Low-carbon economy 11 kWh

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Low-carbon energy refers to energy sources that produce minimal levels of carbon dioxide emissions when generating electricity. Prominent examples of low-carbon energy sources include wind, nuclear, and solar power. These forms of energy are crucial in the global quest to reduce greenhouse gas emissions, combat climate change, and ensure a sustainable future.

The process of generating electricity through low-carbon sources involves various technologies. Wind energy harnesses the kinetic energy of the wind to turn turbines, which then convert this mechanical energy into electricity. On the other hand, solar energy employs photovoltaic cells that capture sunlight and directly convert it to electrical energy. Nuclear power relies on nuclear fission reactions in reactors, where the splitting of atoms releases a tremendous amount of heat, which is then used to generate steam that drives turbines to produce electricity.

One significant advantage of low-carbon energy is its remarkably low carbon intensity. Wind has a carbon intensity of 11 gCO2eq/kWh, nuclear power emits just 12 gCO2eq/kWh, and solar energy averages around 45 gCO2eq/kWh. When compared to fossil fuel-based sources like coal (820 gCO2eq/kWh) and natural gas (490 gCO2eq/kWh), the emissions from low-carbon sources are negligible. This stark contrast underscores the critical role of low-carbon technologies in mitigating climate change and reducing air pollution.

Low-carbon energy sources currently generate 40.75% of all electricity consumed globally, reflecting their significant contribution to the world"s electricity needs. This demonstrates a growing global commitment to embracing sustainable energy sources and reducing dependency on high-emission fossil fuels. Particularly in nations like Iceland, where 100% of electricity is generated from low-carbon sources, it is clear that such technologies can provide reliable and clean power on a large scale.

In specific examples, countries like Norway (99%), Sweden (96%), and Finland (88%) extensively rely on low-carbon energy for their electricity supply. Canada also demonstrates a commendable commitment, with low-carbon energy making up 81% of its electricity generation. These countries serve as exemplary models in showcasing how robust investments in low-carbon technologies can yield substantial environmental and economic benefits.

The widespread adoption of low-carbon energy has numerous advantages. It promotes energy security by diversifying the energy mix and reduces dependence on imported fossil fuels. Additionally, it helps in creating green jobs, stimulates technological innovation, and fosters sustainable development. By focusing on expanding the reach of wind, nuclear, and solar power, countries worldwide can ensure a greener, more resilient, and environmentally friendly energy future.

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Figure 1 shows that a wide range of regulatory and economic incentive measures have been implemented in the global power sector since the financial crisis. The majority (37%) of these policies involve financial mechanisms such as payments, grants, transfers, and taxation. Regulations, codes, and standards are the second most common category of policy, accounting for 25%. Targets, plans, and framework legislation account for 18%, while feed-in tariffs/premiums account for 12% and tax credits, taxes, fees, charges, and exemptions account for 8% (Fig. 1a). Governments prioritized economic incentives, designed regulatory measures, and set targets and plans for power sector during the recovery period of financial crisis (2007-2011).

a Regulatory and economic instruments. b Renewables. c Other technologies. Regulatory policies and economic policies are divided into five types. RCS represents regulation, codes, and standards; TPFL represents targets, plans, and framework legislation; FT represents feed-in tariffs/premiums; PFTGT represents payments, finance, transfers, grants, and taxation; TTFCE represents tax credits, taxes, fees, charges, and exemptions. The year was the time that policy went into force. Tables S1.1-S1.9 present national samples of these policies.

In terms of other technological policy, 45% of newly enacted policies are focused on energy efficiency (Fig. 1c). There was also a major growth in policies relating to technology R& D innovation and combined heat and power projects during the crisis recovery phase. Finally, Carbon Capture, Utilization and Storage (CCUS) and digitization policies have a smaller share during the study period19. The global financial crisis provided the opportunity for climate scientists and policymakers to examine and update the energy policy framework of the global power sector20.

a Regulatory and economic instruments. b Renewables. c Other technologies. This policy map covers 125 countries.

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