control | N | Y | Y | Y | Y |
| | Clean coal processing technologies | N | Y | Y | Y | Y |
| | Carbon capture technologies | N | Y | Y | Y | Y |
| | Carbon storage technologies | N | Y | Y | Y | Y |
| | Carbon utilization technologies | N | N | N | N | N |
| Monitoring and compliance | Leak detection technologies (ultrasonic detection and measurement, gas leak detection) | N | Y | Y | Y | Y |
| | Environmental measurement apparatus | N | Y | Y | Y | Y |
| Air pollution or flue gas or greenhouse gases management | Software | N | Y | Y | Y | Y |
| | Platform or system | N | Y | Y | Y | Y |
| | Sensors | N | Y | Y | Y | Y |
| | Other | N | Y | Y | Y | Y |
| Physical/chemical/biological treatment of air pollution or flue gas | Filters (membrane, baghouse, granular bed), cyclones | Y | Y | Y | Y | Y |
| | Electrostatic precipitator | Y | Y | Y | Y | Y |
| | Scrubbers (Venturi, spray tower, mechanical, plate tower, packed tower) | Y | Y | Y | Y | Y |
| | Waste gas absorber, waste gas flare/incinerator | Y | Y | Y | Y | Y |
| | Industrial catalytic converter | Y | Y | Y | Y | Y |
| | Pollutant recovery condenser | Y | Y | Y | Y | Y |
| | Adsorbers | Y | Y | Y | Y | Y |
| Industrial air pollution or flue gas or greenhouse gas services | Emissions trading services | N | Y | Y | Y | Y |
| | Generation of compliance units, surplus allowances, emissions performance credits, offset credits | N | Y | Y | Y | Y |
| | Preparation of emissions reports and verification services | N | Y | Y | Y | Y |
| | Allowance auctioning services, exchange platform provision services | N | Y | Y | Y | Y |
| | Market monitoring services | N | Y | Y | Y | Y |
| | Offset protocol development and validation services | N | Y | Y | Y | Y |
| | Development of compliance systems, electronic emissions reporting system | N | Y | Y | Y | Y |

Table 1b
Wastewater treatment and municipal sewage treatment

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|--|--|--|--------------|--------------|--------------|--------------|
| Water and wastewater | | | | | | |
| Physical/chemical treatment of industrial wastewater | Tanks (including components) for dilution/equalization, neutralization, sedimentation, chemical precipitation | Y | Y | Y | Y | Y |
| | Oil separator/skimmer | Y | Y | Y | Y | Y |
| | Ion exchange bed | Y | Y | Y | Y | Y |
| | Air stripping tank/column | Y | Y | Y | Y | Y |
| | Liquid extraction column | Y | Y | Y | Y | Y |
| | Micro-porous membrane adsorber | Y | Y | Y | Y | Y |
| | Equipment for advanced chemical oxidation/UV radiation | Y | Y | Y | Y | Y |
| | Pre-treatment filters | Y | Y | Y | Y | Y |
| | Chemicals used in industrial wastewater treatment | Y | Y | Y | Y | Y |
| Centralized physical/chemical and biological treatment of sewage | Intake screen | Y | Y | Y | Y | Y |
| | Air sparging grit chamber | Y | Y | Y | Y | Y |
| | Oil separator/skimmer | Y | Y | Y | Y | Y |
| | Tanks (including components) for sedimentation, chemical precipitation/flocculation, aerobic biological treatment, aeration, clarification, disinfection | Y | Y | Y | Y | Y |
| | Membrane bioreactor | Y | Y | Y | Y | Y |
| | Trickling filter | Y | Y | Y | Y | Y |
| | | Chemicals used in municipal sewage treatment | Y | Y | Y | Y |
| Wastewater management system/services | Software | N | N | Y | Y | Y |
| | Platform or system | N | N | Y | Y | Y |
| | Sensors | N | N | Y | Y | Y |
| | Vehicles | N | N | N | N | N |
| | | Other | N | N | Y | Y |

Table 1c
Management of non-hazardous waste

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|-------------------------------------|---|--------------|--------------|--------------|--------------|--------------|
| Waste and recycling | | | | | | |
| Collection | Collection vehicles for non-hazardous waste, recycling and organics | Y | Y | Y | Y | Y |
| | Containers for collection of recycled materials and household organics, backyard composters, yard | Y | Y | Y | Y | Y |
| Separating and sorting | Air classifier, magnetic separator, eddy current separator | Y | Y | Y | Y | Y |
| Compaction | Balers, densifiers, compactors, shredders, granulators | Y | Y | Y | Y | Y |
| Centralized biological reprocessing | Centralized composters (turned-windrow, aerated static pile, mechanically agitated in-vessel) | Y | Y | Y | Y | Y |
| Disposal | Equipment for landfill leachate collection and containment | Y | Y | Y | Y | Y |
| | Equipment for landfill gas management | Y | Y | Y | Y | Y |
| | Equipment for thermal treatment (rotary kiln incinerator, mass burning, starved air incinerator, fluidized bed) | Y | Y | Y | Y | Y |
| Waste | Software | N | N | N | N | N |
| | Platform or system | N | N | N | N | N |
| | Sensors | N | N | N | N | N |
| | Other | N | N | Y | Y | Y |
| Recycling | Recycling equipment and related services | N | N | Y | Y | Y |

Table 1d
Protection and remediation of soil, sediment, sludge, groundwater, surface water, and leachate

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|---|---|--------------|--------------|--------------|--------------|--------------|
| Air, environment & remediation | | | | | | |
| In situ physical/chemical treatment of soil, sediment, and sludge | Chemical oxidation, fracturing, soil flushing, soil vapour extraction, solidification/stabilization Include sales of chemicals for remediation of soil, sediment and sludge | Y | Y | Y | Y | Y |
| Ex situ physical/chemical treatment of soil, sediment, and sludge | Chemical extraction, chemical reduction/oxidation, dehalogenation, separation, soil washing, solidification/stabilization Include sales of chemicals for remediation of soil, sediment and sludge | Y | Y | Y | Y | Y |
| In situ biological treatment of soil, sediment, and sludge | Bioventing, enhanced bioremediation, phytoremediation | Y | Y | Y | Y | Y |
| Ex situ biological treatment of soil, sediment, and sludge | Biopiles, composting, landfarming, slurry phase biological treatment | Y | Y | Y | Y | Y |
| In situ thermal treatment of soil, sediment, and sludge | Hot air injection, electrical resistance | Y | Y | Y | Y | Y |
| Ex situ thermal treatment of soil, sediment, and sludge | Incineration, pyrolysis, thermal desorption | Y | Y | Y | Y | Y |
| Water and wastewater | | | | | | |
| In situ biological treatment of groundwater, surface water, and leachate | Enhanced bioremediation, phytoremediation | Y | Y | Y | Y | Y |
| Ex situ biological treatment of groundwater, surface water, and leachate | Bioreaction | Y | Y | Y | Y | Y |
| In situ physical/chemical treatment of groundwater, surface water, and leachate | Air sparging, bioslurping, chemical oxidation, directional wells, dual phase extraction, thermal treatment, hydrofracturing enhancements, in-well air stripping, passive/reactive treatment walls Include sales of chemicals for remediation of ground water, surface water and leachate | Y | Y | Y | Y | Y |
| Ex situ physical/chemical treatment of groundwater, surface water, and leachate | Adsorption/absorption, advanced oxidation, air stripping, ion exchange, precipitation/flocculation/coagulation, separation, sprinkler irrigation Include sales of chemicals for remediation of ground water, surface water and leachate | Y | Y | Y | Y | Y |
| Control, containment, and monitoring services (air, water, soil) | Landfill cap, landfill cap enhancements/alternatives, physical barriers, deep well injection | Y | Y | Y | Y | Y |
| Treatment of air emissions or off-gas | Oxidation, scrubbing, vapour phase | Y | Y | Y | Y | Y |
| Other | Carbon adsorption | Y | Y | Y | Y | Y |

Table 1d
Protection and remediation of soil, sediment, sludge, groundwater, surface water, and leachate

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|---|--|--------------|--------------|--------------|--------------|--------------|
| Water and wastewater | | | | | | |
| Treatment of drinking water / filtration systems | Microscreening | N | N | Y | Y | Y |
| | Chemicals used in drinking water treatment | N | N | Y | Y | Y |
| | Equipment for advanced chemical oxidation/UV radiation | N | Y | Y | Y | Y |
| | Fluoridation | N | N | Y | Y | Y |
| | Alkalinity adjustment for process control | N | N | Y | Y | Y |
| | Corrosion control - pH adjustment | N | N | Y | Y | Y |
| | Coagulant | N | N | Y | Y | Y |
| | Flocculation | N | Y | Y | Y | Y |
| | Tanks (including components) for dilution/equalization, neutralization, sedimentation, chemical precipitation | N | Y | Y | Y | Y |
| | Membrane bioreactor | N | Y | Y | Y | Y |
| | Air stripping tank/column | N | Y | Y | Y | Y |
| | Ion exchange bed | N | Y | Y | Y | Y |
| | Greensand filtration | N | N | Y | Y | Y |
| | Micro/ultrafiltration | N | N | Y | Y | Y |
| | Electrodeionization | N | N | Y | Y | Y |
| Reverse osmosis or nano filtration | N | N | Y | Y | Y | |

Table 1e
Other environmental protection activities

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|---|---|--------------|--------------|--------------|--------------|--------------|
| Air, environment & remediation | | | | | | |
| Noise and vibration abatement | Goods and services for noise insulation in buildings | N | N | N | N | N |
| | Noise insulation works | N | N | N | N | N |
| Protection of environment | Site remediation services | Y | Y | Y | Y | Y |
| | Environmental emergency response services | Y | Y | Y | Y | Y |
| Protection against radiation | Radioactive waste management, decommissioning, and site remediation | N | N | Y | Y | Y |
| Other environmental protection | Research and development | N | N | N | N | N |
| | Training | N | N | N | N | Y |
| | Consulting & administrative services | N | N | N | N | Y |

Table 2 Sustainable resource activities - energy

**Table 2a
Alternative fuel production**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|-------------------------------|--|--------------|--------------|--------------|--------------|--------------|
| Biofuels and bioenergy | | | | | | |
| Biofuel production | Grain ethanol | N | N | Y | Y | Y |
| | Cellulosic ethanol | N | N | Y | Y | Y |
| | Corn ethanol | N | N | N | N | N |
| | Biodiesel | N | N | Y | Y | Y |
| | Algae biodiesel | N | N | N | N | Y |
| | Biobutanol | N | N | Y | Y | Y |
| | Methanol and Dimethyl Ether | N | N | Y | Y | Y |
| | Syngas biofuels | N | N | Y | Y | Y |
| | Drop-in sythetic fuels | N | N | Y | Y | Y |
| | Biofuel oil | N | N | Y | Y | Y |
| | Biogas | N | N | Y | Y | Y |
| | Renewable natural gas | N | N | Y | Y | Y |
| | Hydrogen (produced from non-fossil sources) | N | N | Y | Y | Y |
| | Renewable diesel | N | N | Y | Y | Y |
| | Pyrolysis oil | N | N | Y | Y | Y |
| | Biobased naphtha | N | N | N | N | N |
| | Low carbon hydrogen | N | N | N | N | N |
| | Sustainable aviation fuel | N | N | N | N | N |
| Engineering services | | N | N | N | N | Y |
| Bioenergy production | Chips, cubes, briquettes, pucks, and pellets from wood residues and grasses etc. | N | N | Y | Y | Y |
| | Black pellets | N | N | Y | Y | Y |
| | Other biomass | N | N | Y | Y | Y |
| | Biochar | N | N | Y | Y | Y |
| | Fuel wood and other wood | N | N | Y | Y | Y |
| | Engineering services | | N | N | N | N |

Table 2b
Renewable / non-emitting electricity and heat production

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|---|---|--------------|--------------|--------------|--------------|--------------|
| Renewable / non-emitting energy supply | | | | | | |
| Wind energy | Wind turbine equipment, including nacelles, blades, towers | Y | Y | Y | Y | Y |
| | Wind turbines | Y | Y | Y | Y | Y |
| | Switchgears, transformers | Y | Y | Y | Y | Y |
| | Engineering, installation, maintenance, and architectural services | N | N | Y | Y | Y |
| Bioenergy | Domestic woodstoves, wood pellets, including own use by households and industry | Y | Y | Y | Y | Y |
| | Biomass-fired industrial boilers | Y | Y | Y | Y | Y |
| | Anaerobic digesters | Y | Y | Y | Y | Y |
| | Engineering, installation, maintenance, and architectural services | N | N | Y | Y | Y |
| Geothermal energy | Heat pumps, heat exchangers, other equipment used in geothermal energy systems | Y | Y | Y | Y | Y |
| | Hydrothermal equipment | N | N | Y | Y | Y |
| | Hot dry rock (HDR) equipment | N | N | Y | Y | Y |
| | Advanced drilling and exploration equipment | N | N | N | N | Y |
| | Engineering, installation, maintenance, and architectural services | N | N | Y | Y | Y |
| Hydro energy | Turbines and components for wave/tidal energy | Y | Y | Y | Y | Y |
| | Turbines and components for run-of-river hydro | Y | Y | Y | Y | Y |
| | Turbines (Francis, Kaplan, Pelton, propeller) and components for large hydro | Y | Y | Y | Y | Y |
| | Generators (including components), valves, gates, transformers, switchgear | Y | Y | Y | Y | Y |
| | Salinity gradient power equipment | N | N | N | N | N |
| | Engineering, installation, maintenance, and architectural services | N | N | Y | Y | Y |
| Solar energy | Active (thermal) solar heating & cooling equipment (glazed flat plate collectors, glazed evacuated tubes/collectors, unglazed panels/collectors for heating pools, perforated cladding for solar air heating) | Y | Y | Y | Y | Y |
| | Active (thermal) solar power generation equipment (concentrating mirrors, receivers) | Y | Y | Y | Y | Y |
| | Solar photovoltaic energy equipment (photovoltaic cells, modules, panels/arrays, inverters for solar photovoltaic systems) | Y | Y | Y | Y | Y |
| | Thin film solar PV (nanotechnology) | N | N | N | N | N |
| | Engineering, installation, maintenance, and architectural services | N | N | Y | Y | Y |
| Waste to energy | Organic (liquid) waste to energy | N | N | Y | Y | Y |
| | Organic (solid) waste to energy | N | N | Y | Y | Y |
| | Landfill gas to energy | N | N | N | N | Y |
| | Engineering, installation, maintenance, and architectural services | N | N | Y | Y | Y |
| Nuclear energy | Nuclear reactors, or nuclear island components (primary circuit, steam generators, primary side auxiliaries, nuclear island electrical supply and instrumentation and controls) | N | N | Y | Y | Y |
| | Nuclear fuel handling, processing, and fabrication equipment | N | N | Y | Y | Y |
| | Balance of nuclear power plant, or conventional island components | N | N | N | N | Y |
| | Engineering, installation, maintenance, licensing support, and architectural services | N | N | Y | Y | Y |
| | Uranium processing, conversion, and nuclear fuel fabrication services | N | N | Y | Y | Y |

Table 2c
Smart grid & energy storage

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|---|---|--------------|--------------|--------------|--------------|--------------|
| Smart grid | | | | | | |
| Demand management | Inverters | N | Y | Y | Y | Y |
| | Smart meters | N | Y | Y | Y | Y |
| | Phasor measurement units / sensors | N | Y | Y | Y | Y |
| | Management systems (communication solutions, monitoring and automation, software) | N | Y | Y | Y | Y |
| | Engineering, installation, and maintenance services | N | N | N | N | Y |
| Transmission and distribution | Transmission and distribution management | N | N | Y | Y | Y |
| | Microgrid solutions | N | N | Y | Y | Y |
| | Local & district heating equipment and related services | N | N | N | N | N |
| | Other related ICT equipment | N | N | Y | Y | Y |
| | Engineering, installation, and maintenance services | N | N | N | N | Y |
| Energy storage | | | | | | |
| Mechanical energy storage | Flywheels | N | Y | Y | Y | Y |
| | Pumped hydro | N | Y | Y | Y | Y |
| | Compressed air | N | Y | Y | Y | Y |
| Electrochemical energy storage (advanced batteries) | Nickel cadmium (NiCd) | N | Y | Y | Y | Y |
| | Nickel metal hydride (NiMH) | N | Y | Y | Y | Y |
| | Lead acid (LA) | N | Y | Y | Y | Y |
| | Lithium-ion (Li-ion) | N | Y | Y | Y | Y |
| | Sodium sulphur (NaS) | N | Y | Y | Y | Y |
| | Sodium nickel chloride (NaNiCl) | N | Y | Y | Y | Y |
| | Hybrid flow | N | Y | Y | Y | Y |
| | Redox flow | N | Y | Y | Y | Y |
| | Hydrogen storage | N | Y | Y | Y | Y |
| | Liquid hydrogen storage | N | N | N | N | N |
| | Gaseous hydrogen storage | N | N | N | N | N |
| | Fuel cells | N | Y | Y | Y | Y |
| | Synthetic natural gas | N | Y | Y | Y | Y |
| Electrical storage | Double-layer and super/ultra capacitors (DLC) | N | Y | Y | Y | Y |
| | Superconducting magnetic energy storage (SMES) | N | Y | Y | Y | Y |
| Thermal storage | Thermal storage systems | N | Y | Y | Y | Y |
| Hybrid storage | Hybrid storage systems | N | N | N | N | Y |
| Energy storage services | Engineering, installation, and maintenance services | N | N | N | N | Y |

Table 2d
Substitutes for fossil fuels and fossil fuel-based materials (bioproducts)

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|--|---|---|--------------|--------------|--------------|--------------|
| Biofuels and bioproducts | | | | | | |
| Equipment for producing biofuels and bioproducts | Mixers/centrifuges | N | Y | Y | Y | Y |
| | Filtration systems | N | Y | Y | Y | Y |
| | Biofuel reactors (distillation towers, digesters) | N | Y | Y | Y | Y |
| | Washers | N | Y | Y | Y | Y |
| | Dryers | N | Y | Y | Y | Y |
| | Heaters | N | Y | Y | Y | Y |
| | Storage systems | N | Y | Y | Y | Y |
| | Additives/catalysts (e.g., sodium hydroxide, potassium hydroxide) | N | Y | Y | Y | Y |
| | Shredders, chippers | N | Y | Y | Y | Y |
| | Dust collectors | N | N | Y | Y | Y |
| | Conveyors | N | N | Y | Y | Y |
| | Other conversion technologies/equipment | N | Y | Y | Y | Y |
| | Biochemicals | Lubricants, waxes, and grease | N | Y | Y | Y |
| Bio-oils & derivatives | | N | N | Y | Y | Y |
| Resins | | N | N | Y | Y | Y |
| Bioplastics | | N | N | Y | Y | Y |
| Biobased packaging | | N | N | Y | Y | Y |
| Acids | | N | Y | Y | Y | Y |
| Sugars (C5, C6), cellulose esters, polyols | | N | N | Y | Y | Y |
| Other building block chemicals | | N | N | N | N | Y |
| Paints, coatings, solvents, adhesives | | N | N | Y | Y | Y |
| Other biobased specialty chemicals | | N | N | N | N | Y |
| Bio-pesticides and bio-stimulants | | N | N | Y | Y | Y |
| Bio-catalysts and bio-enzymes | | N | N | Y | Y | Y |
| Biofoam(insulation) and biorubber | | N | Y | Y | Y | Y |
| Lignin | | N | N | Y | Y | Y |
| Hemicellulose | | N | N | Y | Y | Y |
| Biomaterials | Biocomposites & Biofibres | N | Y | Y | Y | Y |
| | Advanced materials (e.g. nanomaterials, nanocomposites, nanocrystalline cellulose, silk fibres) | N | N | Y | Y | Y |
| | Cross laminated timber | N | N | Y | Y | Y |
| | Wood composite | N | N | Y | Y | Y |
| | Agri-based composite | N | N | Y | Y | Y |
| | Textile | N | N | N | N | N |
| | Mats and specialty cellulose products | N | N | Y | Y | Y |
| | Panels, cement, and other building products | N | N | Y | Y | Y |
| | Automotive and transportation products | N | N | Y | Y | Y |
| | Furniture and Consumer Goods | N | N | N | N | N |
| | Other | Reclaimed rubber or other petro-based materials | N | N | N | N |

Table 2e
Technologies to improve energy and resource efficiency / management

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|---|--|--------------|--------------|--------------|--------------|--------------|
| Energy efficiency | | | | | | |
| Energy & resource efficient modifications, improvements | In process (ancillary/own use) modifications | N | N | N | N | N |
| | Combined heat and power and cogeneration | N | N | Y | Y | Y |
| | Enhanced solvent extraction for oil sands | N | N | N | N | N |
| | Fuel control systems | N | N | N | N | Y |
| | Material/waste recovery and related services | N | N | N | N | Y |
| | Energy recovery and related services | N | N | Y | Y | Y |
| | Low-energy/passive buildings and related services | N | N | N | N | N |
| | Energetic refurbishment of existing buildings and related services | N | N | N | N | Y |
| | Advanced thermostats | N | N | N | N | Y |
| | Advanced insulation activities | N | N | Y | Y | Y |
| | Collaborative consumption systems | N | N | N | N | N |
| | Additive manufacturing | N | N | N | N | Y |
| Measurement, controls and monitoring | Energy Audit for houses, buildings, industries and fleets | N | Y | Y | Y | Y |
| | Energy efficiency certification (such as energy star for products, R-2000 for houses, BOMA Best for buildings, ISO 50001 for industry) | N | Y | Y | Y | Y |
| | Energy management system services | N | N | N | N | Y |
| | Energy monitoring services | N | N | Y | Y | Y |
| | Demand control services | N | N | Y | Y | Y |
| | Process integration services | N | N | Y | Y | Y |
| | Data analysis and modelling services | N | N | Y | Y | Y |
| | Automation and control technology | N | N | Y | Y | Y |
| | Uncertified green property investments | N | N | N | N | N |
| Green building certification | N | Y | Y | Y | Y | |
| Industrial design and related services | Aerodynamic design | N | N | Y | Y | Y |
| | Aerodynamic testing | N | N | Y | Y | Y |
| | Modelling tools and services | N | N | Y | Y | Y |
| | Energy efficiency consulting services | N | Y | Y | Y | Y |
| | Design of emission control technologies | N | N | Y | Y | Y |
| | Circular design services | N | N | N | N | N |

Table 3 Sustainable resource activities - water

**Table 3a
Reduction of water use, losses**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|-----------------------------|---------------------------------------|-----------|-----------|-----------|-----------|-----------|
| Water and wastewater | | | | | | |
| Water efficiency | Planning and design | N | N | Y | Y | Y |
| | Efficiency consulting | N | N | Y | Y | Y |
| | Laboratory | N | N | Y | Y | Y |
| | Piloting, validation and verification | N | N | Y | Y | Y |
| | Training and plant operation | N | N | Y | Y | Y |
| | Equipment to reduce water consumption | N | N | Y | Y | Y |
| | Processes for desalinated water | N | N | Y | Y | Y |
| | Rainwater collection | N | N | Y | Y | Y |
| | Pipe inspection | N | N | Y | Y | Y |

**Table 3b
Water management**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|--------------------------------------|--|-----------|-----------|-----------|-----------|-----------|
| Water and wastewater | | | | | | |
| Measurement and control of water use | Software | N | N | Y | Y | Y |
| | Platform or system | N | N | Y | Y | Y |
| | Sensors | N | N | Y | Y | Y |
| | Information and communication technologies | N | N | Y | Y | Y |

**Table 3c
Water recycling**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|-----------------------------|-----------------------------------|-----------|-----------|-----------|-----------|-----------|
| Water and wastewater | | | | | | |
| Recycling | Gray water reuse | N | N | Y | Y | Y |
| | Water recycling technologies | N | N | Y | Y | Y |

Table 4 Sustainable resource activities - Agriculture, Forestry and Biodiversity

**Table 4a
Agriculture**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|--|---|-----------|-----------|-----------|-----------|-----------|
| Precision agriculture, forestry, biodiversity | | | | | | |
| Precision inputs | Precision fertilizers and other inputs (e.g., smart seeds) | N | N | Y | Y | Y |
| Machinery and equipment | Variable rate/precision (GPS enabled) seeders, fertilizer applicators, sprayers, etc. | N | N | Y | Y | Y |
| | Sensors (crop canopy, yield, etc.) | N | N | Y | Y | Y |
| | PA decision support software packages for seeding, spraying, fertilizing, irrigating | N | N | Y | Y | Y |
| | UAV drones with/for agricultural platforms | N | N | Y | Y | Y |
| | Ionophores for livestock feed | N | N | N | N | N |
| | Livestock precision feeding technology (RFID sensors, automated feeders) | N | N | Y | Y | Y |
| | Anaerobic digestors | N | N | N | N | N |
| | Other | N | N | Y | Y | Y |

**Table 4b
Aquaculture**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|--|---|-----------|-----------|-----------|-----------|-----------|
| Precision agriculture, forestry, biodiversity | | | | | | |
| Aquaculture | Alternative feeds (plant, algal, yeast-based proteins to replace fish meal consumption) | N | N | N | N | N |
| | Fish waste reduction/recycling (solid and liquid waste collected/filtered) | N | N | Y | Y | N |
| | Conversion to land-based culture (e.g. Recirculating Aquaculture System (RAS)) | N | N | Y | Y | N |
| | Energy efficient pumps, filters, processes | N | N | Y | Y | N |
| | Organic aquaculture products and supporting services | N | N | N | N | N |

**Table 4c
Wild flora and fauna**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|--|--|-----------|-----------|-----------|-----------|-----------|
| Precision agriculture, forestry, biodiversity | | | | | | |
| Wild flora and fauna management | Minimization of the intake of wild flora and fauna | N | N | N | N | N |
| | Restoration activities | N | N | N | N | N |
| | Measurement, control, and laboratories for wild flora and fauna management | N | N | N | N | N |
| | Training and administrative activities related to flora and fauna management | N | N | N | N | N |

**Table 4d
Forestry**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|--|---|-----------|-----------|-----------|-----------|-----------|
| Precision agriculture, forestry, biodiversity | | | | | | |
| Sustainable forestry | Management of forest areas (including restoration, replenishment, development of new forest areas, and prevention and control of fires) | N | N | N | N | Y |
| | Minimization of the intake of forest resources | N | N | N | N | Y |
| | Measurement, control, and laboratories for forest management | N | N | N | N | Y |
| | Training and administrative activities related to forest management | N | N | N | N | Y |
| | Precision sampling and data gathering technologies | N | N | N | N | N |

**Table 5
Sustainable resource activities - Minerals****Table 5a
Minerals and metals**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|---|---|-----------|-----------|-----------|-----------|-----------|
| Mining, processing, materials manufacturing & industry | | | | | | |
| Mineral use | In-process modifications to reduce consumption of mineral resources | N | N | N | N | N |
| | Production of substitutes for minerals-based materials | N | N | N | N | N |
| | Measurement/control related to the reduction of the use of minerals | N | N | N | N | N |
| | Recovery of mineral-based materials | N | N | N | N | N |
| | Machinery for metal recovery | N | N | N | N | N |
| Green mining and processing | Enhanced solvent extraction | N | N | N | N | N |
| | Sustainable mineral processing | N | N | N | N | N |
| Waste management | Recycling and reprocessing | N | N | N | N | N |
| Energy efficiency | Energy efficient processes and equipment for various applications | N | N | N | N | N |
| Low carbon energy use | Renewables, non-fossil fuels | N | N | N | N | N |
| Site reclamation | Cover technologies | N | N | N | N | N |
| Ecosystems | Dust collectors | N | N | N | N | N |

Table 6 Adapted goods

**Table 6a
Energy efficient equipment & appliances**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|--|---|-----------|-----------|-----------|-----------|-----------|
| Energy efficiency | | | | | | |
| Efficient industrial equipment | High efficiency burners and boilers | N | N | Y | Y | Y |
| | High efficiency pumps and motors | N | N | Y | Y | Y |
| | High efficiency industrial HVAC | N | N | Y | Y | Y |
| | High efficiency industrial lighting system | N | N | Y | Y | Y |
| | Batteries for portable devices | N | N | Y | Y | Y |
| Efficient commercial/ residential equipment | High efficiency commercial/residential HVAC | N | N | Y | Y | Y |
| | High efficiency electric appliances | N | N | N | N | N |
| | High efficiency lighting system | N | N | Y | Y | Y |

**Table 6b
Sustainable mobility**

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|--|---|-----------|-----------|-----------|-----------|-----------|
| Transportation | | | | | | |
| Fuel efficient automotive equipment | Fuel efficient engines and components (including electrification and hybrids) | N | N | Y | Y | Y |
| | Electric vehicle battery | N | N | Y | Y | Y |
| | Battery powered electric vehicle other components | N | N | Y | Y | Y |
| | Fuel cell vehicle FC stack | N | N | Y | Y | Y |
| | Fuel cell vehicle other components | N | N | Y | Y | Y |
| | Automobile components using lightweight materials | N | N | Y | Y | Y |
| | Electric vehicle infrastructure (charging stations) | N | N | Y | Y | Y |
| | Alternative fuel (including hydrogen & natural gas) refueling infrastructure | N | N | Y | Y | Y |
| | LNG/CNG engine | N | N | Y | Y | Y |
| | LNG/CNG tank | N | N | Y | Y | Y |
| | LNG/CNG control system | N | N | Y | Y | Y |
| | Aerodynamic device | N | N | Y | Y | Y |
| | Auxiliary power unit | N | N | Y | Y | Y |
| | Engine control module | N | N | Y | Y | Y |
| | Low rolling resistance tire | N | N | Y | Y | Y |
| | Vehicle emission monitoring | N | N | Y | Y | Y |
| | Alternative fuel retrofits | N | N | Y | Y | Y |
| | Technical inspection services related to air emissions | N | N | Y | Y | Y |

Table 6b
Sustainable mobility

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|------------------------------------|--|-----------|-----------|-----------|-----------|-----------|
| Transportation | | | | | | |
| Fuel efficient aerospace equipment | Efficient turbine | N | N | Y | Y | Y |
| | Fuel efficient engines (including electrification and other alternative fuels) | N | N | Y | Y | Y |
| | Additive composite | N | N | Y | Y | Y |
| | Aircraft components using lightweight materials | N | N | Y | Y | Y |
| | Powder metallurgy, coatings, polishing, anodizing for fuel efficiency | N | N | Y | Y | Y |
| Infrastructure and traffic control | Intelligent traffic control | N | N | Y | Y | Y |
| | Integrated traffic infrastructure | N | N | Y | Y | Y |
| | Traffic management | N | N | Y | Y | Y |
| Other | Car sharing | N | N | N | N | N |
| | Electric and more resource efficient transport equipment | N | N | Y | Y | Y |
| | Vehicle fleet management & logistics | N | N | Y | Y | Y |

Table 6c
Advanced materials

| Industry and sub-industry | Technology area / type of service | SEGS 2012 | SEGS 2015 | SEGS 2017 | SEGS 2018 | SEGS 2019 |
|--|---|-----------|-----------|-----------|-----------|-----------|
| Materials, manufacturing & industry | | | | | | |
| Advanced/lightweight materials | Products developed using additive manufacturing or low-impact processes | N | N | N | N | N |
| | Nanotechnology | N | N | Y | Y | Y |
| | Compound materials | N | N | Y | Y | Y |
| | Advanced packaging | N | N | Y | Y | Y |
| | Other lightweight materials | N | N | Y | Y | Y |