

**CPC****COOPERATIVE PATENT CLASSIFICATION****Y02E****REDUCTION OF GREENHOUSE GASES [GHG] EMISSION, RELATED TO ENERGY GENERATION, TRANSMISSION OR DISTRIBUTION****Guidance heading:****Y02E 10/00****Energy generation through renewable energy sources**

- Y02E 10/10 . Geothermal energy
- Y02E 10/12 .. Earth coil heat exchangers
- Y02E 10/125 ... Compact tube assemblies, e.g. geothermal probes
- Y02E 10/14 .. Systems injecting medium directly into ground, e.g. hot dry rock system, underground water
- Y02E 10/16 .. Systems injecting medium into a closed well
- Y02E 10/18 .. Systems exchanging heat with fluids in pipes, e.g. fresh water or waste water
- Y02E 10/20 . Hydro energy
- Y02E 10/22 .. Conventional, e.g. with dams, turbines and waterwheels
- Y02E 10/223 ... Turbines or waterwheels, e.g. details of the rotor
- Y02E 10/226 ... Other parts or details
- Y02E 10/28 .. Tidal stream or damless hydropower, e.g. sea flood and ebb, river, stream
- Y02E 10/30 . Energy from sea ([tidal stream Y02E 10/28](#)) (not used; see subgroups)
- Y02E 10/32 .. Oscillating water column [OWC]
- Y02E 10/34 .. Ocean thermal energy conversion [OTEC]
- Y02E 10/36 .. Salinity gradient
- Y02E 10/38 .. Wave energy or tidal swell, e.g. Pelamis-type
- Y02E 10/40 . Solar thermal energy
- Y02E 10/41 .. Tower concentrators
- Y02E 10/42 .. Dish collectors
- Y02E 10/43 .. Fresnel lenses
- Y02E 10/44 .. Heat exchange systems
- Y02E 10/45 .. Trough concentrators
- Y02E 10/46 .. Conversion of thermal power into mechanical power, e.g. Rankine, Stirling solar thermal engines
- Y02E 10/465 ... Thermal updraft
- Y02E 10/47 .. Mountings or tracking
- Y02E 10/50 . Photovoltaic [PV] energy
- Y02E 10/52 .. PV systems with concentrators
- Y02E 10/54 .. Material technologies (not used; see subgroups)

- Y02E 10/541 ... CuInSe<sub>2</sub> material PV cells
- Y02E 10/542 ... Dye sensitized solar cells
- Y02E 10/543 ... Solar cells from Group II-VI materials
- Y02E 10/544 ... Solar cells from Group III-V materials
- Y02E 10/545 ... Microcrystalline silicon PV cells
- Y02E 10/546 ... Polycrystalline silicon PV cells
- Y02E 10/547 ... Monocrystalline silicon PV cells
- Y02E 10/548 ... Amorphous silicon PV cells
- Y02E 10/549 ... organic PV cells
- Y02E 10/56 ... Power conversion electric or electronic aspects
- Y02E 10/563 ... for grid-connected applications
- Y02E 10/566 ... concerning power management inside the plant , e.g. battery charging/discharging, economical operation, hybridisation with other energy sources
- Y02E 10/58 ... Maximum power point tracking [MPPT] systems
- Y02E 10/60 . Thermal-PV hybrids
- Y02E 10/70 . Wind energy
- Y02E 10/72 .. Wind turbines with rotation axis in wind direction
- Y02E 10/721 ... Blades or rotors
- Y02E 10/722 ... Components or gearbox
- Y02E 10/723 ... Control of turbines
- Y02E 10/725 ... Generator or configuration
- Y02E 10/726 ... Nacelles
- Y02E 10/727 ... Offshore towers
- Y02E 10/728 ... Onshore towers
- Y02E 10/74 .. Wind turbines with rotation axis perpendicular to the wind direction
- Y02E 10/76 .. Power conversion electric or electronic aspects
- Y02E 10/763 ... for grid-connected applications
- Y02E 10/766 ... concerning power management inside the plant, e.g. battery charging/discharging, economical operation, hybridisation with other energy sources
- Y02E 20/00      Combustion technologies with mitigation potential**
- Y02E 20/10 . Combined combustion ([not used, see subgroups](#))
- Y02E 20/12 .. Heat utilisation in combustion or incineration of waste
- Y02E 20/14 .. Combined heat and power generation [CHP]
- Y02E 20/16 .. Combined cycle power plant [CCPP], or combined cycle gas turbine [CCGT]
- Y02E 20/18 ... Integrated gasification combined cycle [IGCC]
- Y02E 20/185 .... combined with carbon capture and storage [CCS]
- Y02E 20/30 . Technologies for a more efficient combustion or heat usage ([not used, see subgroups](#))
- Y02E 20/32 .. Direct CO<sub>2</sub> mitigation ([not used, see subgroups](#))

- Y02E 20/322 ... Use of synair, i.e. a mixture of recycled CO<sub>2</sub> and pure O<sub>2</sub>
- Y02E 20/324 ... Use of reactants before or during combustion
- Y02E 20/326 ... Segregation from fumes, including use of reactants downstream from combustion or deep cooling
- Y02E 20/328 ... Controls of combustion specifically inferring on CO<sub>2</sub> emissions
- Y02E 20/34 .. Indirect CO<sub>2</sub> mitigation, i.e. by acting on non CO<sub>2</sub> directly related matters of the process, e.g. more efficient use of fuels ([not used, see subgroups](#))
- Y02E 20/342 ... Cold flame
- Y02E 20/344 ... Oxyfuel combustion
- Y02E 20/346 ... Unmixed combustion
- Y02E 20/348 ... Air pre-heating
- Y02E 20/36 .. Heat recovery other than air pre-heating
- Y02E 20/363 ... at fumes level
- Y02E 20/366 ... at burner level

## **Y02E 30/00 Energy generation of nuclear origin**

- Y02E 30/10 . Fusion reactors
- Y02E 30/12 .. Magnetic plasma confinement [MPC]
- Y02E 30/122 ... Tokamaks
- Y02E 30/124 ... Stellarators
- Y02E 30/126 ... Other reactors with MPC
- Y02E 30/128 ... First wall, divertor, blanket
- Y02E 30/14 .. Inertial plasma confinement
- Y02E 30/16 ... Injection systems and targets
- Y02E 30/18 .. Low temperature fusion, e.g. "cold fusion"
- Y02E 30/30 . Nuclear fission reactors
- Y02E 30/31 .. Boiling water reactors
- Y02E 30/32 .. Pressurized water reactors
- Y02E 30/33 .. Gas cooled reactors
- Y02E 30/34 .. Fast breeder reactors
- Y02E 30/35 .. Liquid metal reactors
- Y02E 30/36 .. Pebble bed reactors
- Y02E 30/37 .. Accelerator driven reactors
- Y02E 30/38 .. Fuel
- Y02E 30/39 .. Control of nuclear reactions
- Y02E 30/40 .. Other aspects relating to nuclear fission

## **Y02E 40/00 Technologies for an efficient electrical power generation, transmission or distribution**

- Y02E 40/10 . Flexible AC transmission systems [FACTS]
- Y02E 40/12 .. Static VAR compensators [SVC], static VAR generators [SVG] or static VAR

- systems [SVS], including thyristor-controlled reactors [TCR], thyristor-switched reactors [TSR] or thyristor-switched capacitors [TSC]
- Y02E 40/14     ..     Thyristor-controlled series capacitors [TCSC]
- Y02E 40/16     ..     Static synchronous compensators [STATCOM]
- Y02E 40/18     ..     Unified power flow controllers [UPF] or controlled series voltage compensators
- Y02E 40/20     .     Active power filtering [APF] [\(not used, see subgroups\)](#)
- Y02E 40/22     ..     Non-specified or voltage-fed active power filters
- Y02E 40/24     ..     Current-fed active power filters
- Y02E 40/26     ..     using a multilevel or multicell converter
- Y02E 40/30     .     Reactive power compensation [\(Y02E 40/10, Y02E 40/20 take precedence\)](#)
- Y02E 40/32     ..     using synchronous generators
- Y02E 40/34     ..     for voltage regulation
- Y02E 40/40     .     Arrangements for reducing harmonics [\(Y02E 40/10 to Y02E 40/30 take precedence\)](#)
- Y02E 40/50     .     Arrangements for eliminating or reducing asymmetry in polyphase networks
- Y02E 40/60     .     Superconducting electric elements or equipment or power systems integrating superconducting elements or equipment
- Y02E 40/62     ..     Superconducting generators
- Y02E 40/622     ...     Superconducting synchronous generators
- Y02E 40/625     ....     with a superconducting rotor
- Y02E 40/627     ...     Superconducting homopolar generators
- Y02E 40/64     ..     Superconducting transmission lines or power lines or cables or installations thereof
- Y02E 40/641     ...     characterised by their form
- Y02E 40/642     ....     Films or wires on bases or cores
- Y02E 40/644     ....     Multifilaments embedded in normal conductors
- Y02E 40/645     ...     characterised by the disposition of thermal insulation
- Y02E 40/647     ...     characterised by cooling
- Y02E 40/648     ...     Installation of superconducting cables or lines
- Y02E 40/66     ..     Superconducting transformers or inductors
- Y02E 40/67     ..     Superconducting energy storage for power networks, e.g. SME, superconducting magnetic storage
- Y02E 40/68     ..     Protective or switching arrangements for superconducting elements or equipment
- Y02E 40/69     ..     Current limitation using superconducting elements, including multifunctional current limiters
- Y02E 40/70     .     Systems integrating technologies related to power network operation and communication or information technologies for improving the carbon footprint of electrical power generation, transmission or distribution, i.e. smart grids as climate change mitigation technology in the energy generation sector [\(smart grids relating to the energy generation sector in general, including the technologies with no associated climate change mitigation effect Y04S 10/00\) { not used, see subgroups }](#)
- Y02E 40/72     ..     Systems characterised by the monitoring, control or operation of energy generation units, e.g. distributed generation [DER] or load-side generation

- Y02E 40/74      ..      Systems characterised by the monitoring, control or operation of flexible AC transmission systems [FACTS] or power factor or reactive power compensating or correcting units
- Y02E 40/76      ..      Computing methods or systems for efficient or low carbon management or operation of electric power systems

## **Y02E 50/00      Technologies for the production of fuel of non-fossil origin**

- Y02E 50/10      .      Biofuels
- Y02E 50/11      ..      CHP turbines for biofeed
- Y02E 50/12      ..      Gas turbines for biofeed
- Y02E 50/13      ..      Bio-diesel
- Y02E 50/14      ..      Bio-pyrolysis
- Y02E 50/15      ..      Torrefaction of biomass
- Y02E 50/16      ..      Cellulosic bio-ethanol
- Y02E 50/17      ..      Grain bio-ethanol
- Y02E 50/18      ..      Bio-alcohols produced by other means than fermentation
- Y02E 50/30      .      Fuel from waste
- Y02E 50/32      ..      Synthesis of alcohols or diesel from waste including a pyrolysis and/or gasification step
- Y02E 50/34      ..      Methane (not used, see subgroups)
- Y02E 50/343      ...      production by fermentation of organic by-products, e.g. sludge
- Y02E 50/346      ...      from landfill gas

## **Y02E 60/00      Enabling technologies or technologies with a potential or indirect contribution to GHG emissions mitigation**

- Y02E 60/10      .      Energy storage (not used, see subgroups)
- Y02E 60/12      ..      Battery technology
- Y02E 60/122      ...      Lithium-ion batteries
- Y02E 60/124      ...      Alkaline secondary batteries, e.g. NiCd or NiMH
- Y02E 60/126      ...      Lead-acid batteries
- Y02E 60/128      ...      Hybrid cells
- Y02E 60/13      ..      Ultracapacitors, supercapacitors, double-layer capacitors
- Y02E 60/14      ..      Thermal storage (empty, covered by subgroups)
- Y02E 60/142      ...      Sensible heat storage
- Y02E 60/145      ...      Latent heat storage
- Y02E 60/147      ...      Cold storage
- Y02E 60/15      ..      Pressurised fluid storage
- Y02E 60/16      ..      Mechanical energy storage, e.g. flywheels
- Y02E 60/17      ..      Pumped storage
- Y02E 60/30      .      Hydrogen technology (not used, see subgroups)
- Y02E 60/32      ..      Hydrogen storage

- Y02E 60/321 . . . Storage of liquefied, solidified, or compressed hydrogen in containers
- Y02E 60/322 . . . Storage in caverns
- Y02E 60/324 . . . Reversible uptake of hydrogen by an appropriate medium
- Y02E 60/325 . . . . the medium being carbon
- Y02E 60/327 . . . . the medium being a metal or rare earth metal, an intermetallic compound or a metal alloy
- Y02E 60/328 . . . . the medium being an organic compound or a solution thereof
- Y02E 60/34 . . Hydrogen distribution
- Y02E 60/36 . . Hydrogen production from non-carbon containing sources
- Y02E 60/362 . . . by chemical reaction with metal hydrides, e.g. hydrolysis of metal borohydrides
- Y02E 60/364 . . . by decomposition of inorganic compounds, e.g. splitting of water other than electrolysis, ammonia borane, ammonia
- Y02E 60/366 . . . by electrolysis of water
- Y02E 60/368 . . . . by photo-electrolysis
  
- Y02E 60/50 . Fuel cells
- Y02E 60/52 . . characterised by type or design
- Y02E 60/521 . . . Proton Exchange Membrane Fuel Cells [PEMFC]
- Y02E 60/522 . . . . Direct Alcohol Fuel Cells [DAFC]
- Y02E 60/523 . . . . . Direct Methanol Fuel Cells [DMFC]
- Y02E 60/525 . . . Solid Oxide Fuel Cells [SOFC]
- Y02E 60/526 . . . Molten Carbamate Fuel Cells [MCFC]
- Y02E 60/527 . . . Bio Fuel Cells
- Y02E 60/528 . . . Regenerative or indirect fuel cells, e.g. redox flow type batteries
- Y02E 60/56 . . integrally combined with other energy production systems
- Y02E 60/563 . . . Cogeneration of mechanical energy, e.g. integral combination of fuel cells and electric motors
- Y02E 60/566 . . . Production of chemical products inside the fuel cell; incomplete combustion
  
- Y02E 60/60 . Arrangements for transfer of electric power between AC networks via a high-tension DC link, HVDC transmission
  
- Y02E 60/70 . Systems integrating technologies related to power network operation and communication or information technologies mediating in the improvement of the carbon footprint of electrical power generation, transmission or distribution, i.e. smart grids as enabling technology in the energy generation sector ([smart grids relating to the energy generation sector in general, including the technologies with no associated climate change mitigation effect Y04S 10/00](#)) { not used, see subgroups }
- Y02E 60/72 . . Systems characterised by the monitored, controlled or operated power network elements or equipments { not used, see subgroups }
- Y02E 60/721 . . . the elements or equipments being or involving electricity based vehicles, i.e. power aggregation of electric vehicles [EV] or hybrid vehicles [HEV] ([remote or cooperative charging Y02T 90/168](#); [details associated with the interoperability in the section of transportation, e.g. vehicle recognition, authentication, identification or billing Y02T 90/169](#))
- Y02E 60/722 . . . the elements or equipments being or involving energy storage units ([for systems comprising uninterruptible power supplies or standby generators Y04S 20/12](#))

Y02E 60/723	...	the elements or equipments being or involving electric power substations
Y02E 60/724	...	the elements or equipments being or involving switches, relays or circuit breakers, e.g. intelligent electronic devices [IED]
Y02E 60/725	...	the elements or equipments being or involving protection elements, arrangements or systems
Y02E 60/726	...	the elements or equipments being or involving voltage regulating units
Y02E 60/727	...	the elements or equipments being or involving measuring units
Y02E 60/728	....	the elements or equipments being or involving phasor measuring units [PMU]
Y02E 60/74	..	Systems characterised by state monitoring, e.g. fault, temperature monitoring, insulator monitoring, corona discharge
Y02E 60/76	..	Computer aided design [CAD]; Simulation; Modelling
Y02E 60/78	..	Communication technology specific aspects (not used, see subgroups)
Y02E 60/7807	...	Details of the transmission structure or support between the monitoring, controlling or managing units and monitored, controlled or operated electrical equipment (not used, see subgroups)
Y02E 60/7815	....	using the power network as support for the transmission
Y02E 60/7823	.....	using pulsed signals
Y02E 60/783	.....	using modification of a parameter of the network power signal
Y02E 60/7838	....	using a data transmission bus
Y02E 60/7846	....	using phone lines
Y02E 60/7853	....	using wireless data transmission
Y02E 60/7861	.....	By means of mobile telephony
Y02E 60/7869	....	using Internet
Y02E 60/7876	...	Aspects related to the treatment or conditioning of data or signals { not used, see subgroups }
Y02E 60/7884	....	Associated with communication via dedicated transmission supports
Y02E 60/7892	....	Associated with communication via power transmission network
<b>Y02E 70/00</b>	<b>Other energy conversion or management systems reducing GHG emissions</b>	
Y02E 70/10	.	Hydrogen from electrolysis with energy of non-fossil origin, e.g. PV, wind power, nuclear
Y02E 70/20	.	Systems combining fuel cells with production of fuel of non-fossil origin
Y02E 70/30	.	Systems combining energy storage with energy generation of non-fossil origin
Y02E 70/40	.	Energy efficient batteries, ultracapacitors, supercapacitors or double-layer capacitors charging or discharging systems or methods, e.g. auxiliary power consumption reduction, resonant chargers or dischargers, resistive losses minimisation