



HARMONY



What will power  
our electric future?

**“There is no sustainable energy future in the absence of nuclear energy.”**

Fatih Birol, Executive Director, International Energy Agency

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**“With virtually no greenhouse gas emissions during operation, nuclear power can have an important role to play in achieving the United Nations’ Sustainable Development Goals.”**

Mikhail Chudakov, Deputy Director General, International Atomic Energy Agency

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**“A dialogue on the energy transition is incomplete without considering nuclear power.”**

Scott Foster, Director, Sustainable Energy Division, United Nations Economic Commission for Europe

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**“Harmony’s success will depend on an all-hands-on-deck effort across the nuclear community - in business, government, and how we spread the word about nuclear energy to reach the 2050 goals and mitigate the worst impacts of climate change.”**

Josh Freed, Vice President, Clean Energy Program, Third Way



# 25%

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To meet the growing demand for sustainable energy, we will need nuclear to provide at least 25% of electricity by 2050 as part of a clean and reliable low-carbon mix.

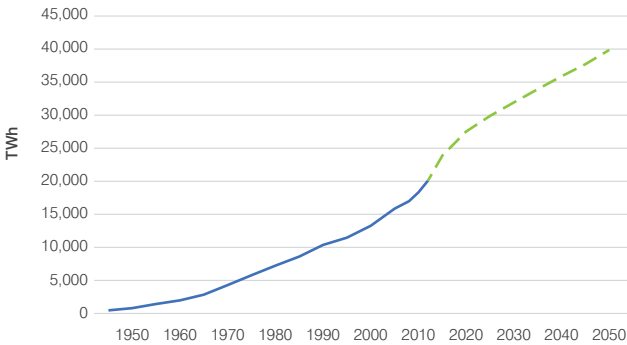
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Achieving this means nuclear generation must triple globally by 2050. The Harmony programme is a global initiative of the nuclear industry that provides a framework for action, working with key stakeholders so that barriers to growth can be removed.

# Why we need Harmony

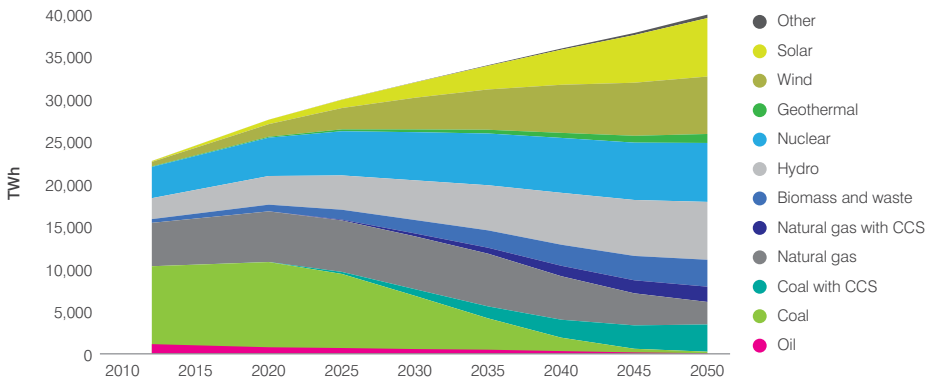
An increased share of low-carbon sources, as well as a drastically reduced level of fossil fuels, work together in harmony to secure a reliable, affordable and clean future energy supply 24 hours a day.

## Electricity consumption growth in a low-carbon scenario



Source: Energy Technology Perspectives 2015

## International Energy Agency (IEA) 2°C Scenario: nuclear to provide a significant contribution to global electricity in 2050



Source: IEA Energy Technology Perspectives 2015



Access to electricity and clean air are vital needs. Currently one in six people in the world has no access to electricity. As electricity demand continues to rise, greenhouse gas emissions must fall if we are to mitigate climate change and we must switch to cleaner sources to reduce air pollution. This will require large increases of all low-carbon energy sources, of which nuclear is an important part.



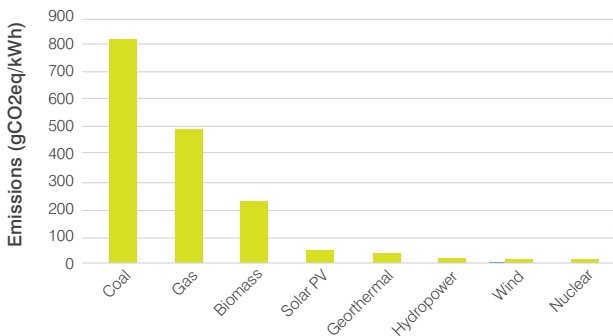
# Nuclear: an important part of the energy mix

The international community recognizes the urgent need to decarbonize our electricity generation to protect people and the planet from the dangers of air pollution\* and climate change. Nuclear energy is proven, available today and can be expanded quickly, making it an important part of the solution.

## When considering whole life-cycle emissions, nuclear ranks as one of the best sources of energy.

The IPCC Special Report on Global Warming of 1.5°C concluded that limiting climate change will require global greenhouse gas emissions to start reducing almost immediately. This will require a faster switch to electricity for energy end use and for that greater electricity demand to be met by low-carbon generation, including nuclear. Nuclear generation increases on average by around 2.5 times by 2050 in the 89 mitigation scenarios considered by the IPCC.

### Life-cycle carbon emissions from selected electricity supply technologies



Source: 2014 IPCC, Global warming potential of selected electricity sources

\* 7 million premature deaths are linked to air pollution every year according to the World Health Organization, Department of Public Health, Environmental and Social Determinants of Health, 2014.





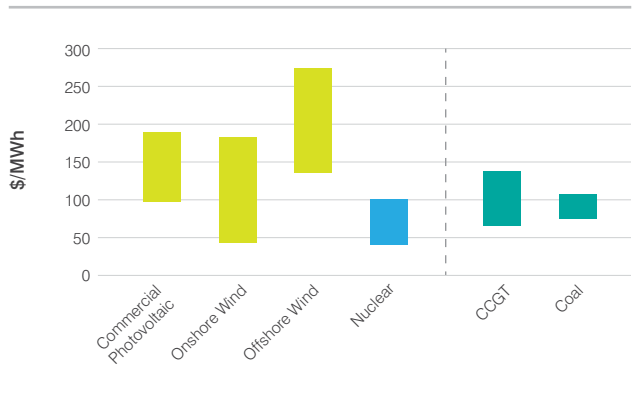


## Nuclear power is one of the most cost-effective low-carbon options for generating electricity.

Nuclear generation is a cost-competitive low-carbon generation option. According to the IEA's World Energy Outlook 2018, the cost of electricity in China from onshore wind, solar PV and offshore wind is respectively 16%, 50% and 140% higher than that from nuclear, even without including the additional costs of adapting the grid and providing back-up generation to compensate for their intermittency.

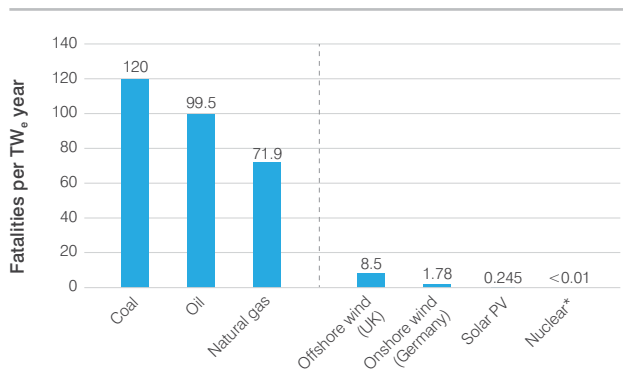
According to the OECD Nuclear Energy Agency "a mix relying primarily on nuclear is the most cost-effective option to achieve the decarbonization target of 50 g CO<sub>2</sub> per kWh."<sup>1</sup>

### Levelized cost of electricity ranges (at 7% discount rate)



Source: Projected Costs of Generating Electricity - 2015 Edition, International Energy Agency and OECD Nuclear Energy Agency

### Nuclear: lowest energy accident fatalities for OECD countries



\* Gen II PWR, Swiss. Source: Paul Scherrer Institut. Data for nuclear accidents modified to reflect UNSCEAR findings/recommendations 2012 and NRC SOARCA study 2015

<sup>1</sup> Source: The Costs of Decarbonisation: System Costs with High Shares of Nuclear and Renewables, OECD Nuclear Energy Agency (2019)





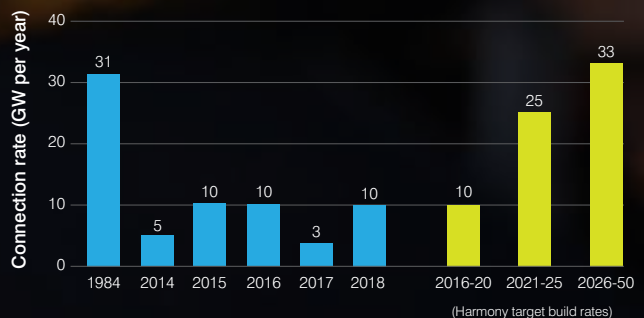


## The Harmony goal

Today, with the experience and knowledge it has gained, the nuclear energy industry is in a strong position to deliver on the Harmony goal of generating 25% of electricity by 2050. This is an ambitious target, but the rate at which new reactors will have to be built is no higher than what has been achieved historically.

To meet the Harmony goal, we will need to build 1000 GWe of new nuclear capacity by 2050. The average build rate required is:

- 10 GWe per year between 2016 and 2020.
- 25 GWe per year between 2021 and 2025.
- 33 GWe per year between 2026 and 2050.



# Creating Harmony

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Low-carbon energy sources are not valued on an equitable basis, preventing nuclear from contributing fully to a sustainable low-carbon energy mix. As an industry, we are working to address this through the following three objectives.

1

**Create a level playing field** in energy markets which drives investment in future clean energy. Nuclear energy needs to be recognized for its reliability and should be treated on equal terms as other low-carbon technologies as part of a robust low-carbon mix.

Currently, electricity markets are failing to recognize the full costs and benefits of different forms of electricity generation. Even where carbon pricing is implemented, it does not represent the true long-term costs of climate change. There is no credit given for the reliable, long-term, 24/7 generation supplied by nuclear energy.

2

**Create harmonized regulatory processes** to provide a more internationally consistent, efficient and predictable nuclear licensing regime, to facilitate growth of nuclear capacity and timely licensing of innovative designs.

Multiple regulatory barriers from diverse national licensing processes and safety requirements currently limit global civil nuclear trade and investment. A lack of international standardization places unnecessary regulatory burdens on nuclear activities, and delays in the licensing of new designs hinders innovation.

3

**Create an effective safety paradigm** focusing on genuine public wellbeing where the health, environmental and safety benefits of nuclear are better understood and valued when compared with other energy sources.

The current energy system fails to consider safety from a holistic societal perspective. The health and environmental benefits of nuclear energy are not valued on an equitable basis with alternative energy sources. The debate fails to take into consideration important factors such as economics, industrial development, societal needs, the environment and public health.

**The International Energy Agency has called for nuclear energy to receive “clear and consistent policy support for existing and new capacity, including clean energy incentive schemes for development of nuclear alongside other clean forms of energy.”**

IEA Energy Technology Perspectives 2017



## Pathway

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Achieving 1000 GWe of new nuclear build by 2050 will require a cooperative effort from the whole nuclear community – industry, research, governments, and regulators – to focus on removing the real barriers to growth.

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Harmony provides a framework for action so that nuclear energy can deliver its potential. Coordinated by World Nuclear Association, the Harmony programme is identifying the measures that need to be put in place, and getting support from key stakeholders to ultimately deliver a low-carbon future to which nuclear fully contributes.

# WORLD NUCLEAR ASSOCIATION

World Nuclear Association  
Tower House 10 Southampton Street  
London WC2E 7HA  
United Kingdom

The Harmony programme is a global initiative of the nuclear industry coordinated by World Nuclear Association.

+44 (0)20 7451 1520  
[www.world-nuclear.org](http://www.world-nuclear.org)  
[harmony2050@world-nuclear.org](mailto:harmony2050@world-nuclear.org)

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