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SUBJECT CATEGORIES AND SCOPE DESCRIPTIONS

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Preface

This document is one in a series of publications known as the **ETDE/INIS Joint Reference Series**. It defines the subject categories and provides the scope descriptions to be used by national and regional centres for categorization of the nuclear literature for the preparation of INIS input, and for categorization of the energy technology literature for the preparation of ETDE input. Together with volumes of the INIS Reference Series and ETDE/INIS Joint Reference Series it defines the rules, standards and practices and provides the authorities to be used in the International Nuclear Information System and the Energy Technology Data Exchange. A list of the volumes published in the INIS Reference Series and ETDE/INIS Joint Reference Series can be found at the end of this publication.

At the 27th Consultative Meeting of INIS Liaison Officers (Vienna, Austria, 25-27 May 1999), it was recommended to adopt a simplified subject category scheme, common to the INIS and ETDE databases, which was prepared by a joint INIS/ETDE working group. The corresponding scope descriptions prepared by the same working group were endorsed by the 5th INIS/ETDE Joint Technical Committee meeting, Knoxville, TN, USA, 28-29 October 1999.

At the 11th Joint INIS/ETDE Technical Committee Meeting, 6-8 November 2007, Vienna, Austria, a new working group was created to review the INIS/ETDE subject categories. Members of the working group included the INIS Secretariat, ETDE OA, Germany, Japan and Switzerland. The objectives of this working group were:

- Review the existing subject categories to include newer concepts and/or areas of research and development
- Make the "ETDE only" categories available for INIS
- Consider the introduction of new categories

Discussion among the working group members led to the introduction of four new subject categories:

- S77 NANOSCIENCE AND NANOTECHNOLOGY
- S79 ASTROPHYSICS, COSMOLOGY AND ASTRONOMY

- S96 KNOWLEDGE MANAGEMENT AND PRESERVATION
- S97 MATHEMATICAL METHODS AND COMPUTING

In all, more than 30 categories, both INIS and ETDE, were either updated to include newer concepts and/or areas of research and development or added as new subject categories.

This categorization scheme contains now 49 one-level broad subject categories, both for INIS and ETDE. These categories have three-character alphanumeric codes. The scope descriptions are given for both INIS and ETDE on opposite pages.

The secretariat wishes to acknowledge the assistance, comments and suggestions received from national INIS centres in the preparation of the new revision of the present document and continues to invite comments and criticism, which should be sent to:

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Introduction

This ETDE/INIS Joint Reference Series document is intended to serve two purposes:

- to define the subject scope of the International Nuclear Information System (INIS) and the Energy Technology Data Exchange (ETDE)
- to define the subject classification scheme of INIS and ETDE.

It is thus the guide to inputting centres in determining which items of literature should be reported, and in determining where the full bibliographic entry and abstract of each item should be included in the INIS or ETDE databases

Each category is identified by a category code consisting of three alphanumeric characters. A scope description is given for each subject category. The scope of INIS and ETDE is the sum of the scopes of all the categories respectively

With most categories cross references are provided to other categories where appropriate. Cross references should be of assistance in finding the appropriate category; in fact, by indicating topics that are excluded from the category in question, the cross references help to clarify and define the scope of the category to which they are appended.

A Subject Index is included as an aid to subject classifiers, but it is only an **aid** and **not a means** for subject classification. It facilitates the use of this document, but is no substitute for the description of the scope of the subject categories. Index-based subject categorization is likely to be wrong and must be avoided.

Subject classifiers, who are expected to be subject specialists at INIS and ETDE inputting centres, are requested to identify the significant topics of each item of literature and to report the item only if it contains significant information that falls within the subject scope of INIS or ETDE. The main topic (from the "nuclear science" point of view for INIS and from the

"energy technology" point of view for ETDE) is the basis for determining the primary subject category. The *INIS: Guide to Bibliographic Description (IAEA-INIS-1)* requires the assignment of a primary subject category to each record (in Tag 008) The primary category should be the one for which the scope description encompasses the main INIS/ETDE topic discussed in the piece of literature. If there are significant secondary topics discussed in the piece of literature that fall within the scope description of a category or categories other than the one relevant to the main topics of the paper, the rules permit the assignment of one or more **secondary categories** for the piece of literature. Furthermore, in order to create subsets of the database containing references to literature that might be useful in a particular area, it has been found advantageous in certain cases to additionally assign a secondary category to indicate the field of application or area of usefulness of the information contained in the piece of literature. This is also permitted under INIS/ETDE rules. Although their number is not limited, **more than one or two secondary categories rarely should be needed.**

Table of Contents

FrontPage

Preface

Introduction

S01 Coal, lignite, and peat

S02 Petroleum

S03 Natural gas

S04 Oil shales and tar sands

S07 Isotopes and radiation sources

S08 Hydrogen

S09 Biomass fuels

S10 Synthetic fuels

S11 Nuclear fuel cycle and fuel materials

S12 Management of radioactive wastes, and non-radioactive wastes from nuclear facilities

S13 Hydro energy

S14 Solar energy

S15 Geothermal energy

S16 Tidal and wave power

S17 Wind energy

S20 Fossil-fueled power plants

S21 Specific nuclear reactors and associated plants

S22 General studies of nuclear reactors

S24 Power transmission and distribution

S25 Energy storage

S29 Energy planning, policy and economy

S30 Direct energy conversion

S32 Energy conservation, consumption, and utilization

S33 Advanced propulsion systems

S36 Materials science

S37 Inorganic, organic, physical and analytical chemistry

S38 Radiation chemistry, radiochemistry and nuclear chemistry

S42 Engineering

S43 Particle accelerators

S46 Instrumentation related to nuclear science and technology
S47 Other instrumentation
S54 Environmental sciences
S58 Geosciences
S60 Applied life sciences
S61 Radiation protection and dosimetry
S62 Radiology and nuclear medicine
S63 Radiation, thermal, and other environmental pollutant effects on living organisms and biological materials
S70 Plasma physics and fusion technology
S71 Classical and quantum mechanics, general physics
S72 Physics of elementary particles and fields
S73 Nuclear physics and radiation physics
S74 Atomic and molecular physics
S75 Condensed matter physics, superconductivity and superfluidity
S77 Nanoscience and nanotechnology
S79 Astrophysics, cosmology and astronomy
S96 Knowledge management and preservation
S97 Mathematical methods and computing
S98 Nuclear disarmament, safeguards and physical protection
S99 General and miscellaneous
Appendix 1
Appendix 2

S01 Coal, lignite, and peat

Includes all topics in the field of coal and coal products, including lignite and peat, such as reserves, geology and exploration; underground and surface mining (including mountain top removal); preparation (sizing, crushing, washing, flotation, agglomeration, blending, briquetting); processing (purification and upgrading, gasification, liquefaction, hydrogenation, pyrolysis, carbonization); products and by-products; properties and composition; combustion; transport, handling and storage; waste management; environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

S02 Petroleum

Includes all topics in the field of petroleum, such as reserves, geology, and exploration; drilling and production; processing; products and by-products; properties and composition; combustion; transport, handling, and storage; waste management; environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

S03 Natural gas

Includes all topics in the field of natural gas including liquified natural gas, such as reserves, geology, and exploration; drilling, production, and processing; products and by-products (e.g.. LPG); properties and composition; combustion;

transport, handling, and storage; waste management; environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

S04 Oil shales and tar sands

Includes all topics in the field of oil shales and tar sands, such as reserves, geology, and exploration; drilling, fracturing, and mining; oil production, recovery, and refining; products and by-products; properties and composition; combustion; transport, handling, and storage; waste management, environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

S07 Isotopes and radiation sources

Physical methods of isotope separation and enrichment for both radioactive and stable isotopes (except uranium for the nuclear fuel cycle), heavy water production, and all industrial processes for the separation of deuterium from hydrogen. Design and performance of separation equipment such as gas centrifuges and separation nozzles. Design, construction, and maintenance of facilities and equipment for heavy water production.

Design, fabrication, and operation of isotopic sources of nuclear radiation such as neutron sources, gamma sources, etc., (including isotopic x-ray sources) and associated facilities. Applications of nuclear techniques and radiations, accelerated particles, radioisotopes, and fission products in industry for measurement and control, e.g., thickness measurement. Applications in radiation processing, including waste treatment. Advances in tracer techniques when no specific application is indicated.

Radiation source metrology, including radiation source calibration and standardization; units for radiation and activity measurements; activity measurement of radiation sources and calculation and measurement of dose distributions from radiation sources.

Isotopic power supplies using separated radioisotopes or mixed fission products as sources of electric, propulsive, or thermal energy.

Environmental aspects (siting studies; effluent generation, treatment, and release; accident analysis); health and safety aspects; legislation and regulations; and economic, industrial, and business aspects of the use of isotopes and radiation sources.

For:

Uranium separation and enrichment use [S11](#)

chemical separation and preparation of radioisotopes use [S38](#)

analytical procedures using radioisotopes use [S38](#)

use of radioisotopes in vaccine production and food processing use [S60](#)

use of radioisotopes for radio sterilization in medicine use [S60](#)

S08 Hydrogen

Includes all topics in the field of hydrogen, such as production (electrolysis, thermochemical processes, steam reformer processes, water gas processes, Bosch process, biosynthesis and photochemical processes, steam-iron process, partial oxidation processes, coal gasification); properties and composition; combustion; storage (chemisorption, underground, and cryogenic storage), transport, and handling; products and by-products; waste management; environmental aspects; health

and safety; legislation and regulations; economic, industrial, and business aspects.

S09 Biomass fuels

Includes all topics in the field of biomass fuels (e.g. crops and wastes used directly as fuels, as e.g., wood, straw, municipal wastes or indirectly used as fuels, such as biogas from sanitary landfills, or as feedstocks, such as switchgrass). Aspects include resources; production; processing; products and by-products; properties and composition; combustion; storage, transport and handling; waste management; environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

S10 Synthetic fuels

Includes all fuels produced by chemical synthesis, e.g., inorganic hydrogen compound fuels, town gas, etc. Aspects include production; properties and composition; combustion; products and by-products; storage, transport and handling; waste management; environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

S11 Nuclear fuel cycle and fuel materials

All out-of-reactor aspects of the nuclear fuel cycle except waste processing, storage, and disposal

Geology, mineralogy, petrogenesis, properties, resources, and reserves of uranium and thorium minerals and ores. Identification and prospecting of deposits. All aspects of mining and recovery of uranium and thorium from seawater and other waters, including process design, operation, performance, and chemical engineering of plants for this processing.

Feed processing (chemical processing of ores for recovery of uranium or thorium), including process design, performance, and operation of all extraction, conversion, or reduction steps, as well as design and chemical engineering of associated plants.

Processes for the industrial-scale separation of uranium isotopes and uranium enrichment, such as gaseous diffusion, ultracentrifugation, and laser separation, as well as design, construction, operation, maintenance and safety aspects of facilities and equipment for uranium separation and enrichment.

Reactor fuel properties, production, and fabrication.

Reprocessing of reactor fuels, including analytical control, chemical separation, solvent studies, and plant and process design, performance, and operation.

Handling, transport and interim storage of fresh and spent reactor fuels.

Environmental aspects (siting studies; effluent generation, treatment, and release; accident analysis); health and safety aspects; legislation and regulations; and economic, industrial, and business aspects of the nuclear fuel cycle.

For:

fuel element design, assembly, and performance

use [S22](#)

fuel handling procedures at reactors

use [S22](#)

fuel requirements

see [S21](#), [S22](#)

fuel burn up	see S21 , S22
fuel cycle economics	use S21
handling, transport and interim storage of radioactive materials except reactor fuels	use S42
properties of specific fuel materials	see S36 , S38
shipping container design and development	use S42
storage of radioactive wastes	use S12
radionuclide migration and monitoring in the air, soils, and waters of the earth	use S54
radiation protection procedures	use S61
prevention of radioactive contamination	use S61
decontamination procedures	use S61
nuclear safeguards	use S98
planning and policy aspects of nuclear fuels and their use (non-technical)	see S29 , S98

S12 Management of radioactive wastes, and non-radioactive wastes from nuclear facilities

Studies related to methods for the management, processing, storage, transport, or disposal of radioactive wastes, as well as non-radioactive wastes generated by energy facilities

Radioactive waste processing for concentration, decontamination, or fission product recovery, including transmutation technology; tritium processing, containment, and recovery; radioactive waste treatment plants, structures, and equipment.

Methods, equipment, and treatment plants for the processing of non-radioactive wastes from nuclear facilities.

All methods for **storage** (including ultimate storage) **and disposal** of radioactive and non-radioactive wastes, e.g. tank storage, salt-mine storage, land burial, or sea disposal.

Seismological, geological, hydrological, meteorological and climatic studies of waste treatment plant sites and of waste disposal sites

Legal aspects of waste treatment, storage, and disposal, including the national and international transport of wastes.

For:

Reprocessing of spent reactor fuels use [S11](#)

S13 Hydro energy

Includes all aspects of hydroelectric power plants, such as retrofitting existing dams for power, hydroelectric-dam safety and environmental studies, and generating equipment. Also includes the extraction of energy from the Florida Current, Gulf Stream, or undammed, free-flowing streams (hydrokinetic power). Aspects include resources and availability; site geology and meteorology; plant design and operation; power-conversion systems; environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

For:

energy derived from the salinity gradient in the oceans use [S14](#)

energy derived from the temperature difference between deep and surface water use [S14](#)

energy derived from the use of geothermal tunnel water use **S15**

energy derived from the (quasi)-periodic movements of waves and tides use **S16**

S14 Solar energy

Includes conversion of solar radiation to useful amounts of electric energy, use of solar energy for heating and cooling, or any other use of solar energy that might contribute to the total energy budget. All technical aspects of the design, research and development, manufacture, testing, and operation of solar cells and solar collectors are included along with photovoltaic power systems, solar thermal power systems, ocean thermal energy conversion (OTEC) systems based on the temperature difference between deep and surface water, power systems based on salinity gradients, and solar thermal utilization (space heating and cooling; water heating; agricultural and industrial process heat for e.g. crop drying, food dehydration). Also includes materials with indicated utility in solar cells or solar converters. Aspects include resources and availability; environmental aspects; solar energy conversion (photovoltaic, thermionic, thermoelectric, photochemical, photobiological and thermochemical conversion); solar energy storage; health and safety; legislation and regulations; economic, industrial, and business aspects.

Note: For solar energy storage, category S25 should also be assigned.

For:

energy derived from undammed, free-flowing streams or ocean currents use **S13**

energy derived from the (quasi)-periodic movements of waves and tides use **S16**

energy derived from wind and similar air movements use **S17**

S15 Geothermal energy

Includes all aspects of geothermal resources, such as availability; geology and hydrology of geothermal systems, including low-depth, mid-depth and high-depth geothermal systems, and use of tunnel water; geothermal exploration and exploration technology; products and by-products; geothermal power plants and components; geothermal engineering (drilling technology, well hardware, fluid transmission; corrosion, scaling, and materials development; geothermal reservoir and well performance; control systems; reservoir stimulation and extraction technology); direct energy utilization; geothermal data and theory (properties of aqueous solutions, minerals and rocks; rock-water-gas interactions; isotope and trace element studies); waste management; environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

S16 Tidal and wave power

Includes all aspects of tidal and wave power, such as resources and availability (site characteristics); tidal power plants and power conversion systems; wave energy converters; environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

For:

energy derived from undammed, free-flowing streams or ocean currents use **S13**

energy derived from the salinity gradient in the oceans use **S14**

energy derived from the temperature difference between deep and surface water use **S14**

S17 Wind energy

Includes all aspects of wind energy, such as resources and availability (climatology and site characteristics); wind energy engineering including applications, turbine design, transport, construction, operation and maintenance, power-conversion systems, grid integration; environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

S20 Fossil-fueled power plants

Routine aspects of power plant hardware use are not included, but new designs, developments, and technologies are appropriate. Includes design, operation and performance of fossil-fueled power plants and power generation (e.g. cooling and heat transfer equipment; power cycles; waste-fueled systems; components, heat utilization such as combined heat and power plants (cogeneration), off-peak energy storage); waste management (on-site equipment and processes for the control of emissions and effluents; processing, disposal and management of waste fuel products such as fly ash; environmental protection measures); environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

S21 Specific nuclear reactors and associated plants

Note: This category must be assigned to the relevant literature if the reactor type is specified.

Includes the design, construction, performance, operation, accidents, decommissioning and dismantling of specific reactors (e.g. BWR-, PWR-, PHWR-, WWER-, GCR-, AGR-, HTGR-, LMFBR-types) and reactor plants as energy sources for electricity and heat generation; research reactors (including experimental reactors, zero-power reactors, and subcritical assemblies), test, training, production (of fissionable materials, tritium, other isotopes), irradiation (such as chemonuclear reactors), materials testing, and materials processing reactors; and other applications (includes mobile, propulsion, package, and transportable reactors)....

Environmental aspects (selection criteria, environmental impact studies, environmental implications of generation and release of radioactive and non-radioactive substances, environmental consequences predicted from accident analysis), economic aspects (materials and labor costs, prices, financing, taxes and tax credits, comparative analysis of fission nuclear energy with other energy sources), legal aspects (licensing and inspection of all aspects of reactor siting, operation, and decommissioning as well as accidents of nuclear-powered ships), and reactor safety aspects are included.

(In the case of reactor accidents, please see Appendix 2 for the International Nuclear Event Scale).

S22 General studies of nuclear reactors

Note: This category must be assigned to the relevant literature if no reactor type is specified.

General studies of nuclear reactors, such as reactor theory and reactor physics calculations (including experiments to verify the accuracy of these), reactor components and accessories (design, construction, fabrication, characteristics, performance, and safety aspects of pressure vessels, shielding, cooling systems, coolants, loading machines, etc.; methods and equipment for in-service inspection), reactor fuels (design, fabrication, performance, and safety-related aspects of fuel pellets, fuel elements, and fuel assemblies, fuel-loading procedures, fuel fabrication plants), and reactor control systems (control rods, control rod drives, alarms, and systems for automatic shutdown and initiation of protective actions, including on-line control and man-machine communication problems in reactor control).

Legal aspects of nuclear damage and risk, including operator liability, state responsibility, financial security, insurance for third-party liability or for damage to a nuclear installation, etc.

S24 Power transmission and distribution

Includes the planning, design, development, construction, maintenance, operation and new technologies of power systems and power transmission from any source. Hardware includes transformers, switchgear, converters, and cables. Aspects include power systems; power systems networks, transmission, and distribution; power transmission lines and cables (overhead and underground, including cryogenic and superconducting cables); environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

S25 Energy storage

Covers methods for storing energy in a readily recoverable form for later use. Such methods may be mechanical (potential or kinetic energy), chemical, electromagnetic, or thermal. Aspects include energy storage by compressed and liquefied gas; capacitor banks; flywheels or magnetic, thermal and chemical storage or batteries (design, development, materials, components and auxiliaries). Includes all environmental aspects; health and safety; legislation and regulations; economic, industrial, and business aspects.

Note: For storage of solar energy, category S14 should be assigned (as primary) in addition to this category.

For:

solar energy storage use [S14](#)

S29 Energy planning, policy and economy

Contains general aspects of energy planning, policy, and policy analysis (only non-technical documents). Includes planning and policy aspects of electric power and its generation; of energy storage and transport (e.g. by pipelines); of energy consumption, utilization, and conservation; of district heating and cooling; and of specific energy sources such as fossil fuels, synthetic fuels, nuclear energy, and renewable energy sources (wind, tides, geothermal energy, etc.). Also includes sociology and economics of energy production and use, such as supply and demand, cost comparisons, and environmental, health, and safety aspects. Also includes broad, generally applicable articles on total energy systems, energy management, energy analysis and modelling, legislation and regulations, and the research, development, demonstration, and commercialization policies of governments and private institutions.

S30 Direct energy conversion

Includes methods and devices for converting heat or other forms of energy into electrical energy without intermediate conversion into mechanical work. Aspects include MHD generators; EHD generators; thermoelectric generators; thermionic converters; fuel cells; other converters (e.g. piezoelectric, ferroelectric, magnetothermoelectric, photoelectromagnetic or magnetorestrictive conversion)

For:

direct energy converters used in fusion technology see [S70](#).

S32 Energy conservation, consumption, and utilization

Information on equipment and methods to reduce energy consumption, to increase energy efficiency, or to enable the replacement of scarce or inefficient energy sources by sources which are more plentiful or environmentally favorable. This topic area includes energy conservation within buildings (improved insulation; more efficient lighting, heating, and cooling; monitoring and management of energy consumption), in transportation (improved traffic flow, increased vehicle occupancy, reduction in fuel consumption and in the need for travel), in industry and agriculture, and within municipalities and communities (improvements in district heating and cooling systems, street lighting, recreational facilities, power systems, sewer systems, water and natural gas distribution systems). Typical aspects included are the optimization of materials and processes for reducing energy consumption; improvements in the energy efficiency of equipment and devices (e.g., electric motors, electrical and electronic apparatus for offices, households, commercial facilities and industrial plants, etc.); waste heat recovery and utilization; waste management for energy or resource recovery; consumer educational and motivational tools; and the removal of institutional barriers to energy conservation.

Note: Documents discussing improvements in the "hardware" to promote energy conservation and energy efficiency in vehicles such as automobiles, buses, trucks, and trains are categorized to S33, Advanced Propulsion Systems.

S33 Advanced propulsion systems

Design and development of advanced propulsion systems for automobiles, buses, trucks, trains, ships, and aircraft; for example, components and devices which promise better fuel economy, less maintenance, and increased service life; more efficient power cycles; better emission-control devices; feasibility studies on the use of alternative fuels such as hydrogen or alcohol fuels. Internal combustion engines, external combustion engines, electric-powered systems, hybrid systems, and flywheel propulsion are included, along with associated vehicle design factors involving body and chassis, engine-transmission matching, weight reduction, etc.)

S36 Materials science

This category includes materials science aspects of the metals, alloys, intermetallic compounds, refractories, ceramics, and cermets (borides, carbides, hydrides, nitrides, oxides, and silicides) of metals of interest in energy and nuclear science and technology (see Appendix 1), as well as composite materials, polymers and plastics, boron, carbon, graphite, concrete, glass, semiconductor materials, soil, rock, cloth, and textiles of similar identified energy-related interest.

The specific aspects of interest include the following:

Preparation and fabrication (bonding, brazing, casting, cold working, drawing, extrusion, fastening, forging, forming, hot working, molding, pressing, rolling, sintering, soldering, swaging, welding, etc.)

Structure and phase studies (allotropy, crystal-phase transformations, melting points, microstructure, phase diagrams, solidification)

Mechanical properties (brittleness, buckling, cracking, creep, deformation, ductility, elasticity, embrittlement, fatigue, fracture properties, friction, hardness, plasticity, Poisson's ratio, rupture, shear properties, strain, strength, stress, tensile properties, toughness, wear, Young's modulus, etc.)

Physical properties (damping, density, electrical properties, internal friction, magnetic properties, optical properties, specific heat, superconducting properties (such as critical current, critical fields, Meissner effect, transition temperature), thermal conductivity, thermal diffusivity, thermal expansion, thermodynamic properties, transformation temperature, vapor pressure, etc.)

Corrosion and erosion (including oxidation, hydridation, and sulfidation)

In addition, this category includes all radiation effects on the mechanical integrity or physical properties of ALL materials.

S37 Inorganic, organic, physical and analytical chemistry

Includes **analytical and separation chemistry** (activation, nuclear reaction, radiometric, and radiochemical procedures; inorganic, organic, and physical chemistry; electrochemistry; photochemistry; combustion, pyrolysis and high-temperature chemistry....

Isotope effects on nonnuclear chemical and physical properties of elements and compounds. (isotope effects are not included when used only as a tool in the analysis of reaction mechanisms or in chemical structure studies)....

Isotope exchange if the exchange is of primary concern or the exchange mechanism is used in isotope separation. Chemical and physicochemical methods of **isotope separation** are included. (For industrial methods of isotope separation see S07).

S38 Radiation chemistry, radiochemistry and nuclear chemistry

Hot-atom chemistry. Chemical reactions of atoms or ions of high kinetic energy (more than 1 eV) resulting from nuclear transformations, including recoil production).

Properties of radioactive materials. Chemical and physico-chemical properties of radioactive elements, compounds or materials....

Preparation of radioactively-labeled compounds. Chemical separation and preparation of radioisotopes (other than analytical applications and industrial methods of production, separation and enrichment), preparation of radioactively labeled compounds and studies of their stability.

Radiation Chemistry. Radiation-induced chemical reactions, including formation of free radicals and G value determination, analysis of radiolytical products; chemical radiation effects on gases, liquids, and solids (excluding industrial applications); post-factum detection of food irradiation (nuclear radiation only, e.g., beta, gamma radiation). Note: effects of ultraviolet, visible and infrared radiation as well as laser beams are excluded.

S42 Engineering

Encompasses general engineering information directly related to energy, including facilities, equipment and techniques. Includes **protective structures and equipment**, such as blast and fallout shelters, air-filtration systems, fire protection systems, special clothing. **Handling equipment and procedures**, e.g. for handling of radioactive materials not necessarily related to nuclear fuel cycle (see S11), handling equipment, such as remote-handling equipment, glove boxes, hot cells. **Shipping containers** for radioactive materials. **Transport and storage facilities**, such as tanks, pipelines, tanker vessels. **Heat transfer and fluid flow** studies (nucleate boiling, boiling burnout, critical heat flux, two-phase flow). **Materials testing.** **Combustion systems** (e.g. boilers, furnaces). **Mining and underground engineering.** **Marine engineering** (equipment for offshore operations). **Power cycles** (Brayton, Rankine, Stirling and others). **Components, electron devices and circuits** (including lasers and masers). Peaceful uses of **Nuclear explosions** for e.g. civil engineering purposes.

S43 Particle accelerators

Design, development, operation, decommissioning, dismantling of particle accelerators and storage rings used in energy research. Topics include beam dynamics, field calculations, and ion optics; auxiliaries and components (e.g. ion and electron sources; injection and extraction systems), experimental facilities and equipment

S46 Instrumentation related to nuclear science and technology

Includes radiation detectors or monitors, radiometric instruments, radiation dosimeters, nuclear spectroscopic instrumentation, high-energy physics instrumentation, particle detectors, and other nuclear-related instrumentation such as flowmeters, pressure gages and heat sensors....

Radiation effects on instruments or electronic systems

S47 Other instrumentation

Includes well logging, thermal, optical, geophysical, meteorological and other instrumentation associated with energy research.

S54 Environmental sciences

This category is used for pollutants/contaminants in the environment that cannot be directly connected with a particular energy source. If the source is clear, the subject category for the energy source is used.

Includes information on the effects of any energy-related activity on the environment (land, water or atmosphere), on methods for mitigating or eliminating adverse effects (e.g. carbon capture and sequestration), and on technical aspects (e.g. radiometric methods using radioisotopes or ionizing radiations) of ensuring that energy-related activities are environmentally safe and socially acceptable. Includes site resource and use studies, such as seismological, geological, soil, hydrological, meteorological, climatic and atmospheric studies of existing or potential sites for any phase of energy development and use. This area covers all aspects of global climate change. Covers monitoring and transport of chemicals, radioactive materials and thermal effluents within the atmospheric, terrestrial and aquatic environment.

S58 Geosciences

This area is limited to providing information to support research in geosciences where the context of the work is energy technology. Aspects of geology, geography, seismology and geochemistry are covered when energy-related. This category should be used if an item cannot be categorized elsewhere.

S60 Applied life sciences

Comprehensive coverage is not obligatory for ETDE

Plant cultivation and breeding (crop and plant improvement by development of radiation-induced mutants, including use of radiomimetic substances in comparative studies, nuclear techniques (tracers only if the application is new) in plant growth and cultivation, including plant nutrition, metabolism, fertilizer utilization, and irrigation studies, assessment of seed quality by nuclear or radiographic techniques, low-dose stimulation of plant growth)

Pest and disease control (nuclear techniques (tracers only if the application is new) relating to specific human, animal and plant parasitic diseases, to pathogens, including viruses, and to disease transmission, radiation procedures in vaccine production and animal reactions to irradiated pathogens, new applications of tracers in pest ecology, including host-parasite relationships, and in studying pesticides (including weed control) and insect pathogens, radiation sterilization for control of insects and other arthropods of agricultural significance (e.g. sterile insect release)

Food protection, preservation and human nutrition evaluation (irradiation procedures for, and radiation effects on, agricultural food products, fish and fish products, processed foods and food ingredients, processed animal feed, extension of storage life and sprout inhibition, radiation disinfestation of stored and packaged food products and chemical changes resulting from irradiation, radiation processing of food on an industrial scale, evaluation of wholesomeness and quality of irradiated food, contamination and monitoring of, and decontamination procedures for food, new applications of isotopic techniques in human nutrition evaluation)

Animal husbandry (new applications of tracers in nutrition, metabolism and breeding of domestic animals, nuclear techniques in veterinary science)

Other applications of radiations and radioisotopes in life sciences (irradiation sterilization in medicine, nuclear techniques and applications of radiation and stable or radioactive isotopes (tracers only if the tracer or application is new) in the life sciences)

S61 Radiation protection and dosimetry

Radiation Protection Standards. Technical standards, including definitions and units, dealing with the presence of radioactive materials, natural or artificial (e.g. radon in houses or mines), or with the operation of reactors or other nuclear equipment or facility when such standards are set to provide radiation protection for man; documents about such standards....

Radiation Protection Procedures. Procedures designed wholly or primarily to provide radiation protection for man (except for shielding of reactors and accelerators); prevention of contamination or procedures for decontamination, including chemical decontamination of materials, structures and equipment.

Dosimetry and Monitoring. Personnel dosimetry and radiation monitoring (e.g., in nuclear facilities, industry, radiotherapy, X-ray diagnostics, nuclear medicine) for both patients and medical personnel; medical surveillance of personnel exposed to ionizing radiations in conformance with national or international radiation protection regulations or recommendations; population dose estimates, collective dose and dose commitment from natural background radiation (e.g. radon in houses or mines), or as a result of nuclear accidents, from medical or industrial use of radioisotopes and ionizing radiations or from contaminated food; calculation and measurement of absorbed doses in man, animals, plants and other biological systems at all levels, as well as in tissue-equivalent materials and phantoms)....

Legal aspects. Legal aspects of protecting personnel and members of the public; legal aspects of protecting the environment against contamination from the operation of nuclear facilities; legal aspects of direct or indirect applications of radioisotopes and radiation to man (e.g., medical and industrial applications, food irradiation, radiation from consumer products).

S62 Radiology and nuclear medicine

Comprehensive coverage is not obligatory for ETDE

External radiation in diagnosis (advances in the use of ionizing radiations (e.g., X-rays, bremsstrahlung, gamma radiation, neutrons, charged particles) for diagnostic purposes, advances in imaging procedures, including NMR

spectroscopy and tomography)

Note: sonography and routine X-ray diagnostics are excluded

Radioisotopes in diagnosis (advances in the use of radioisotopes and stable isotopes for diagnostic purposes, imaging and non-imaging procedures, radioassay, including radioimmunoassay, incorporation and elimination of radioisotopes and labelled compounds, advances in Single Photon ECT, Positron Computed Tomography)

External radiation in therapy (advances in the use of ionizing radiations for therapeutic purposes (implants are included), surface and depth dose distributions, afterloading, irradiation and dose planning, use of response modifying factors in radiation therapy)

Radioisotopes in therapy (advances in the use of radioisotopes for therapeutic purposes, internal dose distributions, response modifying factors, radioactivation (e.g. neutron capture therapy), incorporation and elimination of radioisotopes and labelled compounds)

S63 Radiation, thermal, and other environmental pollutant effects on living organisms and biological materials

Effects of External Irradiation on Biochemicals, on Cell and Tissue Cultures, and on Microorganisms. Effects of radiations, including ultraviolet radiation and laser radiation, on living systems at the biochemical, cellular and tissue culture level, on isolated cell constituents, and on microorganisms, both animals and plants (e.g., bacteria, bacteriophages, rickettsiae, yeasts, viruses); includes the relative effects of irradiation procedures, doses, dose rates, Relative Biological Effectiveness (RBE), Linear Energy Transfer (LET) and various response modifying factors.

Effects of External Irradiation on Plants. Effects of ionizing radiations on plants or parts of plants (seeds, roots, leaves, etc.), plant growth, physiology and metabolism; includes the relative effects of irradiation procedures, doses, dose rates, Relative Biological Effectiveness (RBE) and Linear Energy Transfer (LET); modification of effects of such radiation due to various response modifying factors, such as radioprotective and effect-enhancing substances or irradiation conditions....

Effects of External Irradiation on Animals. Effects of ionizing radiations, including immunological consequences, on any animal; includes the relative effects of irradiation procedures, doses, dose rates, Relative Biological Effectiveness (RBE) and Linear Energy Transfer (LET); modification of effects of such radiations due to various response modifying factors, such as radioprotective or effect-enhancing substances or irradiation conditions; side effects (e.g. toxicity) of such substances; effects of radiomimetic substances and radiation in comparative studies....

Effects of External Irradiation on Man. Effects of ionizing radiations (including immunological consequences, acute and late effects) on man; includes the relative effects of irradiation procedures, doses, dose rates, Relative Biological Effectiveness (RBE), Linear Energy Transfer (LET) and quality factors; modification of effects of such radiations due to various response modifying factors, such as radioprotective or effect-enhancing substances or irradiation conditions; side effects (e.g. toxicity) of such substances; side and late effects of such radiations in medical diagnosis and therapy; epidemiological studies of possible radiation-caused illness....

Effects of Internal Irradiation and Various Aspects of Radioisotope Kinetics and Toxicity in Man, Animals, Plants and Microorganisms. Acute and late effects of absorbed or incorporated radioactive materials (not implanted sources or afterloading); internal source evaluation; side and late effects, including toxicity, of the use of radioisotopes in bound or unbound form in diagnosis and therapy; radioisotope kinetics, localization, uptake and elimination of radioisotopes at all levels (subcellular, cellular, tissue, organ and whole organism); also includes contamination and decontamination (both internal and external), use of chelating agents or complex forming agents, modifying factors and radioprotective substances, e.g., EDTA (ethylenediaminetetraacetic acid), DTPA (diethylenetriaminepentaacetic acid), stable iodine; epidemiological studies of possible radioisotope-caused illness].

Effects of thermal effluents on living organisms from energy production, utilization or conservation activities.

Includes effects of temperature change resulting from the energy cycle, such as decreased temperature effects from hydroelectric dams or increased temperature effects from fossil fuel burning.

Chemicals Metabolism and Toxicology. Includes effects of any element or compound (e.g. PCBs, freons) associated with an energy cycle, including resource extraction, conversion utilization, and waste processing and disposal.

Effects of other environmental pollutants, such as noise produced in energy production, conversion, or utilization; hazards from power transmission lines, Laser and microwave hazard, effects from global climate changes, and any other health hazards from energy related activities that are not covered in other categories.

S70 Plasma physics and fusion technology

Plasma Physics (Note: includes only plasmas related to nuclear fusion). Plasma confinement, including both magnetic and inertial confinement (studies on plasma lifetime, particle and heat loss, energy balance in plasma and fusion devices, enhanced confinement concepts, alpha particle confinement, disruptions), plasma production, heating, and interactions (includes ohmic, radiofrequency, microwave, ICR, ECR and lower hybrid heating, plasma heating by laser or particle beams, shock waves, compression, plasma production by guns or other means, electromagnetic wave propagation and absorption, interactions with antennas, walls, probes and sheaths, current drive), plasma kinetic equations, thermodynamic properties, neoclassical theory, plasma transport, plasma impurities, plasma simulation, plasma waves (electrostatic, electrodynamic, MHD, sound, drift or other waves, linear or nonlinear), plasma oscillations, plasma instabilities (macro- and micro-instabilities), turbulence, solitons, BGK modes, shock waves, plasma fluid and MHD properties (includes MHD equilibria and resistive MHD effects), nuclear fusion reactions (exoenergetic fusion reactions between nuclei of light elements in plasma, beam-induced fusion, cold fusion, muon-catalyzed fusion, etc.), elementary and classical processes in plasmas (particle orbits, electron, atom, ion, molecule and heavy-particle collisions in plasmas), plasma diagnostic techniques and instrumentation (diagnostic techniques and instrumentation for rf, optical, X-ray, gamma-ray and particle measurements), other physics studies of fusion plasmas....

Fusion Technology (Note: includes hybrid reactors). Fusion devices and experiments (design and specifications of magnetic or inertial confinement devices, implosion physics, studies related to laser fusion, electron beam fusion and ion beam fusion, safety analyses of fusion devices), plasma-facing components (physics and engineering related to first wall, liners, limiters, divertors, impurity control, etc.), magnet coils and fields (experiments, design analyses and design codes related to magnets and magnetic field configurations), power supplies and energy storage (design and performance analyses for any power supply or energy storage system associated with a fusion device), blankets and cooling systems (physics and engineering studies of blankets, and studies of heat transfer or system components), other components of fusion devices (such as vacuum and exhaust systems, control systems, shielding), materials studies related to fusion research, heating and fueling systems (studies on any plasma gun, neutral beam source to be used for beam injection, or microwave or laser radiation source used for plasma heating), fusion fuels (studies on deuterium, tritium, boron -11, etc., for use as fuel, including processing, inventories and availability), power conversion systems (studies on MHD topping cycles, direct energy converters, gas turbines, etc.).

Economics of Fusion Nuclear Power and Fusion Fuel Cycle (Note: includes economic aspects of hybrid reactors). Economic aspects of fusion nuclear energy; forecasts, R & D expenditures; economic comparison of fusion reactors with alternative power sources or of different reactor types; financing of fusion nuclear power; methodology of comparative analysis of fusion nuclear energy and other energy costs; economic aspects of fusion fuel production or recovery; forecasts of fusion fuel requirements, R & D expenditures; economic aspects of waste management; economic aspects of nuclear accidents.

S71 Classical and quantum mechanics, general physics

Comprehensive coverage is not obligatory for ETDE

Aspects of classical mechanics of interest for nuclear science and technology, general aspects of quantum mechanics (formalism, theory of measurement, mathematical models, non-relativistic scattering theory, semiclassical theories) not applied to a specific field, general theory of scattering;

Cryogenics (methods and equipment for low temperature application in systems of interest for nuclear science for which no more appropriate category is identifiable, basic cryogenic studies relevant to nuclear technology or in which nuclear phenomena are involved (e.g. nuclear alignment at low temperature), vacuum production and techniques at cryogenic temperatures and of interest for nuclear science and technology);

Particle beam production and handling, targets (beam production and transport of electron, neutron, ion, atomic and molecular beams (not for specific applications), nonisotopic electron, neutron and ion sources not developed for specific applications), nuclear target preparation using ion, atomic or molecular beams);

Other aspects of physical science of nuclear relevance

Note: restricted to physical processes or studies of systems or materials of stated nuclear relevance

(other physical sciences such as statistical physics, dynamical systems, thermodynamics, electricity and magnetism, electrodynamics, optics, acoustics, continuum mechanics, etc., that have a relevance for nuclear science and technology)

S72 Physics of elementary particles and fields

Comprehensive coverage is not obligatory for ETDE

Theory of fields and strings (axiomatic, Lagrangian and Hamiltonian approaches, renormalization, field theories in higher dimensions, such as Kaluza-Klein theories, Schwinger source theory, Bethe-Salpeter equations, relativistic wave equations, lattice gauge theory, techniques employed in field theory studies, such as strong-coupling expansions, theories of strings and other extended objects in the context of elementary particles, superstring theory, theory of quantized fields, etc.), symmetry, conservation laws, currents and their properties (Lorentz and Poincare invariance, C, P, T and other discrete symmetries, flavor symmetries, internal symmetries, supersymmetry, spontaneous symmetry breaking, chiral symmetries, current algebras, studies concerning scalar, pseudoscalar, vector, axial vector and tensor currents, etc.), S-matrix theory (scattering matrices, dispersion relations, sum rules, bootstraps, crossing symmetries, Mandelstam representation, Regge formalism, etc.), relativistic scattering theory, unified theories and models (models of electroweak interactions, extensions of gauge or Higgs sector, quark and lepton masses and mixing, applications of electroweak models to specific processes, neutral currents in electroweak interactions, unified theories and models of strong and electroweak interactions, including those that involve gravitation, etc.), Quantum Electrodynamics (QED) (specific calculations and limits of QED, experimental tests of QED), Quantum Chromodynamics (QCD) (general properties, lattice QCD calculations, quark-gluon plasma, experimental tests), models for strong interactions (bag models, statistical models, Regge poles and cuts, peripheral, multiperipheral and multi-Regge models, duality and dual models, bootstrap model, absorptive, optical and eikonal models, potential models, vector-meson dominance, other composite models of quarks, leptons, gauge bosons, symmetry breaking, hadron mass formulas, etc.), interactions, decays and processes (interactions of leptons, i.e. neutrinos, electrons, muons, tauons, and their corresponding antiparticles, among one another and with non-leptons, interactions of photons, interactions of hadrons with other hadrons (e.g., nucleon-nucleon, hyperon-nucleon, pion-baryon, kaon-baryon, meson-meson interactions), decays of mesons, baryons, leptons, intermediate bosons (W^+ , W^- , Z), electromagnetic processes and properties (electromagnetic mass differences, form factors and decays, electromagnetic moments, electromagnetic corrections to strong- and weak- interaction processes, etc.), properties of particles and resonances (properties of baryons and baryon resonances, meson and meson resonances, leptons, other particles, e.g., photons, quarks, intermediate bosons, including hypothetical particles, such as gluons, Higgs bosons, magnetic monopoles, supersymmetric particles, tachyons, etc.)

S73 Nuclear physics and radiation physics

Comprehensive coverage is not obligatory for ETDE

Nuclear Structure

General and average properties of nuclei and nuclear energy levels (masses, binding energies, mass and charge distributions, spin, parity, isospin, spectroscopic factors, static electromagnetic moments, level densities, strength functions, collective levels and giant resonances, Coulomb energies, nuclear forces, few-nucleon systems, nuclear matter, hypernuclei, etc.), nuclear structure models and methods (shell models, collective models, models based on group theory, cluster models, Hartree-Fock and random-phase approximations, etc.)

Radioactivity and electromagnetic transitions (alpha decay, proton-emission decay, decay by emission of heavier composite particles, beta decay, electron and muon capture, including weak-interaction and lepton aspects of beta decay and electron and muon capture by nuclei, and the relation with nuclear matrix elements and nuclear structure), transition probabilities and lifetimes, multipole matrix elements, multipole mixing ratios, internal conversion and extranuclear effects, nuclear resonance fluorescence, angular distribution and correlation measurements of electromagnetic transitions, gamma transitions and level energies, Moessbauer effect, etc.)

Nuclear reactions and scattering (nuclear reactions and scattering models and methods, resonance reactions and scattering, direct reactions, statistical reactions and fluctuations, polarization in reactions and scattering, specific nuclear reactions and scattering (photonuclear reactions and photon scattering, lepton-, nucleon-, deuteron-, triton-, helion-,... and alpha particle-induced reactions and scattering, heavy-ion-induced reactions and scattering, meson and hyperon-induced reactions and scattering, fission, both spontaneous and induced)

Radiation Physics

Note: X radiation, gamma radiation, bremsstrahlung, neutrons, electrons, protons, deuterons, alpha particles, heavy ions, other particles

(interactions of radiations with bulk matter and radiation transport: scattering, absorption, diffusion of radiations as they pass through macroscopic systems, including thermalization, multiplication, and moderation of neutrons, solution of the neutron transport equation and theoretical neutron transport in matter in general geometric configurations such as spheres, cylinders, plates, etc., range-energy relations, energy loss mechanisms and absorption mechanisms, shielding calculations and experiments for which no more appropriate category is identifiable)

S74 Atomic and molecular physics

Comprehensive coverage is not obligatory for ETDE

Theory of electronic structure of atoms and molecules (general theory of electronic structure and transitions, specific calculations and results for atoms relevant to nuclear physics or technology, such as hydrogen, deuterium, tritium, helium, fission products, lanthanides, scandium, technetium, yttrium, and elements with Z greater than 83, and for molecules of hydrogen, deuterium, tritium, helium, fission products, and compounds of technetium and elements with Z greater than 83, effects of molecular interactions on electronic structure of the atoms and molecules specified above, corrections to electronic structure, e.g. hyperfine interactions, isotope effects, radiative and relativistic effects, for the atoms specified above, excited states of the atoms and molecules specified above); Atomic and molecular spectra, interactions with photons (Zeeman and Stark effects, electron paramagnetic resonance (EPR) and relaxation, optical activity, dichroism, magneto-optical and electro-optical effects, and photon collisions with atoms of hydrogen, deuterium, tritium, helium, fission products, lanthanides, scandium, technetium, yttrium, and elements with Z greater than 83, molecules of hydrogen,

deuterium, tritium, helium, fission products, compounds of technetium and elements with Z greater than 83, and elements of interest for thermonuclear fusion, such as lithium, beryllium, boron, carbon, oxygen, neon, magnesium, aluminium, silicon, argon, titanium, vanadium, chromium, iron, nickel, copper, gallium, krypton, niobium, molybdenum, xenon, tantalum and tungsten, fluorescence and phosphorescence of promethium and its compounds and the atoms and molecules specified above, use of nuclear phenomena and techniques in studies of any aspects of atomic and molecular properties and structure, e.g., nuclear magnetic resonance (NMR), nuclear quadrupole resonance (NQR), multiple resonances (DNMR, ENDOR, etc.), Moessbauer effect for the atoms or molecules specified above)

Collision phenomena (general theories and models, experimental and theoretical studies of elastic scattering, excitation, de-excitation, excitation transfer, ionization, dissociation, charge exchange, electron capture, electron loss, electron attachment, or electron detachment in electron-ion, electron-atom, electron-molecule, ion-ion, ion-atom, ion-molecule, atom-atom, and atom-molecule collisions, involving atoms, molecules or ions of nuclear relevance or of interest for thermonuclear fusion)

Experimentally derived information on atomic and molecular properties (masses, abundances, moments, polarizability, fine- and hyperfine-structure constants, ionization potentials, electron affinities, bond strengths, dissociation energies, rotation, vibration and vibration-rotation constants, etc., of atoms of hydrogen, deuterium, tritium, helium, fission products, lanthanides, scandium, technetium, yttrium, and elements with Z greater than 83, molecules of hydrogen, deuterium, tritium, helium, fission products, compounds of technetium and elements with Z greater than 83, and for elements of interest for thermonuclear fusion).

S75 Condensed matter physics, superconductivity and superfluidity

Comprehensive coverage is not obligatory for ETDE

Nuclear techniques in condensed matter physics (advances in the use of nuclear techniques or measurement methods in studies of the structure, including electronic structure, of solids and liquids (e.g., neutron diffraction and scattering, spin-polarized electron scattering, synchrotron -source X-ray scattering, nuclear magnetic resonance and relaxation, including ENDOR, DNMR), muon spin rotation and relaxation, Moessbauer effect and other gamma -ray spectroscopy, positron annihilation);

Solid-state plasma, physics of surfaces, interfaces and thin films (studies of solid-state plasma in bulk matter, surfaces, interfaces and thin films, including electron-hole droplets, physics studies of surfaces, interfaces and thin films of indicated interest for nuclear science and technology);

Physics of direct electricity production: basic studies of magnetohydrodynamics (movement of conducting fluids in magnetic or crossed electric and magnetic fields), electrohydrodynamics (movement of nonconducting fluids in electric fields), thermoelectric effect, thermionic emission, etc., of relevance to energy/nuclear science and technology; Note: for direct energy conversion devices and equipment use S30

Interactions between beams and condensed matter (effects, including channeling, blocking, ion implantation and generation of crystal defects, from bombardment with laser radiation, X-rays, gamma rays, electrons, positrons, neutrons, ions, atoms, and molecules where the interest is in the effect itself at the microscopic level and not in the material in which it takes place, impact phenomena, Auger emission, secondary emission, sputtering, etc., from the collisions of electrons, ions, atoms and molecules with surfaces);

Quantum physics aspects of condensed matter such as superconductivity (both low-temperature and high-temperature superconductivity) (basic superconductivity studies relevant to nuclear technology, basic theory, review studies, general properties, such as magnetization curves, thermodynamic properties, response to electromagnetic fields, nuclear magnetic resonance, flux pinning, critical currents), superconducting devices (application of superconductivity in magnets or other devices of use in nuclear science, including devices using superconductors or superconducting junctions as components; routine applications are excluded), superfluidity (phenomenology, hydrodynamics, transport processes, models, etc., of

superfluid helium-4 (He II), superfluid helium-3 and He II-He-3 mixtures), other quantum aspects of condensed matter (e.g. studies of phenomena relying on quantum statistics, electron-phonon coupling, spin-lattice relaxation, energy bands)

For:

MHD, EHD and thermoelectric generators, thermionic converters use [S30](#)

S77 Nanoscience and nanotechnology

All aspects of **nanoscience and nanotechnology**, which encompasses both the control of matter and the fabrication of devices with critical dimensions in the nanometer size range. Theoretical and experimental studies as well as applications are included.

All applications of radiation in nanoscience and nanotechnology

Nanostructure chemistry and nanomaterials: nanoscale chemical structures; nanocomposites; quantum dots, quantum wells, quantum wires, nanotubes, nanorods, 2D-graphite layers, fullerenes, nanocrystals; sol-gels, quasi crystals; nanoengineered membranes; crystal growth methods like molecular beam epitaxy (MBE), chemical beam epitaxy (CBE), metal-organic chemical vapor deposition (MOCVD), etc., as applied in nanotechnology; properties of nanomaterials and effects of radiation on nanomaterial properties

Nanodevices and nanoelectronics: nanocomputing devices; nanotransistors; nanoelectromechanical systems (NEMS); molecular electronics; nanoscale magnetics, etc.

Nanomedicine and nanotechnology: biomolecular and biomimetic devices; biosensors; molecular motors; bimolecular fabrics; engineered enzymes and proteins; drug discovery and drug delivery systems, etc.

Nanoprocesses: "bottom up" processes like self assembly, directed assembly, self organization; "top down" processes like electron beam nanolithography, ion beam nanolithography, X-ray nanolithography, laser nanomachining; nuclear track membranes; ion etching; nanomechanics; molecular simulation; scanning probe writing and fabrication, etc.

Nanometrology: electron beam techniques (transmission electron microscopy (TEM), high resolution transmission electron microscopy (HRTEM), scanning electron microscopy (SEM), etc.); scanning probe techniques (scanning probe microscopy (SPM), scanning tunneling microscopy (STM), atomic force microscopy (AFM), etc.); optical techniques (near-field scanning optical microscopy, tip-enhanced Raman microscopy, optical tweezers, etc.)

Note: Only if it is of relevance for energy technology or if it is associated with an actual or simulated energy-related application

For:

fabrication and properties of, and radiation effects on, materials on the macroscopic scale use [S36](#)

chemistry of substances on the macroscopic scale use [S37](#)

quantum information, entanglement and teleportation use [S71](#)

S79 Astrophysics, cosmology and astronomy

Application of physical theories and methods to study solar, stellar and galactic origin, structures and evolution, stellar objects and galaxies; and related problems in cosmology

Note: Only if it is of nuclear interest or if it is associated with cosmic radiation, nuclear and high-energy physics.

Fundamental Aspects of Astronomy and Astrophysics: X-ray astronomy, gamma-ray astronomy, infrared astronomy, ultraviolet astronomy, and radio and radar astronomy; Astrophysical processes (in sun, stars, interstellar space etc.): elementary particle, nuclear, atomic and molecular processes and data, spectra and spectral parameters

Solar System: Formation and evolution of the solar and planetary systems; structure and spectra of the Sun, sunspots and solar prominences, radio bursts, etc.; radio emissions from planets, natural radioactivity and age determination of extraterrestrial materials, and radiation belts of planets

N.B. Celestial mechanics and routine astronomical observations, e.g. sky surveys, are excluded.

Stellar systems, galactic and extragalactic objects and systems, Universe: Formation, composition, structure and evolution of stars, stellar systems, star clusters, neutron stars, black holes and galaxies; radio and x-ray sources, quasars, radio galaxies, supernova remnants etc.

Interplanetary/interstellar space: Characteristics of the interstellar medium: magnetic fields, gravitational fields; identification of molecular species in space; dark matter (stellar, interstellar, galactic and cosmological); gravitational collapse; dark energy

Space plasma phenomena: Solar wind plasma, sources of solar wind, stellar wind, galactic wind, plasmasphere, plasma temperature and density, particle acceleration, plasma waves, plasma and MHD instabilities, dusty plasma, plasma interaction with particles and fields, radiation processes

Cosmic radiation: composition, energy spectra, interactions, extensive air showers, cosmic rays propagation and detection, solar radiation, stellar radiation (x-rays, gamma-rays, neutrinos, muons, pions and other elementary particles), induced radioactivity of extraterrestrial material, e.g. meteorites and lunar material.

Cosmology: Origin, formation and evolution of the universe; relict radiation; particle and field theory models for early universe (including cosmic pancakes, cosmic strings, inflationary universe etc.); observational cosmology (Hubble constant, distance scale etc); quantum cosmology; gravitational waves, tests of general relativity.

Methods, equipment and instrumentation: Radio telescopes, X- and gamma-ray telescopes and instrumentation, space-borne and space research instruments, apparatus and components; gravitational wave detectors; spectroscopy; artificial earth satellites and spacecraft; measuring methods in astrophysics.

For:

plasma physics and fusion technology	use S70
nuclear reactions mechanism	use S73
elementary particle processes	use S72
molecular processes and interactions	use S74
radiation detectors and instrumentation not specifically for astrophysical application	use S46
geophysical studies, instrumentation and techniques	use S58
Earth magnetosphere (ionosphere, plasmasphere)	use S58

S96 Knowledge management and preservation

Knowledge Management (to be of use in all sectors of nuclear or energy science and technology) including policies and strategies for energy knowledge management and knowledge preservation programs; methods and tools that have been used to implement knowledge management and preservation programs; terminology, concepts, and techniques associated with knowledge management

Human resources planning and knowledge transfer, practical examples of knowledge management applications within nuclear or energy science and technology, energy education and training, partnerships and networking to support energy knowledge management and education and training

Documentation, data and literature handling: descriptions and evaluations of systems, both manual and computer-based, for collecting, analyzing, evaluating and publishing data, literature and bibliographic information relating to nuclear or energy science and its applications; data libraries, standardization of terminology

For:

electronic and other instrumentation for data acquisition use [S46](#)

S97 Mathematical methods and computing

Mathematical methods and models, simulations and computer codes, programming, computer architecture, supercomputers and supercomputing for applications in nuclear or energy science and technology

For:

Methods and models appropriate to specific subjects see appropriate categories

For example for:

Particle models use [S72](#)

Crystal models use [S36](#) or [S75](#)

For:

electronic and other instrumentation for data acquisition use [S46](#)

S98 Nuclear disarmament, safeguards and physical protection

Legal aspects of **nuclear disarmament**; non-proliferation of nuclear weapons and nuclear-weapon-free zones, including the monitoring of nuclear materials derived from arms reduction and conversion; comprehensive nuclear weapons test ban; national arms control policy and aspects of treaty compliance and verification; legal aspects of **physical protection**; legal aspects of peaceful nuclear explosions, peaceful uses of sea-bed and space; legal aspects of nuclear weapons tests

Safeguards (those measures designed to guard against the diversion of material, such as source and special nuclear material, from uses permitted by law or treaty, and to give timely indication of possible diversion or credible assurance that no diversion has occurred). All technical, non-technical and legal aspects of nuclear safeguards. These aspects include research, development and implementation of systems, techniques, instrumentation and inspection procedures to detect diversion of nuclear material or materials of special interest, such as heavy water from peaceful nuclear activities, and monitoring of nuclear materials derived from arms reduction and conversion; development of nuclear materials accounting systems covering the physical security of materials in transit, in use or in storage; and administrative, political, economic, organizational and other aspects of the development and application of safeguards, including implementation of safeguards to the verification arrangements for regional nuclear-weapon-free-zones and the monitoring of nuclear materials derived from arms reduction and conversion.

S99 General and miscellaneous

This category is intended for research interests of organizations in disciplines for which no specific category has been defined, such as general law. This category encompasses documents dealing with organizations, administration, financing, general descriptions of institutions and programs, directories, reference books, lists of publications, historical,

philosophical and educational aspects.

Note: This category should be used if an item cannot be categorized elsewhere.

Appendix 1. Guide for elements of nuclear interest

This list is provided as a guide to the principal elements of nuclear interest. In addition to the elements mentioned explicitly it also includes **all fission products**. Literature on elements not listed should only be included if positively identified as of nuclear interest. Even for the elements listed, judgment must be used. The study of a large molecule which incidentally includes an element of interest as a minor constituent seldom contributes to the knowledge of the properties of that element, and thus would be outside the scope of INIS.

ACTINIUM	(Ac)
AMERICIUM	(Am)
ASTATINE	(At)
BERKELIUM	(Bk)
BERYLLIUM	(Be)
BORON	(B)
CADMIUM	(Cd)
CALIFORNIUM	(Cf)
CERIUM	(Ce)
CESIUM	(Cs)
CURIUM	(Cm)
DYSPROSIUM	(Dy)
EINSTEINIUM	(Es)
ERBIUM	(Er)
EUROPIUM	(Eu)
FERMIUM	(Fm)
FRANCIUM	(Fr)
GADOLINIUM	(Gd)
HAFNIUM	(Hf)
HOLMIUM	(Ho)
INDIUM	(In)
IODINE	(I)
LANTHANUM	(La)
LAWRENCIUM	(Lr)
LITHIUM	(Li)

NEPTUNIUM	(Np)
NIOBIUM	(Nb)
NOBELIUM	(No)
PLUTONIUM	(Pu)
POLONIUM	(Po)
PRASEODYMIUM	(Pr)
PROMETHIUM	(Pm)
PROTACTINIUM	(Pa)
RADIUM	(Ra)
RADON	(Rn)
RHENIUM	(Re)
RUTHENIUM	(Ru)
SAMARIUM	(Sm)
SCANDIUM	(Sc)
STRONTIUM	(Sr)
TANTALUM	(Ta)
TECHNETIUM	(Tc)
TELLURIUM	(Te)
TERBIUM	(Tb)
THORIUM	(Th)
THULIUM	(Tm)
TUNGSTEN (WOLFRAM)	(W)
URANIUM	(U)
VANADIUM	(V)
YTTERBIUM	(Yb)

LUTETIUM	(Lu)	YTTRIUM	(Y)
MENDELEVIUM	(Md)	ZIRCONIUM	(Zr)
MOLYBDENUM	(Mo)	ALL ELEMENTS WITH Z>103	
NEODYMIUM	(Nd)	ALL FISSION PRODUCTS	

Appendix 2. The international nuclear event scale

for prompt communication of safety significance

LEVEL	DESCRIPTOR	CRITERIA	EXAMPLES
ACCIDENTS			
7	MAJOR ACCIDENT	External release of a large fraction of the radioactive material in a large facility (e.g. the core of a power reactor). This would typically involve a mixture of short and long-lived radioactive fission products (in quantities radiologically equivalent to more than tens of thousands terabecquerels of iodine-131). Such a release would result in the possibility of acute health effects; delayed health over a wide area, possibly involving more than one country; long-term environmental consequences.	Chernobyl NPP, USSR (now in Ukraine), 1986
6	SERIOUS ACCIDENT	External release of radioactive material (in quantities radiologically equivalent to the order of thousands to tens of thousands of terabecquerels of iodine-131). Such a release would be likely to result in full implementation of countermeasures covered by local emergency plans to limit serious health effects.	Kyshtym Reprocessing Plant, USSR (now in Russia), 1957
5	ACCIDENT WITH OFF-SITE RISK	External release of radioactive material (in quantities radiologically equivalent to the order of hundreds to thousands of terabecquerels of iodine-131). Such a release would be likely to result in partial implementation of countermeasures covered by emergency plans to lessen the likelihood of health effects.	Windscale Pile, UK, 1957
		Severe damage to the nuclear facility. This may involve severe damage to a large fraction of the core of a power reactor, a major criticality accident or a major fire or explosion releasing large quantities of radioactivity within the installation.	Three Mile Island, USA, 1979
4	ACCIDENT WITHOUT SIGNIFICANT OFF-SITE RISK	External release of radioactivity resulting in a dose to the most exposed individual off-site of the order of a few millisievert. With such a release the need for off-site protective actions would be generally unlikely expect possibly for local food control.	
		Significant damage to the nuclear facility. Such an	Windscale

		accident might include damage to nuclear plant leading to major on-site recovery problems such as partial core melt in a power reactor and comparable events at non-reactor installations.	Reprocessing Plant, UK, 1973 Saint-Laurent NPP, France, 1980
		Irradiation of one or more workers which results in an overexposure where a high probability of early death occurs.	Buenos Aires Critical Assembly, Argentina, 1983
3	SERIOUS INCIDENT	External release of radioactivity above authorized limits, resulting in a dose to the most exposed individual off site of the order of tenths of millisievert. With such a release, off-site protective measures may not be needed. On-site events resulting in doses to workers sufficient to cause acute health effects and/or an event resulting in a severe spread of contamination for example a few thousand terabecquerels of activity released in a secondary containment where the material can be returned to a satisfactory storage area.	
		Incidents in which a further failure of safety systems could lead to accident conditions, or a situation in which safety systems would be unable to prevent an accident if certain initiators were to occur.	Vandellos NPP, Spain, 1989
2	INCIDENT	Incidents with significant failure in safety provisions but with sufficient defense in depth remaining to cope with additional failures. An event resulting in a dose to a worker exceeding a statutory annual dose limit and/or an event which leads to the presence of significant quantities of radioactivity in the installation in areas not expected by design and which require corrective action.	
1	ANOMALY	Anomaly beyond the authorized operating regime. This may be due to equipment failure, human error or procedural inadequacies. (Such anomalies should be distinguished from situations where operational limits and conditions are not exceeded and which are properly managed in accordance with adequate procedures. These are typically "below scale".)	
BELOW SCALE/ ZERO	DEVIATION	NO SAFETY SIGNIFICANCE	

The doses are expressed in terms of effective dose equivalent (whole body dose). Those criteria where appropriate can also be expressed in terms of corresponding annual effluent discharge limits authorized by National Authorities.

[A] [B] [C] [D] [E] [F] [G] [H] [I] [J] [K] [L] [M] [N] [O] [P] [Q] [R] [S] [T] [U] [V] [W] [X] [Z]

AC power transmission [S24](#)

Abnormal reactor operations [S21](#)

Absorbed dose [S61](#), [S62](#)

Accelerator shielding [S43](#)

Accelerators, particle [S43](#)

 **Accident liability**

nuclear reactor [S22](#)

 **Accidents**

fuel processing cycle [S11](#)

nuclear reactor [S21](#), [S22](#)

radiation source technology [S07](#)

real accidents [S21](#)

Acid mine drainage [S01](#), [S54](#)

 **Acid rain**

abatement [S29](#)

aquatic and atmospheric aspects [S54](#)

biological effects [S63](#)

corrosive effects on building materials [S36](#), [S54](#)

cultural resources [S54](#)

deposition [S54](#)

health hazards [S63](#)

legislation and regulations [S29](#)

monitoring [S54](#)

planning and policy aspects [S29](#)

terrestrial aspects [S54](#)

transport [S54](#)

Acidification, ecological effects [S36](#), [S54](#)

Acoustics [S71](#)

 **Actinides**

analysis and determination [S37](#)

chemical separation studies [S11](#), [S38](#)

Activation analysis [S37](#)

 **Administration**

of (nuclear) institutes and programs [S99](#)

Advanced automotive propulsion systems [S33](#)

 **Age determination (isotope dating)**

objects [S37](#)

terrestrial or extraterrestrial material [S58](#)

 **Agreements**

safeguards [S98](#)

 **Agriculture [S60](#)**

energy conservation See also [S32](#)

hot water use See also [S20](#)

solar process heat See also [S14](#)

 **Air conditioning**

solar [S14](#)

 **Air pollution [S54](#)**

biological effects See also [S63](#)

biomass use and production See also [S09](#)

coal use and processing See also [S01](#)

effects on building materials See also [S36](#)

effects on service life See also [S54](#)
environmental transport See also [S29](#)
flue gas, purification See also [S01](#), [S02](#), [S20](#)
geothermal energy production See also [S15](#)
materials effects See also [S36](#)
natural gas production and use See also [S03](#)
nuclear fuel production and use See also [S11](#)
nuclear reactors See also [S22](#)
oil shale production or use See also [S04](#)
petroleum use and production See also [S02](#)
policy See also [S29](#)
radioactive effluents See also [S11](#), [S22](#)
regulations See also [S29](#)
socioeconomic aspects See also [S29](#)
tar sands processing and use See also [S04](#)
waste use and production See also [S09](#)

 **Air pollution control** [S54](#)

automobiles See also [S33](#)
coal See also [S01](#)
flue gas See also [S01](#), [S20](#)
fossil-fueled power plants See also [S20](#)
natural gas See also [S03](#)
oil shales See also [S04](#)
tar sands See also [S04](#)

Air quality [S29](#)

Aircraft propulsion reactors [S21](#)

Alcohol fuels [S09](#), [S10](#)

Allocations [S29](#)

Alloys [S36](#)

Alpha decay [S73](#)

Alpha particle confinement (plasma) [S70](#)

 **Americum**

analysis and determination [S11](#), [S37](#)
design and operation of radiation sources [S07](#)
radiochemical behavior [S11](#), [S38](#)
separation techniques [S11](#), [S38](#)

 **Ammonia**

biological effects [S63](#)
biosynthesis [S09](#)
chemical preparation [S10](#)
environmental aspects [S54](#)
health hazards [S63](#)
production [S09](#), [S10](#)
safety [S09](#), [S10](#)

Analytical chemistry [S37](#)

Anatomy [S60](#)

 **Animal husbandry**

tracer techniques [S60](#)

Anti de Sitter space [S72](#)













Appliances, energy-efficient [S32](#)









Approximations [S97](#)








Aquatic ecology [S54](#)












Aqueous waste disposal [S54](#)



 **Architecture**





- energy conservation [S32](#)
- solar [S14](#)
-  **Arms control** [S98](#)
 - planning and policy See also [S29](#)
 - treaties See also [S29](#)
- Artificial intelligence [S97](#)
- Assessment of technology impacts [S29](#)
-  **Astatine**
 - analysis and determination [S11](#), [S37](#)
 - radiochemical behavior [S11](#), [S38](#)
 - separation techniques [S11](#), [S38](#)
- Astronomy [S79](#)
- Astrophysics [S79](#)
- Atmospheric chemistry [S54](#)
-  **Atmospheric motion**
 - radioactive contaminants [S54](#)
- Atom collisions [S74](#), [S75](#)
-  **Atomic beams**
 - application in fusion technology [S70](#)
 - application in hot atom chemistry [S38](#)
 - interactions with solids [S75](#)
- Atomic models [S74](#)
- Atomic physics [S74](#)
- Atomic properties, experimental [S74](#)
- Atomic spectra [S74](#)
- Atomic theory [S74](#)
-  **Automation**
 - coal mining [S01](#)
-  **Automobile engines** [S33](#)
 - air pollution control [S54](#)
-  **Automobiles** [S33](#)
 - emission control See also [S54](#)
 - energy conservation See also [S32](#)
 - fuel substitution See also [S08](#), [S29](#)
- Automotive propulsion systems [S33](#)
- Autoradiography [S07](#)
- Axial-vector currents [S72](#)
- BHWR-type reactors [S21](#)
- BWR-type reactors [S21](#)
-  **Bacteria**
 - radiation effects on [S60](#), [S63](#)
-  **Bacteriophages**
 - radiation effects on [S63](#)
- Bag models [S72](#)
- Baryons [S72](#)
- Beam dynamics [S43](#)
- Beam transport systems [S43](#)
-  **Behavior**
 - living organisms [S60](#)
-  **Berkelium**
 - analysis and determination [S11](#), [S37](#)
 - radiochemical behavior [S11](#), [S38](#)
 - separation techniques [S11](#), [S38](#)
-  **Beryllium**













- analysis and determination [S11](#), [S37](#)
- preparation and fabrication [S36](#)
- radiochemical behavior [S11](#), [S38](#)
- separation techniques [S11](#), [S38](#)
- structure and physical properties [S36](#)
- Beta decay [S73](#)
- Bibliographies [S96](#)
- Biochemistry [S60](#)
- Biological radiation effects [S63](#)
- Biology [S63](#)
-  **Biomass** [S09](#)
 - policy and planning [S29](#)
- Biomass fuels [S09](#)
- Biomedical radiography [S61](#), [S62](#)
-  **Biomedical sciences** [S60](#)
 - biological radiation effects See also [S63](#)
 - chemicals metabolism and toxicology See also [S63](#)
 - electricity effects See also [S63](#)
 - electromagnetic radiation effects See also [S63](#)
 - environmental pollutants See also [S63](#)
 - laser radiation effects See also [S63](#)
 - medicine See also [S62](#)
 - microwave radiation effects See also [S63](#)
 - noise effects See also [S63](#)
 - thermal effects See also [S54](#), [S63](#)
 - toxicity of chemicals See also [S63](#)
 - ultraviolet radiation effects See also [S63](#)
-  **Biomimetic processes**
 - solar energy conversion [S14](#)
-  **Biosynthesis**
 - hydrogen production [S08](#)
-  **Biotechnology**
 - applied studies [S09](#)
 - basic studies [S60](#)
- Black holes [S79](#)
-  **Blanket engineering**
 - for fission reactors [S21](#), [S22](#)
 - for fusion power plants [S70](#)
- Body burden [S61](#), [S63](#)
- Boiling water reactors [S21](#)
- Boom towns [S29](#)
- Bootstrap theory [S72](#)
-  **Bosch process**
 - hydrogen production [S08](#)
- Branes [S72](#)
- Brayton power cycles [S42](#)
- Breeder reactors [S21](#)
- Breeding animals [S60](#)
- Breeding blankets [S70](#)
- Building codes and standards [S32](#)
-  **Building materials**
 - energy efficiency [S32](#)
 - life cycle [S54](#)
 - properties [S36](#)





- Buildings [S32](#)
-  **By-products**
 - biomass [S09](#)
 - coal [S01](#)
 - geothermal energy [S15](#)
 - hydrogen fuel [S08](#)
 - natural gas [S03](#)
 - nuclear fuel [S11](#)
 - oil shale [S04](#)
 - petroleum [S02](#)
 - synthetic fuels [S10](#)
 - tar sands [S04](#)
- C1 processes [S01](#)
- CANDU-type reactors [S21](#)
- CMB radiation [S79](#)
- CP invariance [S72](#)
- CPT theorem [S72](#)
- Calculation methods [S97](#)
-  **Californium**
 - analysis and determination [S11](#), [S37](#)
 - design and operation of radiation sources [S07](#)
 - radiochemical behavior [S11](#), [S38](#)
 - separation techniques [S11](#), [S38](#)
- Cancer [S62](#), [S63](#)
- Capacity building [S96](#)
- Carbon corrosion [S36](#)
-  **Carbon dioxide**
 - environmental effects [S54](#)
 - greenhouse effect [S54](#)
-  **Carbon monoxide control**
 - pollution control [S33](#), [S54](#)
-  **Carbonization**
 - coal [S01](#)
-  **Cells**
 - cell culture techniques [S60](#)
 - chemical effects on [S63](#)
 - morphology [S60](#)
 - radiation effects on [S63](#)
 - radioisotopes in [S63](#)
- Central receiver power systems [S14](#)
- Ceramics [S36](#)
- Cermets [S36](#)
- Charcoal [S09](#)
- Charged particle transport [S73](#)
-  **Chemical effluents**
 - air [S54](#)
 - diffusion [S54](#)
 - ecological concentration [S54](#)
 - metabolism [S63](#)
 - nuclear reactors [S22](#), [S54](#)
 - soil [S54](#)
 - toxicity [S63](#)
 - water [S54](#)













- Chemical energy storage [S25](#)
- Chemical metabolism [S63](#)
- Chemical properties [S37](#), [S38](#)
- Chemical radiation effects [S38](#)
-  **Chemical reactions**
 - high temperature [S37](#)
- Chemical toxicity [S63](#)
- Chemistry [S37](#), [S38](#)
- Chemonuclear reactors [S21](#)
- Chiral symmetry [S72](#)
-  **Chromosome aberrations**
 - radiation-induced [S60](#), [S63](#)
- Classical mechanics [S71](#)
-  **Climates**
 - forecasting [S29](#), [S54](#)
- Co-fired boilers [S20](#)
-  **Coal [S01](#)**
 - biological effects See also [S63](#)
 - consumption See also [S29](#)
 - desulfurization See also [S20](#), [S54](#)
 - prices See also [S29](#)
 - supply and demand See also [S29](#)
 - toxicity See also [S63](#)
 - trade See also [S29](#)
 - use effects See also [S54](#)
 - waste management See also [S54](#)
-  **Coal gasification**
 - hydrogen production [S08](#)
 - processes [S01](#)
-  **Coal industry [S01](#)**
 - economics See also [S29](#)
 - legislation See also [S29](#)
 - pollution See also [S54](#)
 - pollution control See also [S54](#)
 - regulations See also [S29](#)
 - waste management See also [S54](#)
-  **Coal liquids [S01](#)**
 - biological effects [S63](#)
-  **Coal mines [S01](#)**
 - reclamation See also [S54](#)
 - site surveys See also [S54](#)
-  **Coal mining [S01](#)**
 - purification See also [S54](#)
 - radioactivity See also [S54](#)
- Coal products [S01](#)
-  **Cogeneration [S32](#)**
 - policy [S29](#)
-  **Coke**
 - production [S01](#)
- Coke ovens [S01](#)
- Cold fusion [S70](#)
- Collective dose [S61](#)
- Collision phenomena [S74](#)








- Combined cycle power plants [S20](#)
-  **Combustion**
 - biomass fuels [S09](#)
 - chemistry [S37](#)
 - coal [S01](#)
 - hydrogen [S08](#)
 - natural gas [S03](#)
 - petroleum [S02](#)
 - petroleum products [S02](#)
 - synthetic fuels [S10](#)
- Combustion systems [S42](#)
- Commercial waste management [S32](#)
- Commercialization [S29](#)
- Community energy systems [S32](#)
- Composite materials [S36](#)
-  **Compressed gases**
 - energy storage [S25](#)
- Computer architecture [S97](#)
- Computer codes [S97](#)
- Computer programs [S97](#)
- Computerized models [S97](#)
- Computers [S97](#)
- Concentrators, solar [S14](#)
- Concrete [S36](#)
- Condensed matter [S75](#)
- Congressional hearings [S29](#)
- Conservation laws (physics) [S72](#)
-  **Construction economics**
 - nuclear power plant [S21](#)
- Consumer motivation [S29](#), [S32](#)
- Consumer products [S32](#)
-  **Containers**
 - radioactive materials [S42](#)
-  **Contamination, radioactive**
 - monitoring of, in earth atmosphere [S54](#)
 - monitoring of, in soils [S54](#)
 - monitoring of, in surface waters [S54](#)
 - of food and animal feed [S60](#)
 - of food chain [S54](#)
 - of man, animals, plants, microorganisms [S63](#)
 - of materials, structures, equipment, prevention of [S61](#)
 - of the environment as consequence of accidents [S11](#), [S21](#), [S54](#)
-  **Control systems**
 - coal mining [S01](#)
 - fusion [S70](#)
 - nuclear reactor [S22](#)
 - vehicle emission [S33](#)
-  **Cooling systems**
 - buildings [S32](#)
 - nuclear reactors [S22](#)
 - thermonuclear reactors [S70](#)
-  **Cooling towers**
 - thermal plumes [S20](#), [S54](#)








- Cooling, solar [S14](#)
- Corrosion [S36](#)
- Corrosive effects on materials in environment [S54](#)
- Cosmic microwave background [S79](#)
- Cosmic radiation [S79](#)
- Cosmic rays propagation [S79](#)
- Cosmic strings [S79](#)
- Cosmology [S79](#), [S79](#)
- Cost benefit studies [S29](#), [S54](#)
- Criticality accidents [S21](#), [S22](#)
-  **Criticality studies**
 - nonreactor [S42](#)
- Crops [S60](#)
- Cryogenic devices [S71](#)
- Cryogenic equipment [S71](#)
- Cryogenic power transmission [S24](#)
- Cryogenic storage, hydrogen [S08](#)
- Cryogenics [S71](#)
-  **Cultural objects**
 - degradation [S29](#), [S36](#), [S54](#)
-  **Curium**
 - analysis and determination [S37](#)
 - chemical separation studies [S11](#), [S38](#)
- Current algebra [S72](#)
- Current drive, plasma [S70](#)
- Cytology [S60](#)
-  **DC power transmission** [S24](#)
 - Decommissioning, fuel cycle installations See also [S11](#)
 - accelerators See also [S43](#)
 - fuel fabrication plants See also [S22](#)
 - nuclear equipment See also [S42](#)
 - specific reactors See also [S21](#)
-  **Dams**
 - hydropower [S13](#)
- Dark energy [S79](#)
- Dark matter [S79](#)
- Data libraries [S97](#)
- Database management [S97](#)
- Daylighting [S32](#)
- De Sitter space [S72](#)
-  **Decontamination**
 - chemical [S38](#), [S54](#)
 - of earth atmosphere [S54](#)
 - of food and animal feed [S60](#)
 - of man, animals, plants, microorganisms, materials, structures, equipment [S61](#)
 - of soils [S54](#)
 - of surface waters [S54](#)
-  **Degradation**
 - composites [S36](#)
 - cultural objects [S36](#), [S54](#)
 - materials [S36](#)
 - plastics [S36](#)
-  **Denitrification**








- flue gas [S01](#), [S20](#), [S54](#)
- natural gas [S03](#)
- shale oil [S04](#)
- tar sands [S04](#)
-  **Desulfurization**
 - coal [S01](#)
 - flue gas [S01](#), [S02](#), [S20](#), [S54](#)
 - natural gas [S03](#)
 - petroleum [S02](#)
 - shale oil [S04](#)
 - tar sands [S04](#)
-  **Deuterium**
 - heavy water production [S07](#)
 - isotope separation [S07](#)
- Deuteron reactions [S73](#)
-  **Diagnostic techniques**
 - medicine [S62](#)
 - plasma [S70](#)
-  **Diesel engines**
 - automobile [S33](#)
-  **Direct energy conversion**
 - EHD generators [S30](#)
 - MHD generators [S30](#)
 - fuel cells [S30](#)
 - in fusion power plants [S70](#)
 - physics [S75](#)
 - thermionic converters [S30](#)
 - thermoelectric generators [S30](#)
-  **Direct energy utilization**
 - geothermal energy [S15](#)
-  **Diseases**
 - basic studies of human [S60](#), [S63](#)
 - basic studies of non-human [S63](#)
 - diagnosis of human [S62](#)
 - new applications of tracers [S60](#), [S63](#)
 - therapy of human [S62](#)
- Disinfestation by radiation techniques [S60](#)
-  **Dispersion relations**
 - elementary particles [S72](#)
-  **Dissociation**
 - atomic [S74](#)
- Distributed collector solar power systems [S14](#)
-  **District cooling**
 - public utilities [S32](#)
-  **District heating**
 - policy [S29](#)
- Diverters (fusion energy) [S70](#)
- Documentation [S96](#)
- Dosemeters [S46](#)
- Dosimetry [S61](#)
-  **Drilling**
 - equipment [S42](#)
 - facilities [S42](#)
 - geothermal [S15](#)








- natural gas [S03](#)
- petroleum [S02](#)
-  **Dry storage**
 - spent fuel [S11](#)
-  **Drying**
 - solar [S14](#)
-  **Ducts**
 - MHD generators [S30](#)
- Early universe [S79](#)
- Earth atmosphere [S54](#)
- Earth satellites [S79](#)
- Earth-sheltered buildings [S29](#)
- Earthquakes [S58](#)
-  **Economics** [S29](#)
 - air transport See also [S32](#)
 - alcohol fuels See also [S09](#), [S10](#)
 - batteries See also [S25](#)
 - biomass fuels See also [S09](#)
 - coal industry See also [S01](#)
 - electric power See also [S20](#), [S29](#)
 - energy industry See also [S29](#)
 - energy storage See also [S25](#)
 - fossil fuels See also [S29](#)
 - fossil-fueled power plants See also [S20](#)
 - fusion technology See also [S70](#)
 - geothermal energy See also [S15](#), [S29](#)
 - hydroenergy See also [S13](#)
 - hydrogen economy See also [S08](#), [S29](#)
 - land transport See also [S32](#)
 - marine transport See also [S32](#)
 - natural gas See also [S03](#)
 - natural gas industry See also [S03](#)
 - nuclear power plants See also [S21](#), [S29](#)
 - nuclear safeguards See also [S98](#)
 - oil shale industry See also [S04](#)
 - oil shales See also [S04](#)
 - petroleum industry See also [S02](#), [S29](#)
 - pipeline transport See also [S32](#)
 - planning See also [S29](#)
 - plutonium recycling See also [S11](#)
 - policy See also [S29](#)
 - radiation sources See also [S07](#), [S29](#)
 - radioactive waste disposal See also [S11](#), [S12](#)
 - rail transport See also [S32](#)
 - renewable energy sources See also [S29](#)
 - resource development See also [S29](#)
 - solar energy See also [S14](#), [S29](#)
 - spent fuels See also [S11](#)
 - synthetic fuels See also [S10](#), [S29](#)
 - tar sand industry See also [S04](#)
 - tar sands See also [S04](#)
 - tidal power See also [S16](#), [S29](#)
 - uranium enrichment See also [S11](#)
 - wind power See also [S17](#)







- Education [S96](#)
- Education and training [S96](#)
- Elastomers [S36](#)
- Electric batteries [S25](#)
-  [Electric energy storage](#)
 - capacitors [S25](#)
-  [Electric generators](#) [S20](#)
 - superconducting [S75](#)
-  [Electric motors](#)
 - superconducting [S75](#)
-  [Electric power](#)
 - biological effects [S63](#)
 - coalmines [S01](#)
 - consumption [S32](#)
 - consumption statistics [S29](#)
 - demand [S29](#)
 - distribution [S24](#), [S29](#)
 - economics [S20](#), [S29](#)
 - generation [S20](#), [S29](#)
 - hazards [S63](#)
 - market [S29](#)
 - policy [S29](#)
 - prices [S29](#)
 - public relations [S29](#)
 - thefts [S29](#)
 - transmission [S24](#), [S29](#)
 - utility management [S29](#)
- Electric power engineering [S20](#), [S24](#)
-  [Electric power generation](#) [S20](#), [S29](#)
 - tidal power See also [S16](#)
 - wind power See also [S17](#)
-  [Electric power plants](#)
 - fossil fuel [S20](#)
 - nuclear [S21](#)
 - solar photovoltaic [S14](#)
 - solar thermal [S14](#)
 - tidal [S16](#)
-  [Electric power systems](#)
 - central receiver solar [S14](#)
 - distributed collector solar [S14](#)
 - ocean thermal [S14](#)
- Electric utilities [S29](#)
-  [Electricity](#)
 - biological effects [S63](#)
-  [Electrochemistry](#) [S37](#)
 - fuel cells [S30](#)
- Electrohydrodynamic generators [S30](#)
-  [Electrohydrodynamics](#)
 - theoretical [S75](#)
-  [Electrolysis](#)
 - hydrogen production [S08](#)
- Electromagnetic form factors [S72](#)
-  [Electromagnetic interactions](#) [S72](#)
 - biological effects [S63](#)

- Electromagnetic transitions [S73](#)
- Electron attachment [S74](#)
- Electron beam fusion [S70](#)
-  **Electron beams**
 - production [S71](#)
- Electron collisions [S74](#), [S75](#)
- Electron detachment [S74](#)
- Electron sources [S71](#)
- Electronic circuits [S42](#)
- Electronic devices [S42](#)
-  **Electronic structure**
 - theory [S74](#)
-  **Electronic systems**
 - radiation effects [S46](#)
- Electroweak interaction models [S72](#)
- Elementary particles [S72](#)
- Embryology [S60](#)
- Emergency measures to ensure energy supplies [S29](#)
- Employment, social impact [S29](#)
- Energy accounting [S29](#)
- Energy analysis [S29](#)
-  **Energy auditing** [S29](#)
 - technical aspects [S32](#)
-  **Energy conservation** [S32](#)
 - agriculture See also [S32](#)
 - buildings See also [S32](#)
 - environmental aspects See also [S29](#), [S54](#)
 - health hazards See also [S63](#)
 - industry See also [S32](#)
 - policy See also [S29](#)
 - public opinion See also [S29](#)
 - socioeconomic aspects See also [S29](#)
 - statistics See also [S29](#)
 - thermionic See also [S30](#)
 - thermoelectric See also [S30](#)
 - tidal power plants See also [S16](#)
 - transportation See also [S32](#)
 - waste heat utilization See also [S32](#)
-  **Energy consumption** [S29](#), [S32](#)
 - agriculture See also [S32](#)
 - buildings See also [S32](#)
 - end use sectors See also [S29](#)
 - industry See also [S32](#)
 - transportation See also [S32](#)
-  **Energy conversion**
 - direct [S30](#)
 - electrohydrodynamics [S30](#)
 - fuel cells [S30](#)
 - geothermal [S15](#)
 - magnetohydrodynamics [S30](#)
 - photovoltaic [S14](#)
 - solar [S14](#)
 - thermionic [S30](#)
 - thermoelectric [S30](#)

- tidal [S16](#)
- water wave [S16](#)
- wind [S17](#)
- Energy demand [S29](#)
- Energy expenditures [S29](#)
- Energy impacts [S29](#)
-  [Energy levels,](#)
 - nuclear [S73](#)
-  [Energy management](#) [S29](#)
 - technical aspects [S32](#)
- Energy modeling [S97](#)
- Energy policy [S29](#)
- Energy prices [S29](#)
- Energy programs [S29](#)
- Energy regulations [S29](#)
- Energy research [S29](#)
-  [Energy source development](#)
 - sociology [S29](#)
-  [Energy sources](#)
 - agriculture [S32](#)
 - conservation [S29](#)
 - development [S29](#)
 - industry [S32](#)
-  [Energy storage](#) [S25](#)
 - fusion energy See also [S70](#)
 - off-peak See also [S20](#)
 - planning and policy See also [S29](#)
 - policy See also [S29](#)
 - pumped water See also [S13](#)
 - safety See also [S25](#)
- Energy substitution [S29](#)
- Energy supply [S29](#)
- Energy transport, policy [S29](#)
- Energy utilization [S29](#)
- Energy-level transitions, nuclear [S73](#)
- Engineering [S42](#)
-  [Engines](#) [S33](#)
 - solar heat [S14](#)
- Enhanced recovery [S02](#)
- Enriched uranium [S11](#), [S29](#)
- Environment [S54](#)
-  [Environmental aspects policy](#) [S29](#)
 - coal See also [S01](#), [S54](#)
 - fusion fuels See also [S54](#)
 - geothermal See also [S15](#), [S54](#)
 - hydrocarbon fuel See also [S09](#), [S10](#), [S54](#)
 - hydrogen fuels See also [S08](#), [S54](#)
 - inorganic hydrogen compound fuels See also [S10](#)
 - natural gas See also [S03](#), [S54](#)
 - nuclear fuel See also [S11](#), [S54](#)
 - nuclear fuel cycle See also [S11](#)
 - oil shale See also [S04](#), [S54](#)
 - petroleum See also [S02](#), [S54](#)
 - solar energy See also [S14](#), [S54](#)

- tar sands See also [S04](#), [S54](#)
- tidal power See also [S16](#), [S54](#)
- use and production of alcohol fuels See also [S09](#), [S10](#), [S54](#)
- water resources See also [S54](#)
- wind power See also [S17](#), [S54](#)
- Environmental assessment [S54](#)
- Environmental impact statements [S29](#)
- Environmental legislation [S29](#)
- Environmental materials [S36](#)
- Environmental policy [S29](#)
- Environmental quality [S29](#)
-  **Environmental regulations** [S29](#)
 - coal industry See also [S01](#)
 - electric power plants See also [S20](#)
 - fossil-fueled power plants See also [S20](#)
 - geothermal energy See also [S15](#)
 - hydroelectric power See also [S13](#)
 - natural gas industry See also [S03](#)
 - nuclear fuels See also [S11](#)
 - nuclear power plants See also [S21](#), [S22](#)
 - nuclear ships See also [S21](#)
 - oil shale industry See also [S04](#)
 - petroleum industry See also [S02](#)
 - solar industry See also [S14](#)
 - tar sands industry See also [S04](#)
 - tidal power See also [S16](#)
 - wind power See also [S17](#)
- Environmental standards [S29](#)
-  **Environmental surveys** [S54](#)
 - nuclear reactors See also [S22](#)
 - oil shale See also [S04](#)
 - tar sands See also [S04](#)
 - tidal power See also [S16](#)
 - wind power See also [S17](#)
- Environmental transport [S54](#)
-  **Erosion** [S36](#)
 - cultural resources [S54](#)
-  **Ethane**
 - biosynthesis [S09](#)
-  **Ethanol**
 - biosynthesis [S09](#)
-  **Exhaust gases**
 - air pollution control [S33](#), [S54](#)
- Exhaust systems (fusion) [S70](#)
-  **Exploration**
 - coal [S01](#)
 - geothermal [S15](#)
 - natural gas [S03](#)
 - oil shale [S04](#)
 - petroleum [S02](#)
 - tar sands [S04](#)
 - thorium ores [S11](#)
 - uranium ores [S11](#)

- Extensive air showers [S79](#)
- External combustion engines [S33](#)
-  **Extraction**
 - particle beam [S43](#)
- Extragalactic objects [S79](#)
- Extraterrestrial material [S79](#)
- Federal research [S29](#)
- Feed materials plants [S11](#)
- Field theories [S72](#)
- First wall [S70](#)
- Fischer-Tropsch synthesis [S01](#)
- Fission, theory [S73](#)
- Flames [S37](#)
- Florida current [S13](#)
-  **Flue gas**
 - denitrification [S01](#), [S20](#), [S54](#)
 - desulfurization [S01](#), [S02](#), [S20](#), [S54](#)
 - environmental aspects [S20](#), [S54](#)
 - fossil-fueled power plants [S20](#)
 - purification [S01](#), [S20](#), [S54](#)
 - radioactivity [S01](#), [S54](#)
- Fluid dynamics [S71](#), [S75](#)
- Fluid flow [S42](#)
- Fluidized-bed combustion coal [S01](#)
- Fluorescence [S37](#), [S74](#)
-  **Fly ash**
 - electric power plants [S20](#), [S54](#)
 - waste management [S01](#), [S20](#), [S54](#)
-  **Flywheels**
 - energy storage [S25](#)
 - propulsion [S33](#)
- Food chains [S54](#)
- Food preservation [S60](#)
-  **Fossil fuels**
 - energy policy [S29](#)
 - power plants [S20](#)
-  **Fossil-fueled power plants** [S20](#)
 - environmental aspects See also [S29](#), [S54](#)
 - land use See also [S54](#)
 - pollution control See also [S54](#)
 - power generation See also [S29](#)
 - site selection See also [S54](#)
 - thermal effluents See also [S54](#)
- Fuel cells [S30](#)
- Fuel conservation [S32](#)
-  **Fuel consumption**
 - agriculture [S32](#)
 - buildings [S32](#)
 - coal [S01](#)
 - end use sectors [S29](#)
 - industries [S32](#)
 - natural gas [S03](#)
 - oil shales [S04](#)
 - petroleum [S02](#)

- tar sands [S04](#)
- transportation [S32](#)
- Fuel gas, properties [S01](#)
- Fuel oils [S02](#), [S10](#)
- Fuel pellets - fusion energy [S70](#)
- Fuel reprocessing plants [S11](#)
- Fuel slurries - coal [S01](#)
-  **Fuel substitution**
 - automobiles [S33](#)
 - power plants [S20](#)
- Fueling systems - fusion energy [S70](#)
-  **Fuels**
 - automotive [S33](#)
 - biomass [S09](#)
 - coal [S01](#)
 - fusion [S70](#)
 - hydrocarbon [S09](#), [S10](#)
 - inorganic hydrogen [S08](#), [S10](#)
 - natural gas [S03](#)
 - shale oils [S04](#)
 - synthetic [S10](#)
 - tar sands [S04](#)
- Fusion energy [S70](#)
- Fusion fuel cycle economics [S70](#)
-  **Fusion fuels** [S70](#)
 - economics See also [S29](#)
 - environmental aspects, use and production See also [S54](#)
 - policy See also [S29](#)
 - regulations See also [S29](#)
- Fusion reactions (plasma) [S70](#)
- Fusion technology [S70](#)
- Galactic objects [S79](#)
- Galaxies [S79](#)
- Gamma decay [S73](#)
-  **Gamma spectroscopy** [S37](#)
 - condensed matter [S75](#)
- Gamma transitions [S73](#)
- Gamma transport theory [S73](#)
- Gamma-ray telescopes [S79](#)
- Gas flow [S42](#)
- Gas spills [S03](#)
- Gaseous diffusion process [S11](#)
- Gaseous wastes [S20](#), [S54](#)
-  **Gasification**
 - biomass [S09](#)
 - coal [S01](#)
- Gauge bosons [S72](#)
- General relativity [S71](#)
- Genetic engineering [S60](#)
- Genetics [S60](#)
- Geochemical surveys [S15](#), [S58](#)
-  **Geochemistry** [S58](#)
 - geothermal theory [S15](#)

Geochronology [S58](#)

Geological materials - weathering [S54](#)

 **Geology** [S58](#)

coal See also [S01](#)

geothermal systems See also [S15](#)

hydroelectric See also [S13](#)

natural gas See also [S03](#)

oil shale See also [S04](#)

petroleum See also [S02](#)

radioactive waste disposal See also [S12](#)

tar sands See also [S04](#)

thorium ores See also [S11](#)

Geophysical surveys [S58](#)

Geophysics [S58](#)

Geosciences [S58](#)

 **Geothermal energy** [S15](#)

economic aspects See also [S29](#)

environmental aspects, use and production See also [S54](#)

legal aspects See also [S29](#)

policy See also [S29](#)

waste management See also [S54](#)

Geothermal engineering [S15](#)

Geothermal exploration [S15](#)

 **Geothermal fields** [S15](#)

site surveys [S54](#)

Geothermal power plants [S15](#)

Geothermal resources [S15](#), [S29](#)

Geothermal systems [S15](#)

Geothermal theory [S15](#)

Geothermometry [S15](#)

Giant resonance [S73](#)

Gluons [S72](#)

 **Government policies** [S29](#)

coal See also [S01](#)

geothermal energy See also [S15](#)

hydroenergy See also [S13](#)

hydrogen economy See also [S08](#)

isotope technology See also [S11](#)

natural gas See also [S03](#)

nuclear fuels See also [S11](#)

nuclear weapons See also [S98](#)

oil shales See also [S04](#)

petroleum See also [S02](#)

radiation source technology See also [S11](#)

synthetic fuels See also [S10](#)

tar sands See also [S04](#)

Graphite [S36](#)

Graphite-moderated reactors [S21](#)

Gravitation theory [S71](#)










Gravitational collapse [S79](#)









Gravitational wave detectors [S79](#)













Greenhouse effect [S54](#)








Ground water [S54](#)

Hadron interactions [S72](#)

- Handling equipment [S42](#)
-  [Hazardous materials](#) [S29](#)
 - pollution control See also [S54](#)
 - waste disposal See also [S54](#)
-  [Health and safety](#) [S60](#)
 - coal miners See also [S01](#)
 - human populations See also [S29](#)
 - miners See also [S01](#), [S11](#)
 - natural gas industry See also [S03](#)
 - nuclear fuels industry See also [S11](#)
 - oil shale industry See also [S04](#)
 - personnel chemical See also [S63](#)
 - radiological See also [S11](#), [S22](#), [S63](#)
 - tar sands industry See also [S04](#)
- Health physics [S61](#)
- Heat pumps [S32](#)
-  [Heat recovery](#)
 - electric power generation [S20](#)
 - industries [S32](#)
 - use policy [S29](#)
-  [Heat storage](#) [S25](#)
 - solar energy [S14](#)
-  [Heat transfer](#) [S42](#)
 - air plumes See also [S54](#)
 - power plant equipment See also [S20](#)
 - soil heat See also [S54](#)
 - water plumes See also [S54](#)
-  [Heat utilization](#) [S29](#)
 - agriculture See also [S32](#)
 - geothermal See also [S15](#)
 - power plants See also [S20](#)
 - solar thermal See also [S14](#)
 - waste See also [S32](#)
- Heated effluents [S54](#)
-  [Heating](#)
 - buildings [S32](#)
 - geothermal [S15](#)
 - solar [S14](#)
-  [Heating systems](#) [S32](#)
 - fusion energy [S70](#)
- Heavy water [S07](#)
- Heavy-ion fusion reactions [S73](#)
- Heavy-ion reactions [S73](#)
- Heavy-water moderated reactors [S21](#)
- Heliostats [S14](#)
- Helium II [S75](#)
- Helium reactions [S70](#), [S73](#)
- Higgs bosons [S72](#)
-  [High energy physics](#) [S72](#)
 - instrumentation [S46](#)
- High-Tc superconductors [S75](#)
- High-temperature gas-cooled reactors [S21](#)
- Horticulture [S60](#)
- Hot-atom chemistry [S38](#)

- Hubble constant [S79](#)
- Human resources planning [S96](#)
- Hybrid reactors [S70](#)
-  **Hybrid systems**
 - solar energy [S14](#)
- Hydrazine [S10](#)
- Hydrocarbon fuels [S01](#), [S09](#), [S10](#)
-  **Hydrocarbons**
 - biological effects [S63](#)
 - coal products [S01](#)
 - ecological concentration [S54](#)
 - environmental transport [S54](#)
 - metabolism [S63](#)
 - petroleum products [S02](#)
 - pollution control [S54](#)
 - toxicity [S63](#)
-  **Hydroelectric Power** [S13](#)
 - environmental aspects See also [S54](#)
 - geology See also [S58](#)
 - land use See also [S54](#)
 - licensing See also [S29](#)
 - meteorology See also [S54](#)
 - planning See also [S29](#)
 - policy See also [S29](#)
 - regulations See also [S29](#)
 - site surveys See also [S54](#)
 - thermal effluents See also [S54](#)
-  **Hydrogen** [S08](#)
 - energy planning and policy See also [S29](#)
 - inorganic compound fuels See also [S10](#)
 - policy See also [S29](#)
-  **Hydrogen fuels**
 - automobile [S33](#)
 - inorganic compounds [S10](#)
 - transportation sector [S33](#)
- Hydrogen production [S08](#)
- Hydrogen storage [S08](#)
- Hydrogen-based economy [S08](#)
-  **Hydrology** [S58](#)
 - oil shales See also [S04](#)
 - site surveys See also [S54](#)
 - tar sands See also [S04](#)
- Hydroxyl radicals [S38](#)
- Hyperfine-structure constants [S74](#)
- Hypernuclei [S73](#)
- Hyperon reactions [S73](#)
- Hyperonic atoms [S74](#)
- Impact fusion [S70](#)
-  **Incineration**
 - electric power generation [S20](#), [S54](#)
-  **Indoor air pollution** [S54](#)
 - socioeconomic aspects [S29](#)

- Indoor air quality [S54](#)
- Industrial equipment energy conservation [S32](#)
-  **Industrial plants**
 - pollution control [S54](#)
-  **Industrial process heat**
 - solar [S14](#)
-  **Industrial processes**
 - energy conservation [S32](#)
- Industrial waste management [S32](#)
-  **Industrial waste recycling**
 - energy recovery [S32](#)
-  **Industries**
 - energy conservation [S32](#)
- Inertial confinement fusion [S70](#)
- Inflationary universe [S79](#)
- Information handling [S96](#)
- Information retrieval [S96](#)
- Information systems [S96](#)
-  **Injection**
 - biological-medical [S62](#)
 - particle beam [S43](#)
- Inorganic chemistry [S37](#)
- Inorganic hydrogen compound fuels [S10](#)
-  **Instrumentation**
 - miscellaneous [S47](#)
 - radiation [S46](#)
- Intermediate bosons [S72](#)
- Intermetallic compounds [S36](#)
- Internal combustion engines [S33](#)
- Interplanetary space [S79](#)
- Interstellar space [S79](#)
- Invariance principles [S72](#)
-  **Invertebrates**
 - baseline ecology [S54](#)
 - chemical toxicology [S63](#)
- Ion beam fusion [S70](#)
- Ion beams - production [S71](#)
- Ion channeling [S36](#), [S75](#)
- Ion collisions [S74](#), [S75](#)
- Ion implantation [S75](#)
- Ion optics [S43](#)
-  **Ion sources**
 - accelerator [S43](#)
 - design [S71](#)
-  **Irradiation effects**
 - instruments [S46](#)
 - materials [S36](#)
- Irradiation reactors [S21](#)
- Isotope dating [S58](#)
- Isotope effects [S37](#)
-  **Isotope production**
 - radioisotopes [S38](#)
 - reactors [S21](#)
-  **Isotope separation**

- heavy water [S07](#)
- industrial processes [S07](#)
- physicochemical [S37](#)
- radioisotopes [S38](#)
- stable isotopes, chemical [S37](#)
- Isotopic exchange [S37](#)
- Josephson junctions [S75](#)
- Kaluza-Klein Theories [S72](#)
- Knowledge management [S96](#)
- Knowledge preservation [S96](#)
- Knowledge transfer [S96](#)
-  **Labeling**
 - radioisotopes [S38](#)
 - stable isotopes [S37](#)
-  **Labelled compounds**
 - diagnostic uses [S62](#)
 - preparation [S37](#), [S38](#)
 - stable isotopes [S37](#)
 - therapeutic uses [S62](#)
 - tissue distribution [S60](#), [S62](#)
-  **Land pollution** [S54](#)
 - policy [S29](#)
-  **Land use** [S29](#), [S54](#)
 - conservation aspects See also [S32](#)
 - fossil-fueled power plants See also [S20](#)
-  **Landscaping**
 - Laser fusion [S70](#)
 - aesthetics [S29](#)
 - energy conservation [S32](#)
 - environmental effects [S54](#)
 - land reclamation [S54](#)
 - pollution control [S54](#)
- Laser isotope separation [S11](#)
- Lasers [S42](#), [S63](#)
- Lattice field theory [S72](#)
- Lattice gauge theory [S72](#)
- Learning and training [S96](#)
-  **Legal aspects**
 - nuclear reactor accidents [S22](#)
 - power reactors [S21](#)
-  **Legislation** [S29](#)
 - biomass fuels See also [S09](#)
 - coal industry See also [S01](#)
 - energy storage See also [S25](#)
 - fossil-fueled power plants See also [S20](#)
 - geothermal energy See also [S15](#)
 - hydro energy See also [S13](#)
 - hydrogen industry See also [S08](#)
 - natural gas industry See also [S03](#)
 - nuclear fuels See also [S11](#)
 - nuclear power plants See also [S21](#)
 - oil shale industry See also [S04](#)
 - petroleum industry See also [S02](#)
 - power transmission and distribution See also [S24](#)

solar energy See also [S14](#)
synthetic fuels See also [S10](#)
tar sands industry See also [S04](#)
tidal power See also [S16](#)
wave power See also [S16](#)
wind energy See also [S17](#)

 **Leptons** [S72](#)

reactions [S73](#)

Library management [S96](#)

 **Licensing**

hydroelectric power plants [S13](#)

hydropower plants [S13](#)

nuclear power plants [S21](#)

nuclear-powered ships [S21](#)

Lighting systems [S32](#)

Lignite [S01](#)

Limiters (fusion technology) [S70](#)

Liquefaction - coal [S01](#)

 **Liquefied gases**

energy storage [S25](#)

Liquefied natural gas [S03](#)

 **Liquid metals** [S36](#)

fluid flow [S42](#)

Load management [S29](#)

Local government research [S29](#)

 **M-theory**

cosmology [S79](#)

quantum fields [S72](#)

MHD equilibrium (plasma) [S70](#)

Magnet coils (fusion technology) [S70](#)

Magnetic confinement (fusion technology) [S70](#)

Magnetic field configurations (fusion) [S70](#)

 **Magnetic fields**

biological effects [S63](#)

physics [S71](#)

Magnetic fusion energy [S70](#)

Magnetic monopoles [S72](#)

Magnetohydrodynamic generators [S30](#)

Magnetohydrodynamics [S75](#)

Mandelstam representation [S72](#)

Marine engineering [S42](#)

 **Marketing**

biomass fuels [S09](#)

coal [S01](#)

electric power [S20](#), [S24](#)

geothermal energy [S15](#)

hydro energy [S13](#)

hydrogen fuel [S08](#)

natural gas [S03](#)

nuclear fuels [S11](#)

oil shales [S04](#)

petroleum [S02](#)

policy [S29](#)

radioisotopes [S07](#)

shale oil [S04](#)
solar energy [S14](#)
synthetic fuels [S10](#)
tar sands [S04](#)
tidal power [S16](#)
wave power [S16](#)
wind energy [S17](#)

 **Materials** [S36](#)

MHD generators See also [S30](#)
agriculture See also [S60](#)
building systems See also [S32](#)
conservation See also [S32](#)
electric batteries See also [S25](#)
fusion devices See also [S32](#), [S70](#)
surface properties general See also [S75](#)
thermionic converters See also [S30](#)

 **Materials handling** [S42](#)

coal [S01](#)

Materials recovery [S32](#)
Materials studies (fusion) [S70](#)
Materials testing [S42](#)
Materials testing reactors [S21](#)
Mathematical methods [S97](#)
Mathematical models [S97](#)
Mathematical solutions [S97](#)
Mathematics [S97](#)
Medical diagnostics [S62](#)
Medical physics - general [S61](#)
Medical therapy [S62](#)
Medicine [S62](#)

 **Membrane theory**

cosmology [S79](#)
quantum fields [S72](#)

 **Mercury**

biological effects [S63](#)
environmental chemistry [S54](#)

Mesic atoms [S74](#)

 **Mesons** [S72](#)

reactions [S73](#)

Metabolism [S60](#), [S63](#)

Metals and alloys [S36](#)

 **Meteorology** [S54](#)

wind availability [S17](#)

Methane [S09](#), [S10](#)

 **Methanol** [S09](#), [S10](#)

C1 processes See also [S01](#)
automotive fuel See also [S33](#)
coal products See also [S01](#)

Microbiology [S60](#)









Mine acid drainage [S01](#), [S54](#)











Mine shafts [S01](#)







Mineral properties geothermal science [S15](#)









Mineralogy [S58](#)











 **Minerals**






- resource management [S29](#)
-  **Mining**
 - coal [S01](#)
 - oil shale [S04](#)
 - radioactive ores [S11](#)
 - tar sands [S04](#)
- Mining equipment [S42](#)
- Mining facilities [S42](#)
- Moessbauer effect (condensed matter) [S75](#)
- Molecular beams, production [S71](#)
- Molecular biology [S60](#)
- Molecular physics [S74](#)
- Molecular properties [S74](#)
- Molecular spectra [S74](#)
- Molecular theory [S74](#)
- Morphology [S60](#)
- Municipal power systems [S32](#)
-  **Municipal waste management**
 - energy recovery [S32](#)
 - environmental aspects [S54](#)
- Muon-catalyzed fusion [S70](#)
- Muonic atoms [S74](#)
- Muonium [S74](#)
-  **Mutations** [S63](#)
 - agricultural [S60](#)
- N/D method [S72](#)
- Nanocrystals [S77](#)
- Nanodevices [S77](#)
- Nanomaterials [S77](#)
- Nanomechanics; [S77](#)
- Nanomedicine [S77](#)
- Nanometrology [S77](#)
- Nanoprocesses [S77](#)
- Nanoscience [S77](#)
- Nanostructures [S77](#)
- Nanotechnology [S77](#)
- Nanotubes [S77](#)
-  **Natural gas** [S03](#)
 - energy planning and policy See also [S29](#)
 - fuel consumption See also [S29](#)
 - pollution control See also [S54](#)
 - transportation applications See also [S33](#)
- Natural gas industry [S03](#)
-  **Natural resources**
 - development and utilization [S29](#)
-  **Negotiations**
 - arms control [S98](#)
- Net energy evaluation [S29](#)
-  **Neutrinos** [S72](#)
 - cosmic [S79](#)
- Neutron diffraction (condensed matter) [S75](#)
- Neutron stars [S79](#)
- Neutron transport theory [S73](#)
-  **Neutrons** [S73](#)






- interactions with matter (macro) [S75](#)
-  **Nitrogen oxides**
 - flue gas [S02](#), [S20](#), [S54](#)
 - pollution control [S54](#)
-  **Noise**
 - biological effects [S63](#)
 - pollution [S63](#)
- Nondestructive testing [S42](#)
-  **Nonlinear optics**
 - atomic theory [S74](#)
 - lasers [S42](#)
- Nonproliferation policies [S98](#)
-  **Nonradioactive wastes**
 - nuclear facilities [S12](#)
- Nuclear chemistry [S38](#)
- Nuclear disarmament [S98](#)
- Nuclear energy - policy [S29](#)
- Nuclear energy levels [S73](#)
-  **Nuclear explosions**
 - legal aspects [S98](#)
 - peaceful uses [S42](#)
-  **Nuclear facilities**
 - nonradioactive wastes [S12](#)
 - radioactive wastes [S12](#)
- Nuclear fission [S73](#)
- Nuclear forces [S73](#)
- Nuclear fuel elements [S21](#), [S22](#)
-  **Nuclear fuels** [S11](#), [S22](#)
 - air pollution See also [S54](#)
 - environmental aspects See also [S54](#)
 - radioactive effluents See also [S54](#)
 - site surveys See also [S54](#)
 - thermal pollution See also [S54](#)
 - water pollution See also [S54](#)
- Nuclear isospin [S73](#)
- Nuclear magnetic resonance (condensed matter) [S75](#)
-  **Nuclear materials**
 - accountability [S98](#)
 - management [S98](#)
- Nuclear matter [S73](#)
- Nuclear models [S73](#)
- Nuclear moments [S73](#)
- Nuclear physics [S73](#)
-  **Nuclear power**
 - policy [S29](#)
 - social aspects [S29](#)
- Nuclear reaction analysis [S37](#)
- Nuclear reactions [S73](#)
- Nuclear reactor accidents [S22](#)
- Nuclear reactor safety [S22](#)
- Nuclear reactor technology [S22](#)
-  **Nuclear reactors** [S21](#), [S22](#)
 - air pollution See also [S54](#)
 - environmental surveys See also [S54](#)











- propulsion See also [S33](#)
- thermal pollution See also [S54](#)
- water pollution See also [S54](#)
- Nuclear scattering [S73](#)
- Nuclear ships [S21](#)
- Nuclear spectrometers [S46](#)
- Nuclear spectroscopic instrumentation [S46](#)
- Nuclear spin [S73](#)
- Nuclear structure [S73](#)
-  **Nuclear techniques**
 - condensed matter [S75](#)
 - government policies [S29](#)
 - proliferation [S98](#)
 - safeguards [S98](#)
- Nucleate boiling [S42](#)
- Nuclei - properties [S73](#)
- Nucleon reactions [S73](#)
- Nuclide kinetics [S63](#)
- Ocean thermal gradient power systems [S14](#)
- Oceanography [S54](#), [S58](#)
- Offshore operations [S42](#)
-  **Oil sands [S04](#)**
 - policy [S29](#)
-  **Oil shale industry [S04](#)**
 - pollution control See also [S54](#)
 - technology assessment See also [S29](#)
- Oil shale mining [S04](#)
- Oil shale products [S04](#)
-  **Oil shale use [S04](#)**
 - environmental regulations See also [S29](#), [S54](#)
 - pollution control See also [S54](#)
 - waste management See also [S54](#)
-  **Oil shales [S04](#)**
 - economics See also [S29](#)
 - energy planning and policy See also [S29](#)
 - environmental aspects See also [S54](#)
 - legislation See also [S29](#)
 - marketing See also [S29](#)
 - regulations See also [S29](#)
- Oil spill effects [S02](#), [S54](#)
- Oil spills [S02](#)
- Oil wells [S02](#)
- Oil yields [S04](#)
- Optics [S71](#)
- Ore processing [S11](#)
- Organic chemistry [S37](#)
- Oxidation [S36](#)
- PCAC theory [S72](#)
- Paints [S36](#), [S54](#)
- Paleoclimatology [S54](#), [S58](#)
-  **Partial oxidation processes**
 - hydrogen production [S08](#)
- Particle accelerators [S43](#)
- Particle decay [S72](#)








- Particle interactions [S72](#)
- Particle invariance principles [S72](#)
- Particle properties [S72](#)
-  **Particulates**
 - biological effects [S63](#)
 - environmental control and monitoring [S01](#), [S20](#), [S54](#)
 - exhaust gas control [S33](#), [S54](#)
- Pathology [S60](#)
- Peat [S01](#)
- Personnel dosimetry [S63](#)
- Pest control [S60](#)
- Petrochemicals [S01](#), [S02](#)
-  **Petroleum** [S02](#)
 - energy planning and policy See also [S29](#)
 - environmental effects See also [S54](#)
 - regulations See also [S29](#)
-  **Petroleum industry** [S02](#)
 - legislation See also [S29](#)
 - pollution control See also [S54](#)
 - technology assessment See also [S29](#)
- Petroleum products [S02](#)
-  **Petrology** [S58](#)
 - coal See also [S01](#)
 - oil shales See also [S04](#)
 - tar sands See also [S04](#)
- Phantoms [S61](#)
- Phase studies [S36](#)
- Phosphorescence [S74](#)
-  **Phosphoric acid**
 - uranium recovery [S11](#)
-  **Photochemical processes**
 - hydrogen production [S08](#)
 - solar energy [S14](#)
- Photochemistry [S37](#)
-  **Photons** [S72](#)
 - reactions [S73](#)
- Photonuclear reactions [S73](#)
- Photosynthesis [S14](#)
- Photovoltaic cells [S14](#)
- Photovoltaic conversion [S14](#)
- Physical chemistry [S37](#)
-  **Physics**
 - atomic physics [S74](#)
 - condensed matter physics [S75](#)
 - cryogenics [S71](#)
 - elementary particles [S72](#)
 - general physics [S71](#)
 - molecular physics [S74](#)
 - nuclear physics [S73](#)
 - particle beam production [S71](#)
 - plasma physics [S70](#)
 - radiation physics [S73](#)
 - target preparation [S71](#)












- Physiology [S60](#)
- Pionic atoms [S74](#)
-  **Pipelines**
 - coal [S01](#)
 - design [S42](#)
 - development [S42](#)
 - natural gas [S03](#)
 - petroleum [S02](#)
 - testing [S42](#)
 - transportation [S32](#)
- Planetary systems [S79](#)
- Planning and policy [S29](#)
-  **Plant breeding** [S60](#)
 - population dynamics See also [S54](#)
 - radioresistance See also [S63](#)
 - revegetation See also [S54](#)
-  **Plants**
 - baseline ecology [S54](#)
-  **Plasma**
 - solid state [S75](#)
 - Plasma disruption [S70](#)
 - Plasma fluid (thermonuclear) [S70](#)
 - Plasma heating systems [S70](#)
 - Plasma impurity control [S70](#)
-  **Plasma phenomena**
 - low energy [S71](#)
 - Plasma physics [S70](#)
 - Plasma research [S70](#)
-  **Plasma-facing**
 - components [S70](#)
- Plastics [S36](#)
- Plutonium recycling [S11](#)
- Policy [S29](#)
- Political aspects [S29](#)
-  **Pollutants**
 - biological effects [S63](#)
 - ecosystem effects [S54](#)
 - environmental transport [S54](#)
 - removal [S54](#)
 - sampling [S54](#)
-  **Pollution**
 - coal [S01](#), [S54](#)
-  **Pollution control**
 - air pollution [S54](#)
 - biomass fuels [S09](#)
 - coal [S01](#)
 - fossil-fueled power plants [S20](#)
 - industrial plants [S54](#)
 - natural gas [S03](#)
 - oil shales [S04](#)
 - petroleum [S02](#)
 - soil pollution [S54](#)
 - water pollution [S54](#)
-  **Pollution control equipment**

- basic engineering [S54](#)
- design for industrial plants [S32](#), [S54](#)
- environmental use [S54](#)
- industrial plants [S32](#), [S54](#)
- methods [S54](#)
- technology assessment [S29](#)
- Polymers [S36](#)
- Positron collisions [S74](#), [S75](#)
- Positronium [S74](#)
- Potentiometry [S37](#)
-  **Power conversion systems**
 - fusion energy [S70](#)
 - hydroelectric [S13](#)
-  **Power cycles** [S42](#)
 - external combustion engines See also [S33](#)
 - internal combustion engines See also [S33](#)
 - power plants See also [S20](#)
- Power distribution [S24](#)
- Power plant hardware [S20](#)
-  **Power plants**
 - air pollution [S54](#)
 - biomass [S20](#)
 - environmental aspects [S54](#)
 - fossil-fueled [S20](#)
 - geothermal [S15](#)
 - hydroelectric [S13](#)
 - land use [S54](#)
 - nuclear [S21](#)
 - pollution [S54](#)
 - refuse-derived fuels [S20](#)
 - site surveys [S54](#)
 - thermal effluents [S54](#)
 - waste-fueled systems [S20](#)
- Power plants and power generation [S20](#)
- Power reactors [S21](#)
-  **Power supplies**
 - fusion energy [S70](#)
- Power transmission and distribution [S24](#)
- Pressurized water reactors [S21](#)
- Process heat reactors [S21](#)
- Programming [S97](#)
- Proliferation [S29](#), [S98](#)
- Propulsion reactors [S21](#)
-  **Prospecting**
 - exploratory drilling [S15](#)
 - geochemical survey methods [S58](#)
 - geochemical techniques [S15](#)
 - geophysical survey methods [S58](#)
 - geophysical techniques [S15](#)
 - geothermal exploration [S15](#)
- Protective clothing [S42](#)
- Protective equipment [S42](#)
- Protective structures [S42](#)
- Psychology [S60](#)

- Public health [S60](#)
- Public policy [S29](#)
-  **Public relations** [S29](#), [S32](#)
 - pollution damage in environment [S54](#)
- Public services [S32](#)
- Public utilities [S32](#)
-  **Purification**
 - coal [S01](#)
 - power plant emissions [S20](#)
 - shale oil [S04](#)
-  **Pyrolysis** [S37](#)
 - coal [S01](#)
- Quality of life [S29](#)
- Quantum beams [S71](#)
- Quantum chromodynamics [S72](#)
- Quantum computers [S77](#)
- Quantum cosmology [S79](#)
- Quantum dots [S77](#)
- Quantum electrodynamics [S72](#)
- Quantum entanglement [S71](#)
- Quantum field theories [S72](#)
- Quantum fluids [S75](#)
- Quantum gravity [S79](#)
- Quantum information [S71](#)
- Quantum mechanics [S71](#)
- Quantum solids [S75](#)
- Quantum teleportation [S71](#)
- Quantum wells [S77](#)
- Quantum wires [S77](#)
- Quark matter [S72](#)
- Quark models [S72](#)
- Quark-gluon plasma [S72](#)
- Quarks [S72](#)
- Quasars [S79](#)
- Qubits [S71](#)
- Radiation chemistry [S38](#)
-  **Radiation effects**
 - chemical [S38](#)
 - electronics [S46](#)
 - instruments [S46](#)
 - materials [S36](#)
 - physicochemical [S38](#)
 - refractories [S36](#)
- Radiation instruments [S46](#)
- Radiation physics [S73](#)
- Radiation protection standards [S61](#)
- Radiation shielding (excluding neutrons) [S73](#)
- Radiation sources [S07](#)
- Radiation transport (excluding neutrons) [S73](#)
- Radiative transitions [S74](#)
- Radio galaxies [S79](#)
- Radio telescopes [S79](#)
- Radioactivation analysis [S37](#)
-  **Radioactive contaminants**

- air [S54](#)
- aquatic ecosystems [S54](#)
- ecological effects [S11](#), [S54](#)
- food chains [S54](#)
- health effects [S11](#), [S63](#)
- waste disposal [S12](#), [S54](#)
- Radioactive decay [S73](#)
-  **Radioactive effluents**
 - air [S54](#)
 - nuclear reactors [S22](#)
 - soil [S54](#)
 - water [S54](#)
- Radioactive isotope production [S07](#), [S11](#), [S38](#)
-  **Radioactive materials** [S11](#)
 - chemistry See also [S38](#)
 - handling See also [S42](#)
 - safeguards See also [S98](#)
 - shipping containers See also [S42](#)
 - transport See also [S11](#)
-  **Radioactive waste disposal** [S12](#)
 - economics See also [S11](#)
 - environmental aspects See also [S12](#)
 - health and safety See also [S11](#)
-  **Radioactive wastes**
 - decontamination [S12](#)
 - disposal [S12](#)
 - management [S12](#)
 - policy [S29](#)
 - processing [S12](#)
 - storage (interim) [S11](#)
 - storage (ultimate) [S12](#)
 - transport [S11](#)
-  **Radioactivity**
 - environmental [S54](#)
 - physics [S73](#)
- Radiochemical analytical procedures [S37](#)
- Radiochemistry [S38](#)
-  **Radiography** [S37](#)
 - biomedical [S62](#)
- Radioimmunoassay [S62](#)
-  **Radioisotope**
 - production [S38](#)
 - uses [S07](#)
- Radiolysis [S38](#)
- Radiometric analysis [S37](#), [S54](#)
- Radiometry [S37](#)
-  **Radionuclide effects** [S63](#)
 - ecological See also [S54](#)
 - environmental See also [S54](#)
-  **Radionuclide kinetics** [S63](#)
 - food chains [S54](#)
-  **Radionuclide migration**
 - air [S54](#)
 - fuel cycle [S11](#)

- geological materials [S12](#)
- soil [S54](#)
- water [S54](#)
- Radiopharmaceuticals [S62](#)
- Rankine cycle [S33](#), [S42](#)
- Reactor safety [S22](#)
-  **Reactors**
 - bioreactors [S09](#)
 - licensing and regulation [S21](#)
 - nuclear [S22](#)
-  **Reclamation**
 - land [S54](#)
 - water [S54](#)
-  **Recreational facilities**
 - energy consumption [S32](#)
-  **Recycling**
 - conservation aspects [S32](#)
 - economics [S32](#)
 - environmental aspects [S54](#)
 - policy [S29](#)
-  **Refining**
 - petroleum [S02](#)
 - shale oil [S04](#)
- Refractory materials [S36](#)
- Refuse-derived fuels [S20](#)
- Regge formalism [S72](#)
- Regge models [S72](#)
-  **Regulations** [S29](#)
 - biomass fuels See also [S09](#)
 - coal industry See also [S01](#)
 - dams See also [S13](#)
 - energy storage See also [S25](#)
 - fossil-fueled power plants See also [S20](#)
 - geothermal energy See also [S15](#)
 - hydrogen fuel See also [S08](#)
 - hydropower plants See also [S13](#)
 - natural gas industry See also [S03](#)
 - nuclear fuels See also [S11](#)
 - nuclear-powered ships See also [S21](#)
 - oil shale industry See also [S04](#)
 - petroleum industry See also [S02](#)
 - power transmission and distribution See also [S24](#)
 - solar energy See also [S14](#)
 - synthetic fuels See also [S10](#)
 - tar sands industry See also [S04](#)
 - tidal power See also [S16](#)
 - wave power See also [S16](#)
 - wind power See also [S17](#)
- Relativistic wave equation [S72](#)
- Relativity, general theory [S71](#)
- Relict radiation [S79](#)
- Remedial action [S11](#), [S54](#)
- Renewable energy sources policy [S29](#)
-  **Reprocessing**

- environmental aspects [S11](#)
- spent fuels [S11](#)
- Research and test reactors [S21](#)
-  **Reserves**
 - coal [S01](#)
 - environmental aspects [S11](#)
 - natural gas [S03](#)
 - oil sands [S04](#)
 - oil shales [S04](#)
 - petroleum [S02](#)
 - tar sands [S04](#)
 - thorium ores [S11](#)
 - uranium ores [S11](#)
-  **Reservoir engineering**
 - oil shales [S04](#)
 - petroleum [S02](#)
-  **Reservoir performance**
 - geothermal [S15](#)
-  **Reservoir rock**
 - drilling oil shales [S04](#)
 - geology oil shales [S04](#)
 - mechanical properties [S36](#)
 - petroleum [S02](#)
-  **Reservoir stimulation**
 - geothermal engineering [S15](#)
-  **Resources**
 - biomass [S09](#)
 - geothermal [S15](#), [S29](#)
 - hydro energy [S13](#)
 - solar energy [S14](#), [S29](#)
 - tidal power [S16](#), [S29](#)
 - wave power [S16](#), [S29](#)
 - wind energy [S17](#), [S29](#)
-  **Retrofitting**
 - buildings [S32](#)
 - power plants [S20](#)
- Revegetation [S54](#)
- Reversed-field pinch [S70](#)
- Risk assessment studies [S29](#), [S54](#)
- Risk nuclear reactor accidents [S22](#)
-  **Roads and streets** [S32](#)
 - land use See also [S54](#)
 - pollution See also [S54](#)
- Robotics [S32](#), [S99](#)
-  **Rock bursts**
 - coal mining [S01](#)
- Rock mechanics [S36](#), [S58](#)
- Rock-water-gas interactions [S15](#)
-  **Rotary engines**
 - automobile [S33](#)
-  **Rutherford scattering** [S71](#), [S73](#)
 - chemical analysis [S37](#)
- S-matrix theory [S72](#)
- SQUID devices [S75](#)

Safeguards S98 **Safety**

- biomass fuels **S09**
- coal industry **S01**
- energy storage **S25**
- fossil-fueled power plants **S20**
- geothermal engineering **S15**
- hydro energy **S13**
- hydrogen **S08**
- natural gas industry **S03**
- nuclear fuels **S11**
- nuclear reactor **S22**
- oil shale industry **S04**
- petroleum industry **S02**
- power transmission and distribution **S24**
- radiation sources **S07**
- radioisotopes **S07**
- solar energy **S14**
- synthetic fuels **S10**
- tar sand industry **S04**
- tidal power **S16**
- wave power **S16**
- wind energy **S17**

Salinity gradient power systems **S14** **Sanitary landfills S54**

- landfill gas recovery **S09**

Scattering matrices **S72** **Scattering theory S71**

- relativistic **S72**

Schwinger source theory **S72** **Seawater**

- uranium recovery **S11**

 **Seismicity S58**

- dam sites **S13**

 **Seismology**

- earthquake prediction **S58**
- geothermal surveys **S15**








Separation procedures **S37**Sewer systems **S32** **Shale oil S04**







- biological effects See also **S63**
- energy planning and policy See also **S29**
- environmental aspects See also **S54**
- legislation See also **S29**
- regulations See also **S29**
- site surveys See also **S54**
- waste management See also **S54**







Shell models **S73**Shielding (fusion) **S70**Ship propulsion reactors **S21** **Ship site surveys S54**










- nuclear-powered **S21**

 **Shipping containers**

- radioactive materials [S42](#)
- safety [S42](#)
- Simulations [S97](#)
-  **Site surveys thermionic conversion** [S14](#)
 - coalmines See also [S01](#)
 - fossil-fueled power plants See also [S20](#)
 - geothermal fields See also [S15](#)
 - meteorology See also [S54](#)
 - natural gas fields See also [S03](#)
 - nuclear reactors See also [S22](#)
 - oil fields See also [S02](#)
 - soil mechanics See also [S54](#)
 - tar sands See also [S04](#)
 - thermal power plants See also [S20](#)
 - tidal power plants See also [S16](#)
 - wind power See also [S17](#)
-  **Slurry pipelines**
 - coal [S01](#)
-  **Socioeconomic aspects**
 - nuclear power [S29](#)
-  **Sociology agriculture** [S14](#)
 - energy policy [S29](#), [S32](#)
- Software [S97](#)
- Soil chemistry [S54](#)
-  **Soil contamination**
 - composition [S54](#)
 - monitoring chemical [S54](#)
 - monitoring radioactive [S54](#)
 - radiometric techniques [S54](#)
 - regulations and implementation [S29](#)
 - remediation [S11](#)
 - removal [S54](#)
- Solar absorbers [S14](#)
- Solar air conditioning [S14](#)
- Solar cells [S14](#)
- Solar collectors [S14](#)
- Solar concentrators [S14](#)
- Solar cooking [S14](#)
- Solar drying [S14](#)
-  **Solar energy** [S14](#)
 - environmental aspects See also [S54](#)
 - photosynthesis See also [S09](#)
 - policy See also [S29](#)
- Solar heat engines [S14](#)
- Solar heating [S14](#)
- Solar power systems [S14](#)
- Solar radiation [S79](#)
- Solar sea power systems [S14](#)
- Solar space heating [S14](#)
- Solar system [S79](#)
- Solar thermal power systems [S14](#)
-  **Solid wastes**
 - disposal [S54](#)
 - environmental aspects [S54](#)

- fuels [S09](#)
- pollution control [S54](#)
- Solid-state physics [S75](#)
- Solid-state plasma [S75](#)
- Solid-state properties [S36](#)
- Solid-state techniques [S75](#)
- Solvated extractions [S38](#)
-  **Solvent extraction**
- spent fuels [S11](#)
-  **Space heating** [S32](#)
- solar [S14](#)
- Space plasma phenomena [S79](#)
- Space power reactors [S21](#)
- Space power systems [S24](#)
- Space propulsion reactors [S21](#)
- Space vehicles [S79](#)
- Spacecrafts [S79](#)
- Spark-ignition engines [S33](#)
- Spectrochemical analysis [S37](#)
- Spectrometers [S46](#)
- Spectroscopic analysis [S37](#)
- Spent fuels [S11](#)
- Spontaneous fission [S73](#)
- Sputtering [S75](#)
- Stable isotopes [S37](#)
- Standard model [S72](#)
- Star clusters [S79](#)
- Stark effect [S74](#)
- State government research [S29](#)
- Statistical physics [S71](#)
- Statistics [S97](#)
-  **Steam-iron process**
- hydrogen production [S08](#)
- Stellar radiation [S79](#)
- Stellar systems [S79](#)
- Stellarators [S70](#)
- Stirling cycle [S33](#), [S42](#)
-  **Stockpiles**
- coal [S01](#)
- petroleum [S02](#)
- Storage facilities [S11](#), [S12](#), [S42](#)
- Storage rings [S43](#)
-  **Strata control**
- coal mining [S01](#)
- proliferation [S98](#)
- Street lighting systems [S32](#)
- String theory [S72](#)
- Strong interaction models [S72](#)
- Structures underground [S42](#)
- Supercomputers [S97](#)
-  **Superconducting** [S36](#), [S75](#)
- power transmission [S24](#)
- Superconductivity [S36](#), [S75](#)
- Superfluidity [S75](#)

- Supernova remnants [S79](#)
- Superstring theory [S72](#)
- Supersymmetry [S72](#)
-  **Supply and demand** [S29](#)
 - biomass fuels See also [S09](#)
 - coal See also [S01](#)
 - electric power See also [S20](#)
 - geothermal energy See also [S15](#)
 - hydro energy See also [S13](#)
 - hydrogen fuel See also [S08](#)
 - natural gas See also [S03](#)
 - nuclear fuels See also [S11](#)
 - petroleum See also [S02](#)
 - shale oil See also [S04](#)
 - solar energy See also [S14](#)
 - synthetic fuels See also [S10](#)
 - tidal power See also [S16](#)
 - wave power See also [S16](#)
 - wind energy See also [S17](#)
- Supply disruption [S29](#)
-  **Surface mining**
 - coal [S01](#)
 - land reclamation [S54](#)
- Surface processing - oil shales, tar sands [S04](#)
- Symmetry breaking [S72](#)
- Symmetry principles [S72](#)
- Symmetry violations [S72](#)
-  **Synthetic fuels** [S10](#)
 - policy See also [S29](#)
 - waste management See also [S54](#)
- T invariance [S72](#)
- Tachyons [S72](#)
- Tanker vessels [S42](#)
-  **Tanks** [S42](#)
 - radioactive waste storage [S12](#)
-  **Tar sand industry** [S04](#)
 - air pollution See also [S54](#)
 - legislation See also [S29](#)
 - soil pollution See also [S54](#)
 - water pollution See also [S54](#)
-  **Tar sands** [S04](#)
 - air pollution See also [S54](#)
 - energy planning and policy See also [S29](#)
 - environmental aspects See also [S54](#)
 - exploration See also [S04](#)
 - supply and demand See also [S29](#)
- Target facilities [S43](#)
- Tax credits [S29](#)
- Taxes [S29](#)
- Technology assessment [S29](#)
- Technology transfer [S29](#)
- Technology utilization [S29](#)
- Tectonics [S58](#)

- Terminology (standardised) [S96](#)
-  [Test methods](#)
 - materials [S42](#)
- Test reactors [S21](#)
-  [Thermal effluents](#) [S54](#)
 - diffusion See also [S54](#)
 - fossil-fueled power plants See also [S20](#)
- Thermal physics [S71](#)
-  [Thermal pollution](#)
 - biological effects [S63](#)
 - diffusion [S54](#)
 - environmental aspects [S54](#)
 - nuclear reactors [S22](#)
-  [Thermionic conversion](#)
 - solar energy [S14](#)
- Thermionic converters [S30](#)
- Thermionic emission [S75](#)
-  [Thermochemical conversion](#)
 - solar energy [S14](#)
- Thermochemical processes [S09](#)
-  [Thermodynamic cycles](#) [S42](#)
 - automobiles See also [S33](#)
 - fusion energy See also [S70](#)
- Thermodynamic properties [S36](#)
- Thermodynamics [S71](#)
- Thermoelectric effect [S75](#)
- Thermoelectric generators [S30](#)
- Thermonuclear devices (general) [S70](#)
- Thermonuclear fuel injection [S70](#)
- Thermonuclear power plants [S70](#)
- Thermonuclear reactions [S70](#)
- Thermonuclear reactor materials [S70](#)
- Thorium ores [S11](#)
-  [Tidal power](#) [S16](#)
 - environmental surveys See also [S54](#)
 - policy See also [S29](#)
 - site surveys See also [S54](#)
 - storage facilities See also [S42](#)
- Titration [S37](#)
- Tokamak devices [S70](#)
-  [Total energy systems](#) [S29](#)
 - solar energy [S14](#)
- Tower focus power systems [S14](#)
-  [Tracer techniques](#)
 - advances in [S38](#)
 - agriculture [S60](#)
 - air [S54](#)
 - animal husbandry [S60](#)
 - behavior [S60](#)
 - biochemistry [S60](#)
 - coal [S01](#)
 - cytology [S60](#)
 - embryology [S60](#)
 - food technology [S60](#)

genetics **S60**
horticulture **S60**
irradiation effects **S60**
medicine **S62**
metabolic studies **S60**
metabolism **S60**
microbiology **S60**
molecular biology **S60**
morphology **S60**
pathology **S60**
pest control **S60**
photosynthesis **S60**
physiology **S60**
preservation **S60**
psychology **S60**
public health **S60**
soils **S54**
technology advancement **S38**
vaccine sterilization **S60**
water **S54**

 **Trade**

biomass fuels **S09**
coal **S11**
foreign **S29**
hydrogen fuel **S08**
natural gas **S03**
nuclear fuels **S11**
petroleum **S02**
shale oil **S04**
synthetic fuels **S10**

Training and education **S96**

Training reactors **S21**

 **Transport**

biomass **S09**
coal **S01**
coalmines **S01**
environmental **S54**
facilities **S42**
hydrogen **S08**
natural gas **S03**
oil shales **S04**
petroleum **S02**
radioactive materials **S11**
radioactive wastes **S11**
synthetic fuels **S10**
tar sands **S04**

Transport theory **S73**

Transportation **S32**











Tribology **S32**










Triton **S73**



Tunnels **S01**

 **Turbines**

automobile **S33**
wind **S17**

-  **Unconventional energy sources**
 - policy **S29**
 - Underground engineering **S42**
-  **Underground mining**
 - coal **S01**
 - Unified models **S72**
 - Universe **S79**
-  **Uranium**
 - depleted **S12**
 - mining **S11**
 - reserves **S11**
-  **Uranium 235**
 - centrifugation separation **S11**
 - gaseous diffusion separation **S11**
 - laser isotope separation **S11**
- Uranium deposits **S11**
- Uranium enrichment **S11**
- Uranium minerals **S11**
- Uranium ores **S11**
- Uranium recovery **S11**
- Vaccine sterilization **S60**
- Vacuum systems (fusion) **S70**
- Vegetable oil fuels **S09**
-  **Ventilation**
 - buildings **S32**
 - coalmines **S01**
 - houses **S54**
 - indoor air pollution control **S54**
-  **Verification**
 - arms control **S98**
-  **Vertebrates**
 - baseline ecology **S54**
- Veterinary science **S60**
- Volcanology **S58**
- Voltametry **S37**
- Waste conversion to fuel **S09**
- Waste energy policy **S29**
-  **Waste fuels**
 - power plants **S20**
-  **Waste heat utilization**
 - energy conservation **S32**
 - policy **S29**
-  **Waste management**
 - biomass fuels **S08**
 - coal industry **S01**
 - fossil-fueled power plants **S20**
 - geothermal energy **S15**
 - hydrogen fuel **S08**
 - natural gas industry **S03**
 - nuclear fuels **S12**
 - oil shale industry **S04**
 - petroleum industry **S02**
 - solid wastes **S54**

- synthetic fuels [S10](#)
- tar sand industry [S04](#)
- Waste oil reclamation [S02](#)
-  **Waste recycling**
 - industrial [S32](#)
 - municipal [S32](#)
 - power generation [S20](#)
- Water chemistry [S54](#)
-  **Water gas processes**
 - hydrogen production [S08](#)
-  **Water heating**
 - energy conservation [S32](#)
 - solar domestic [S14](#)
-  **Water pollution** [S54](#)
 - abatement and control coal See also [S01](#)
 - coal use and production See also [S01](#)
 - geothermal energy See also [S15](#)
 - legislation See also [S29](#)
 - nuclear fuels See also [S11](#)
 - nuclear reactors See also [S22](#)
 - oil shale See also [S04](#)
 - petroleum See also [S02](#)
 - petroleum use and production See also [S02](#)
 - radioactive effluents See also [S22](#)
 - regulations See also [S29](#)
 - tar sand use and production See also [S04](#)
 - tar sands See also [S04](#)
 - thermal See also [S20](#), [S22](#)
-  **Water resources** [S29](#)
 - hydroelectric power [S13](#), [S54](#)
- Water treatment plants [S32](#)
- Water wave energy conversion [S16](#)
- Water-rock-gas interactions [S15](#)
- Wave energy converters [S16](#)
- Wave power [S16](#)
- Weak interaction models [S72](#)
-  **Weatherization** [S32](#)
 - policy See also [S29](#)
 - social impacts See also [S29](#)
-  **Well logging**
 - geothermal exploration [S15](#)
 - instrumentation [S47](#)
- Wind energy [S17](#)
-  **Wind power** [S17](#)
 - applications See also [S17](#), [S29](#)
 - availability (climatology) See also [S54](#)
 - environmental aspects See also [S54](#)
 - policy See also [S29](#)
 - regulations See also [S29](#)
 - site surveys See also [S54](#)
- Wind turbines [S17](#)
- Winterization [S32](#)
-  **Wood**

- fuels **S09**
- policy **S29**
- production **S09**
-  **Wood energy**
- policy **S29**
-  **Wood-burning appliances**
- environmental aspects **S54**
- X-ray fluorescence analysis **S37**
- X-ray telescopes **S79**
- Zeeman effect **S74**