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Harmony – the future of electricity and nuclear delivering its potential

Leonam Guimarães
Board of Management member

WORLD NUCLEAR UNIVERSITY

WNU Short Course on
"The World Nuclear Industry Today"
Rio de Janeiro,19 March 2018

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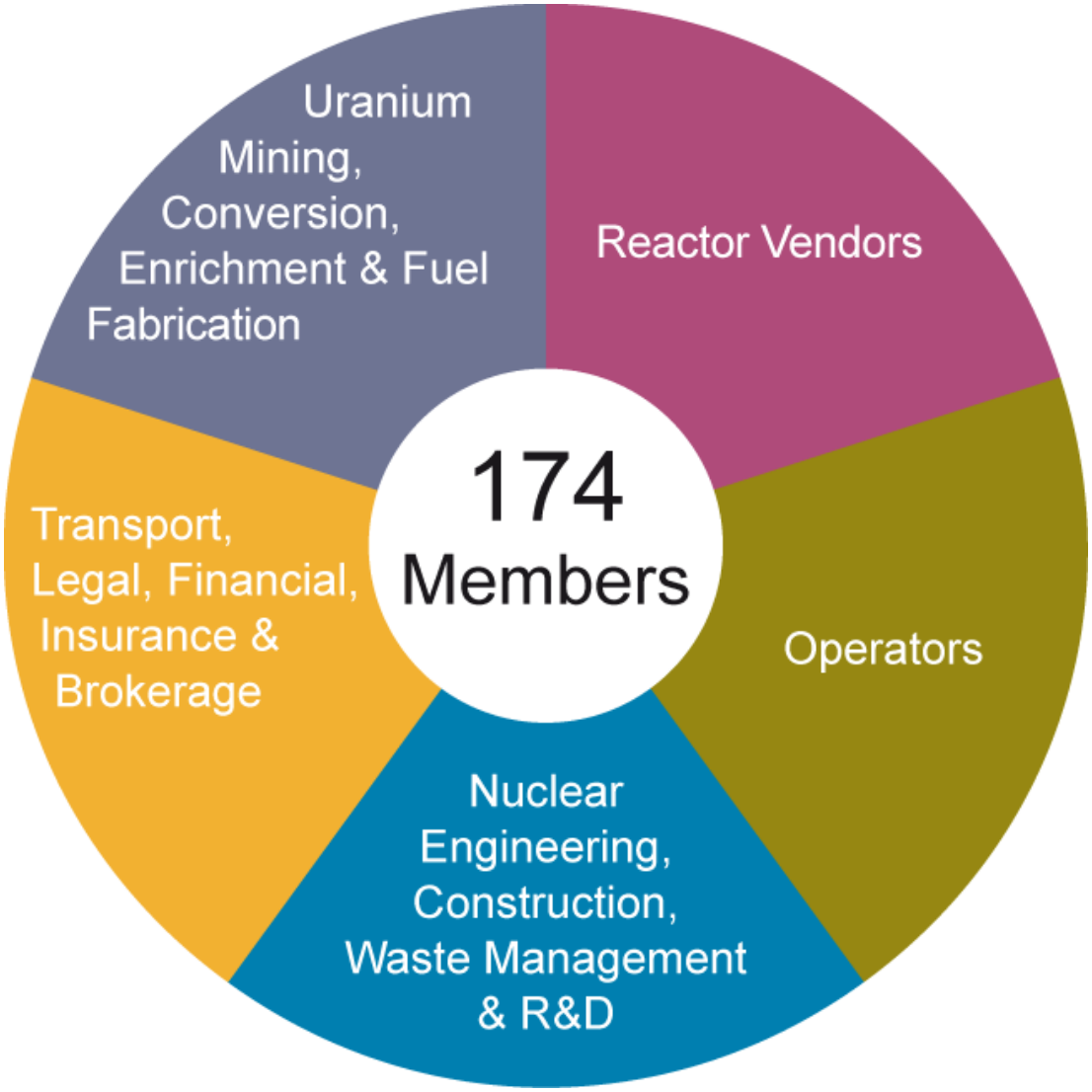
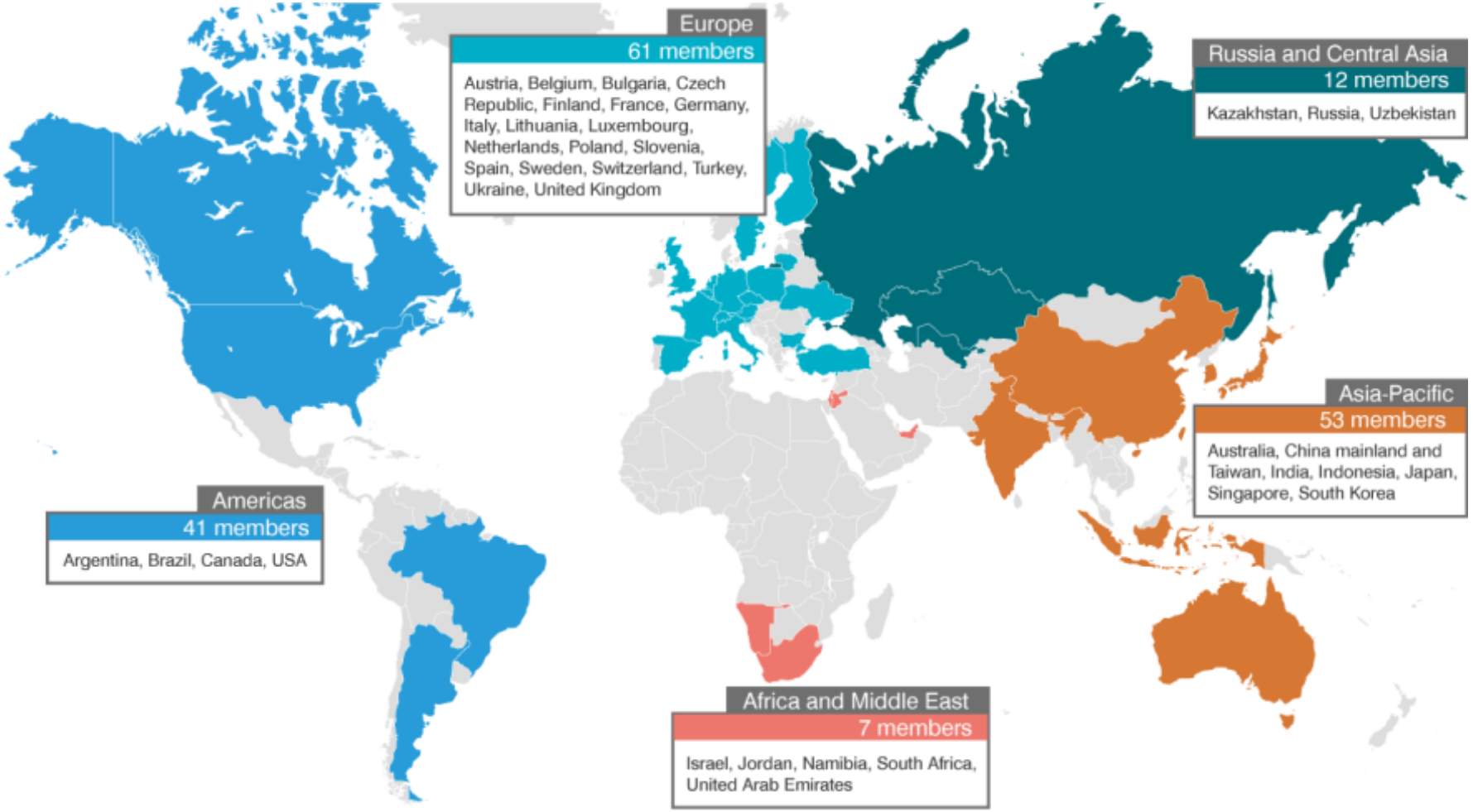
Members


Uranium Mining, Conversion, Enrichment & Fuel Fabrication
Reactor Vendors
Transport, Legal, Financial, Insurance & Brokerage
174 Members
Operators
Nuclear Engineering, Construction, Waste Management & R&D

The World Nuclear Association is the industry organisation that represents the global nuclear industry

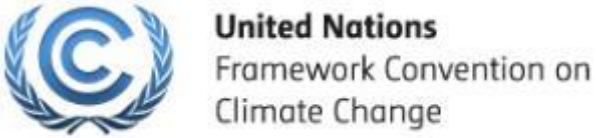


Influencing the energy debate

We represent the nuclear industry's interests where the energy debate is taking place and deliver targeted information to key influencers

- Decision-makers
- International media
- Nuclear industry
- Nuclear organisations

Representing the global nuclear industry in key international forums



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Growth on top of steady performance

GLOBAL NUCLEAR STATUS

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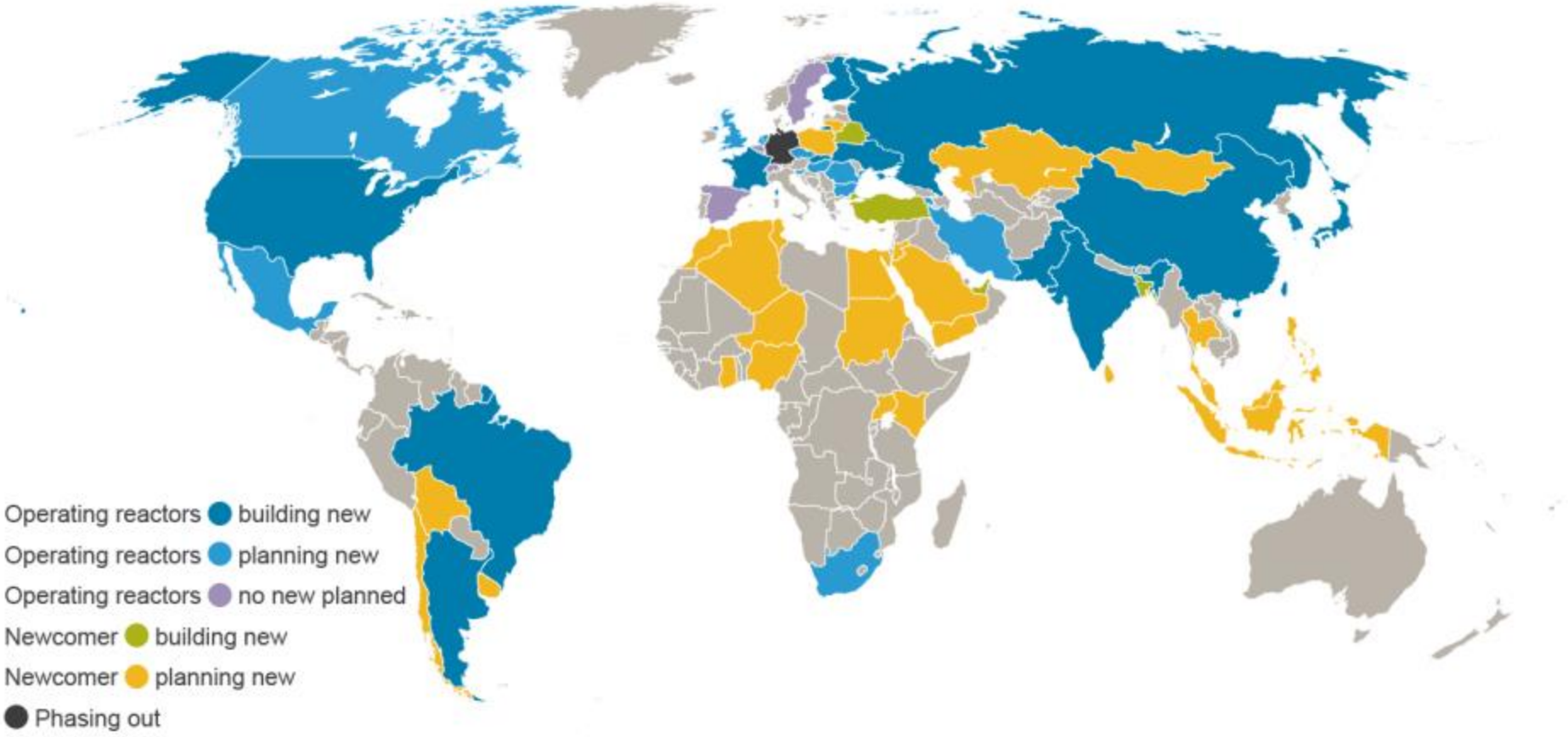
New build and new countries



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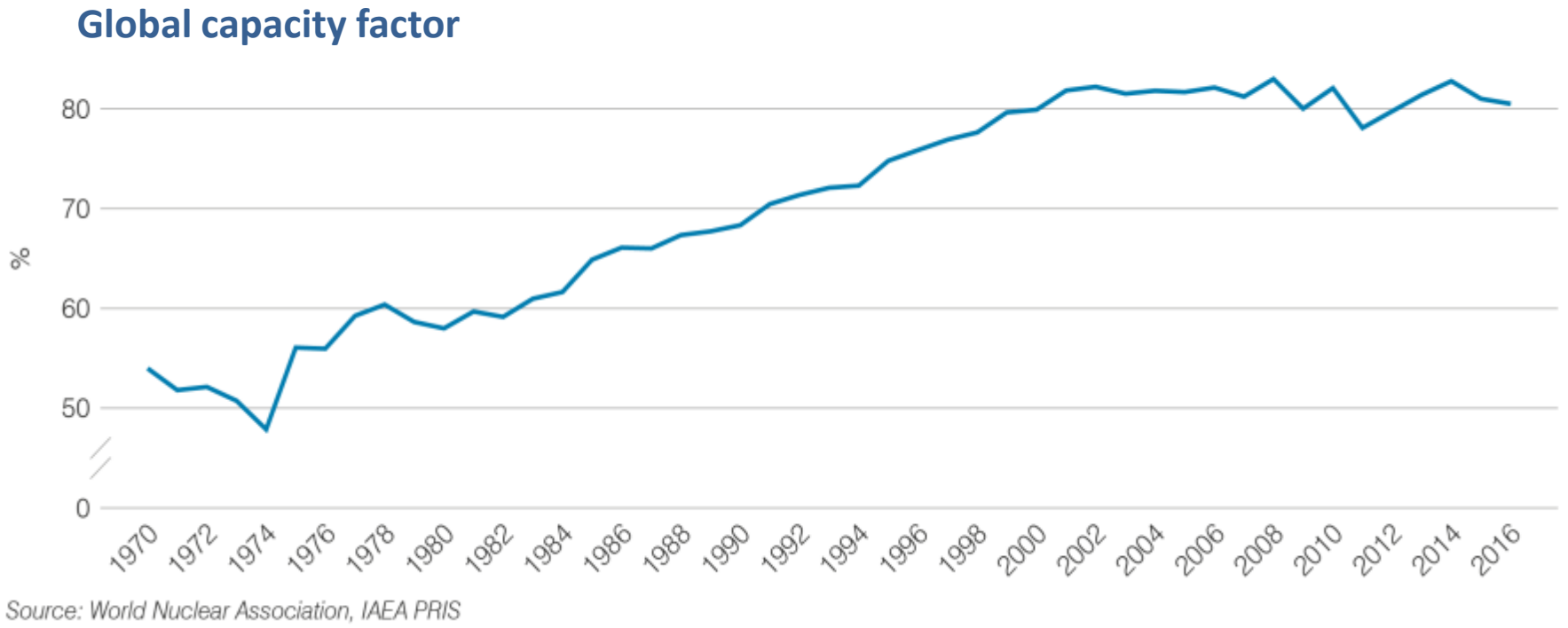
Existing reactors operate better than ever



Source: World Nuclear Association, IAEA PRIS

High and consistent capacity factor = reliable performance worldwide

Ten new reactors in 2016, equalling 2015
Higher than in previous 25 years.

India
Kudankulam-2

Pakistan
Chasnupp-3

Russia
Novovoronezh 2-1

South Korea
Shin-Kori-3

USA
Watts Bar-2

China
Changjiang-2

China
Fangchenggang-2

China
Fuqing-3

China
Hongyanhe-4

China
Ningde-4

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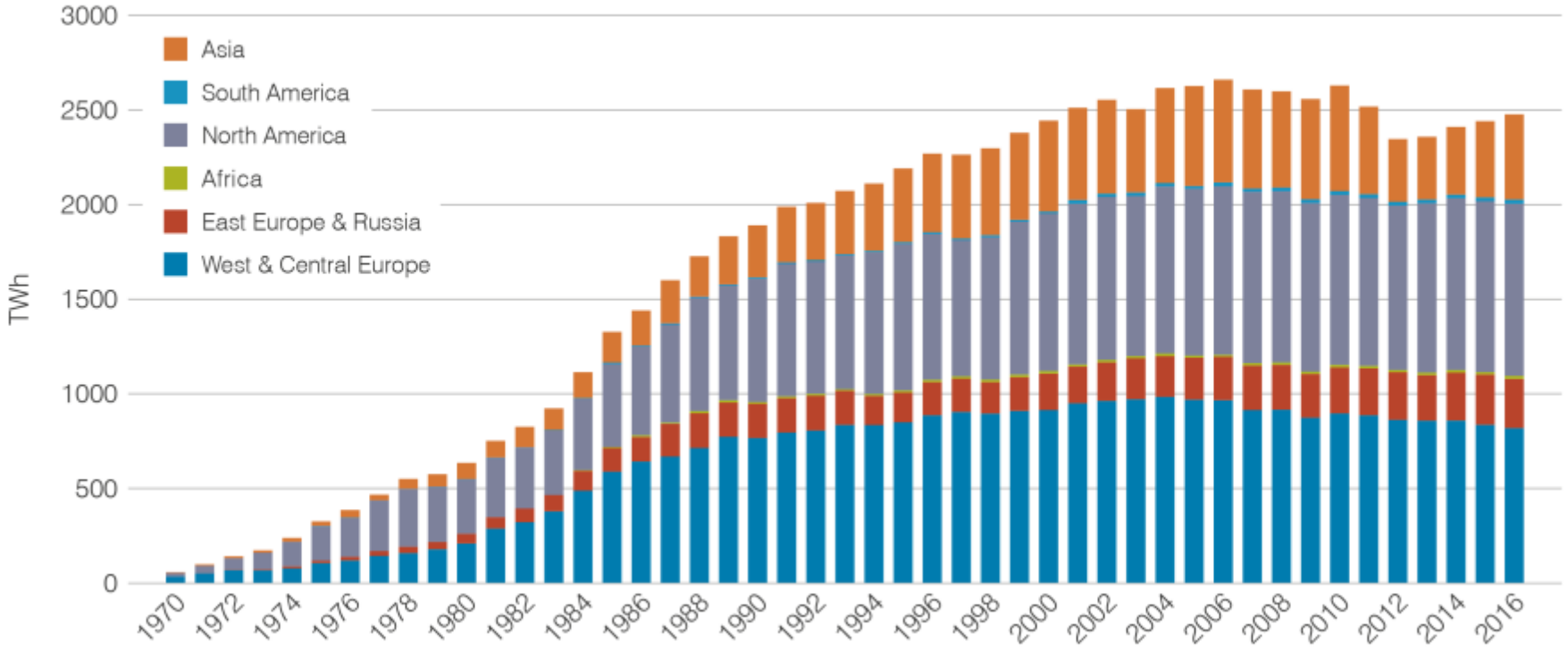
Global nuclear generation



Source: World Nuclear Association, IAEA Power Reactor Information Service (PRIS)

448 operable reactors **10% of global electricity** **2476 TWh**

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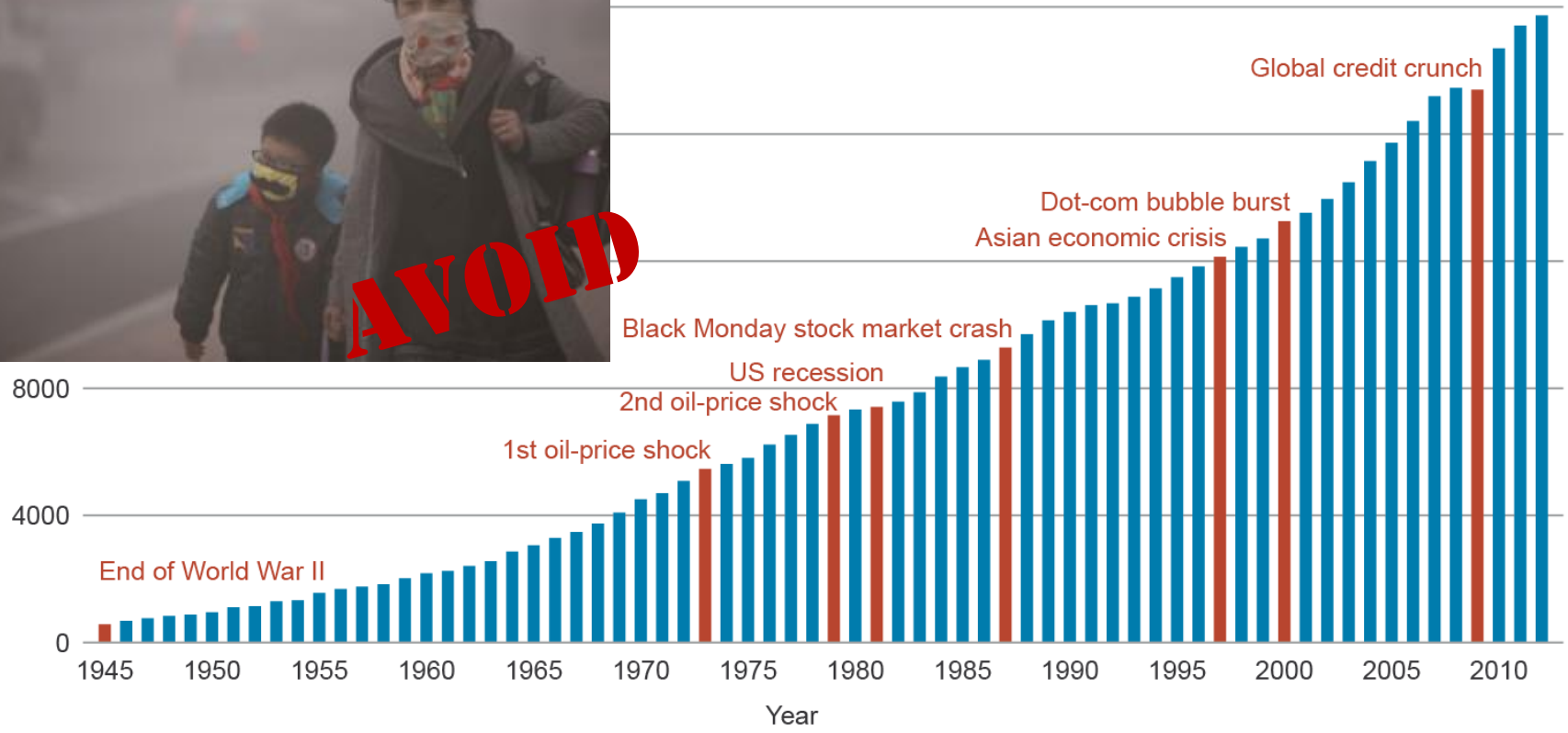
Demand for electricity continues to rise and must be met cleanly



Source: 1945-1979, International Energy Agency databases and analysis
1980-2012, Energy Information Administration

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Many scenarios are used

2 Transition to a lower carbon energy and greater efficiency

The future supply mix is projected to expand into

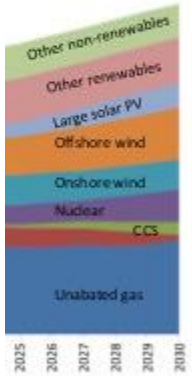
By r

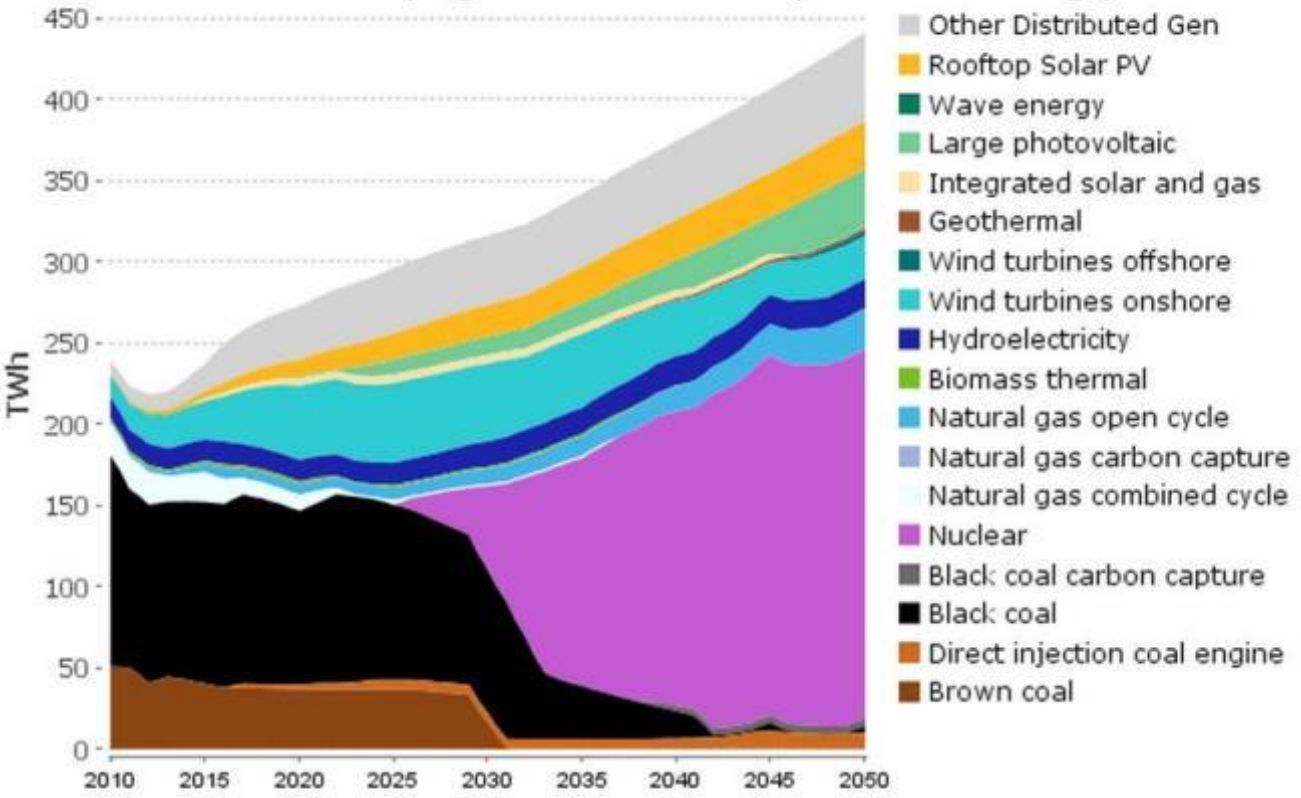
Department
Energy &
limate Change

12-30

Billion toe

18
15
12
9
6
3
0
1990





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Source: Copyright Commonwealth Scientific and Industrial Research Organisation 2012-.
Chart based on user selected assumptions and generated by CSIROs eFuture tool.

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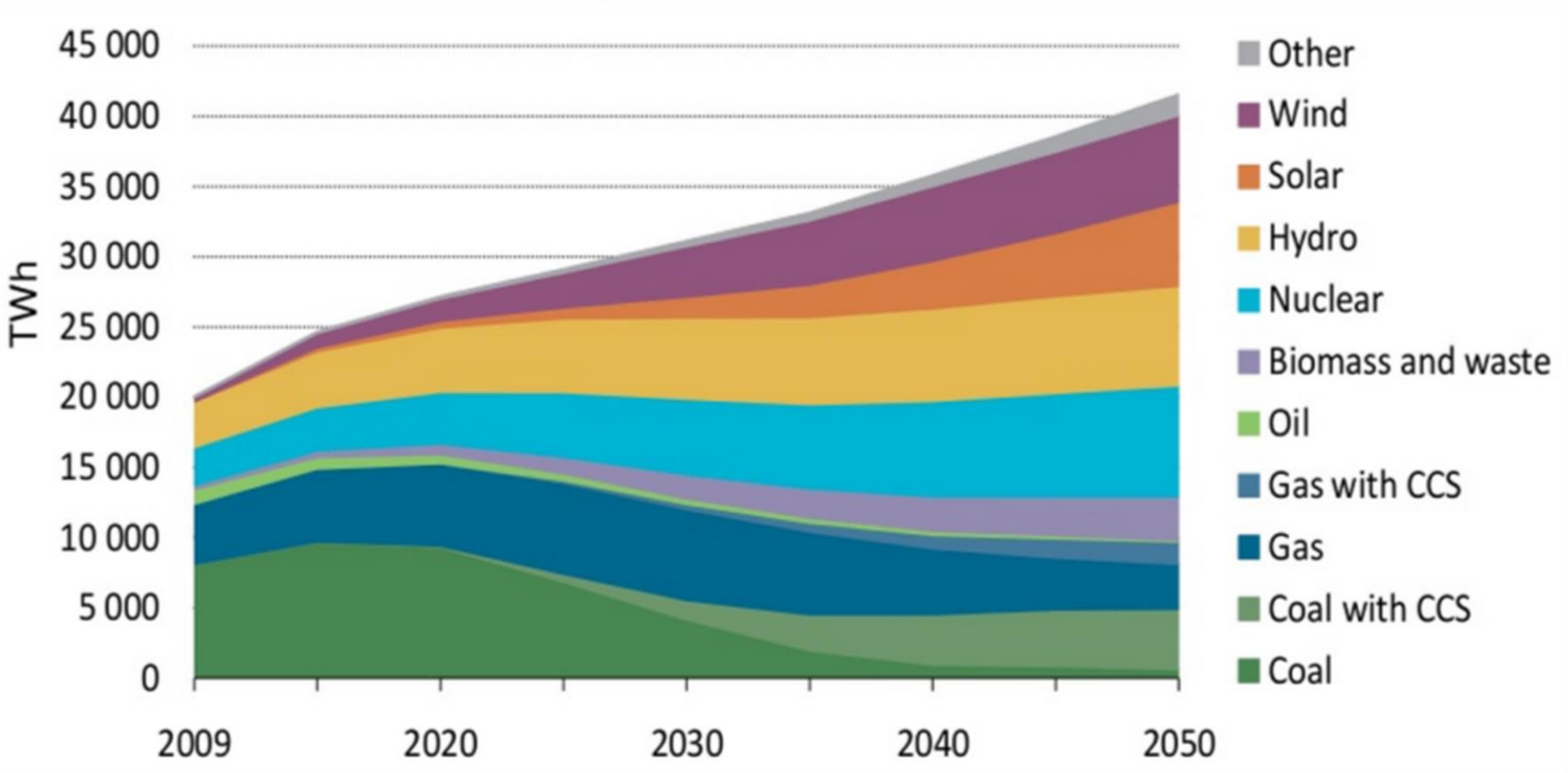
IEA 2°C Scenario is a benchmark



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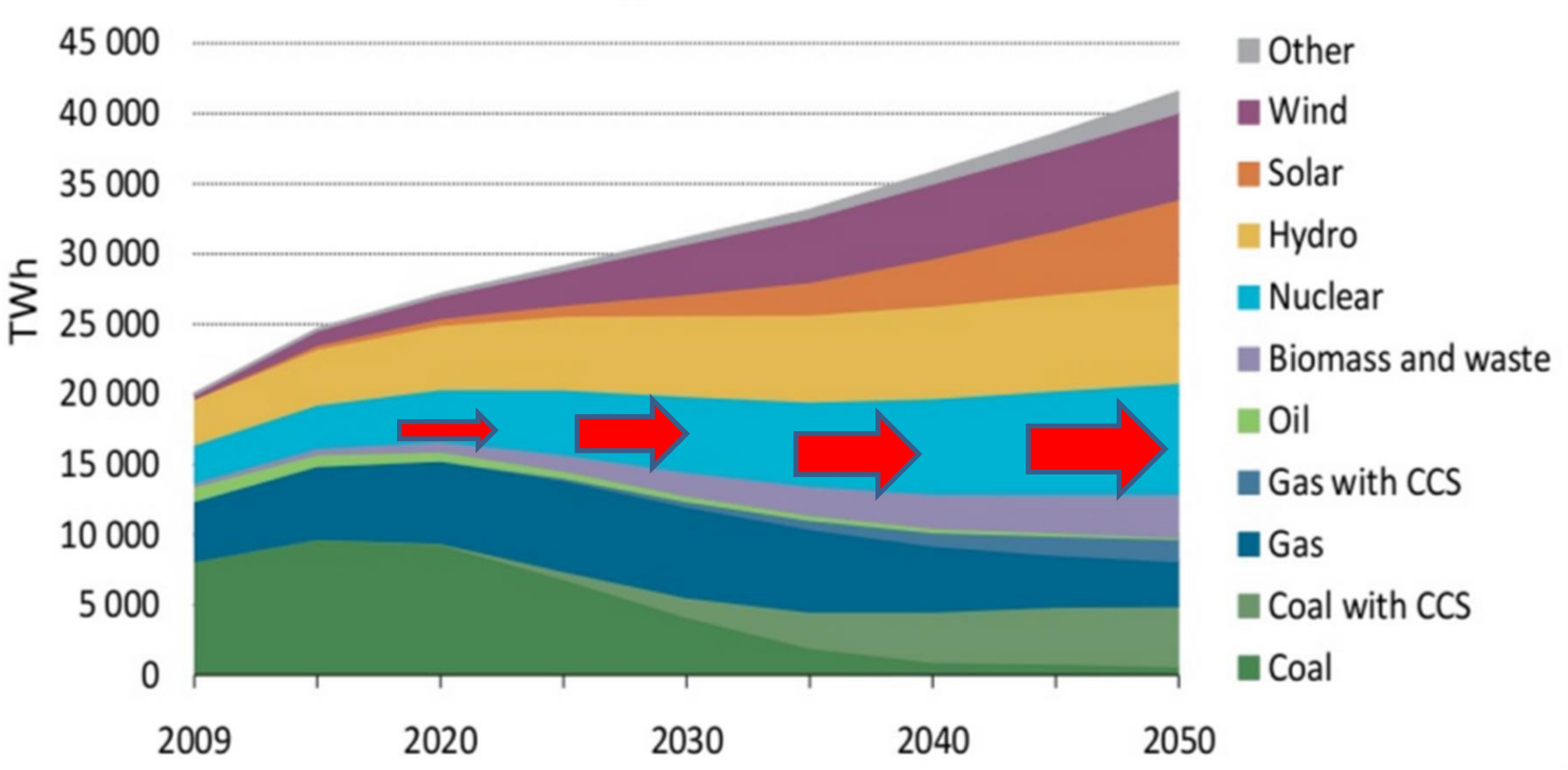
IEA 2°C Scenario: Nuclear to provide the largest contribution to global electricity in 2050



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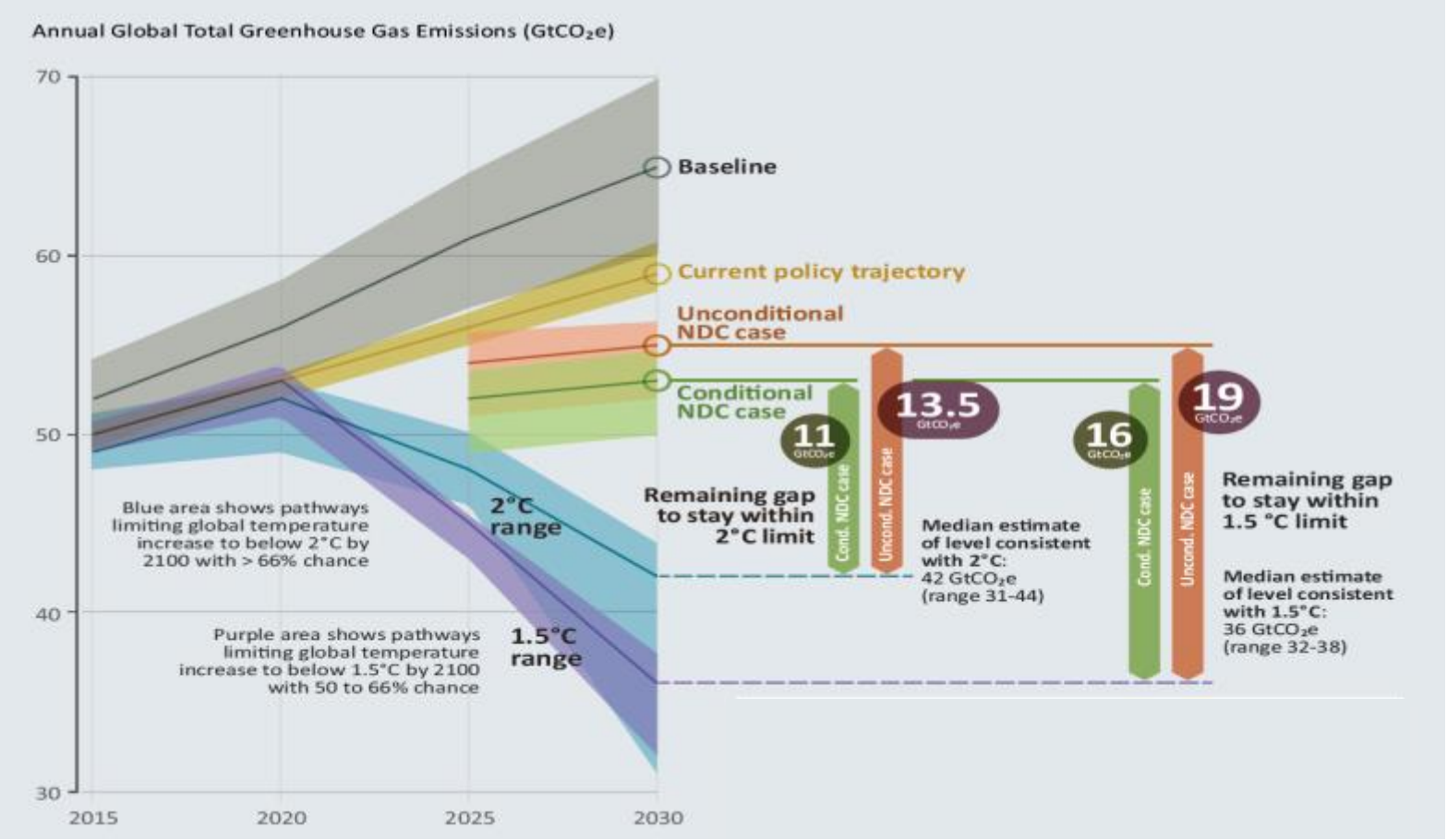
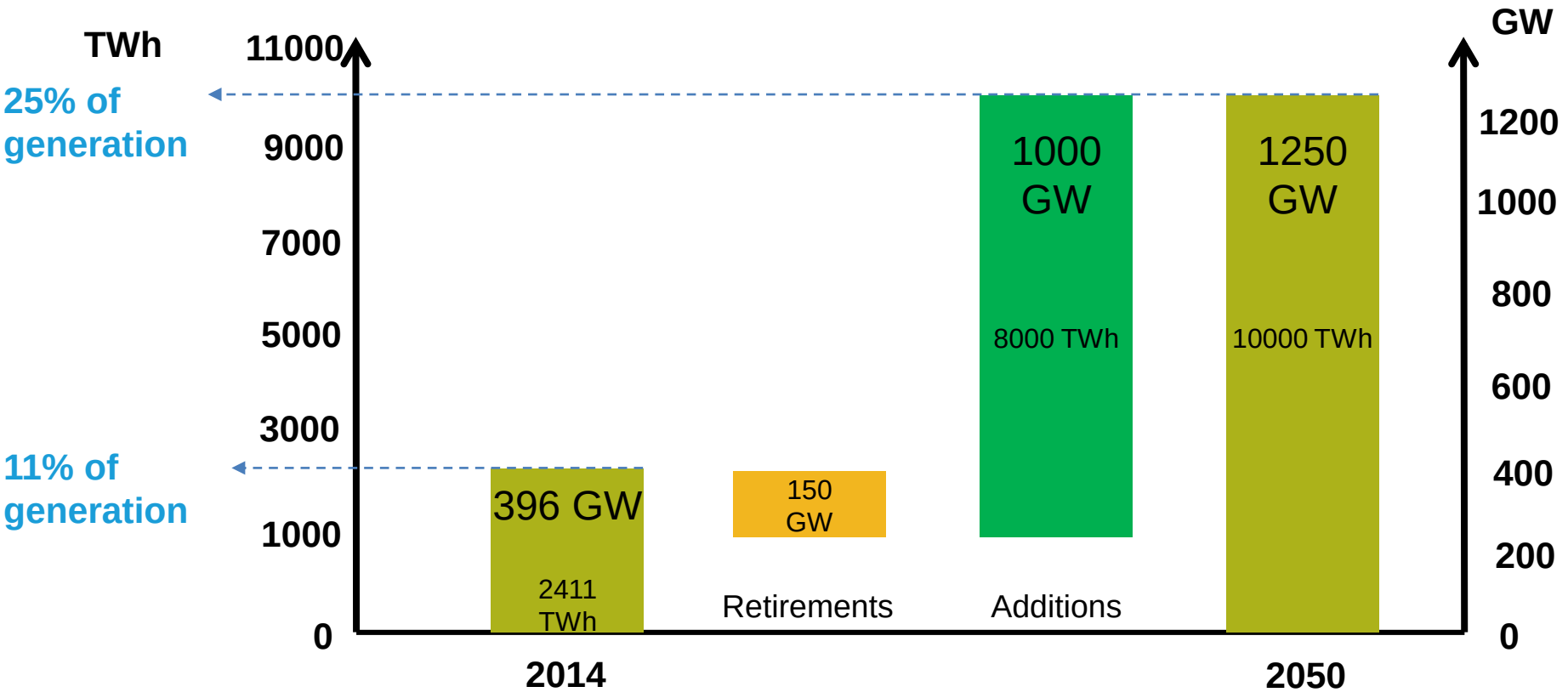
Current global plans to limit emission

Current national plans to limit emissions and address climate change are far from meeting the 2 Degree target.
--- Urgent actions are needed now.



Source: UNEP 2017 The Emissions Gap Report

Nuclear: Substantial growth required to meet demand in IEA 2 degree scenario



Source: World Nuclear Association. Growth required for nuclear energy to supply 25% of electricity in 2050 under demand forecast of two-degree scenario (see IEA, 2015, Energy Technology Perspectives 2015.
Assumption: 91% capacity factor

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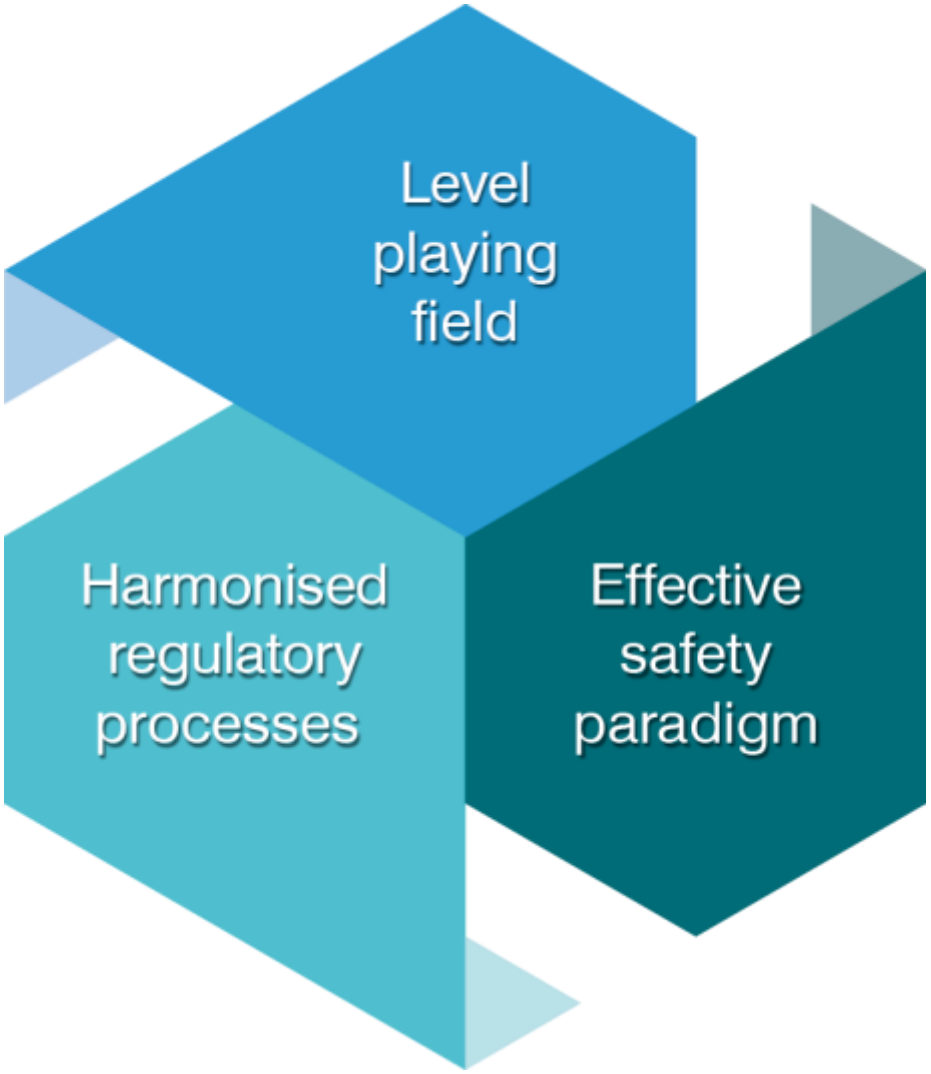
Harmony: a goal for the nuclear community



1000 gigawatt new nuclear capacity by 2050

25% of electricity supply in 2050

Nuclear to deliver reliable, affordable and clean electricity

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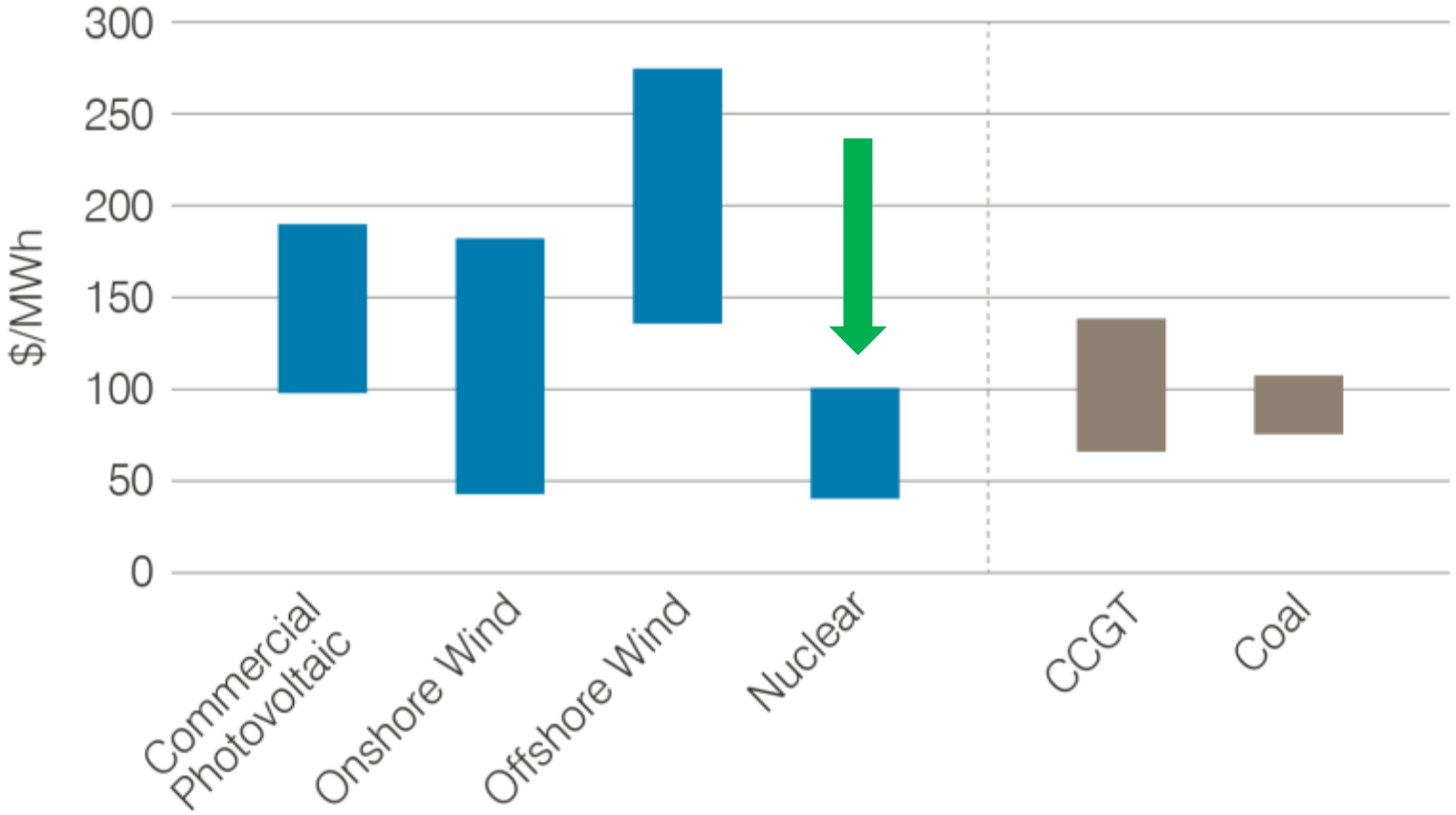
Nuclear energy is cost competitive

Levelised cost of electricity ranges (LCOE) at 7% discount rate



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

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The world in not on track with the energy transition. Nuclear energy has to scale up

There are several barriers to achieving the Harmony goal

Electricity market failure

Multiple regulatory barriers

Misconception of risks and benefits

Markets: A level playing field

Optimise existing low carbon energy resources already in place and drive investment in future clean energy, where nuclear energy is treated equally with other low-carbon techologies and is recognized for its values as part of a low carbon energy mix delivering 24/7

- Avoid specific nuclear tax burdens that distort the economics of long-term operation of nuclear facilities
- Adopt appropriate carbon price that recognises energy sources for their zero-emissions attributes
- Reflected system costs in the energy market, ability to deliver 24/7 and ensure security of supply in systems with a large share of renewables
- Encourage investment in large capital low-carbon electricity generation projects

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Harmonised regulatory processes

Ensure harmonised regulatory processes to provide a more internationally consistent, efficient and predictable nuclear licensing regime allowing for standardised solutions, to facilitate significant growth of nuclear capacity, without compromising safety and security

- Achieve an increased level of harmonisation and standardisation
- Increase awareness that harmonized regulations and enhanced cooperation are compatible with regulatory independence and national sovereignty
- Increase support and expansion of current activities on harmonisation of regulatory processes, focusing on common approach on design acceptance
- Raising international activities of stakeholders (regulators, governments, industry) to the next level in order to develop coherent roadmap of work leading to a more internationally consistent regulatory system

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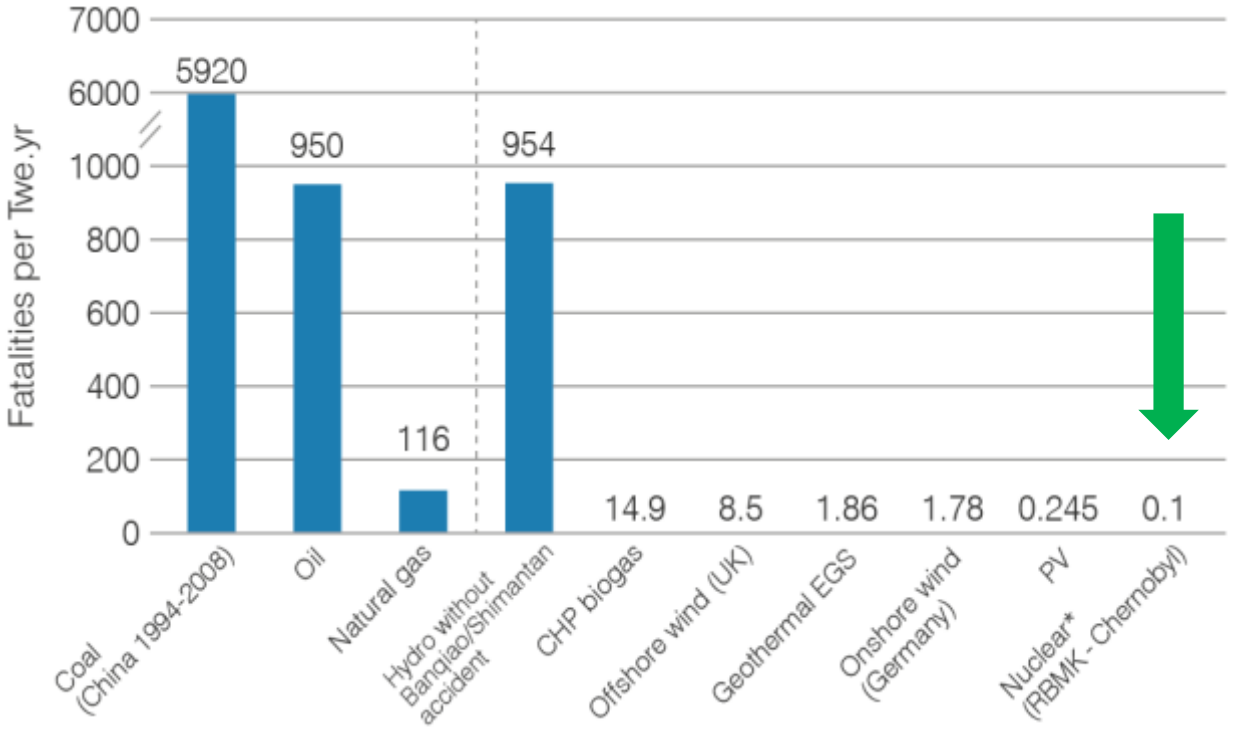
An effective safety paradigm

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

Energy accident fatalities for non-OECD countries



Source: Paul Scherrer Institut. Data for nuclear accidents modified by WNA to reflect UNSCEAR recommendations 2012 and NRC SOARCA study 2015

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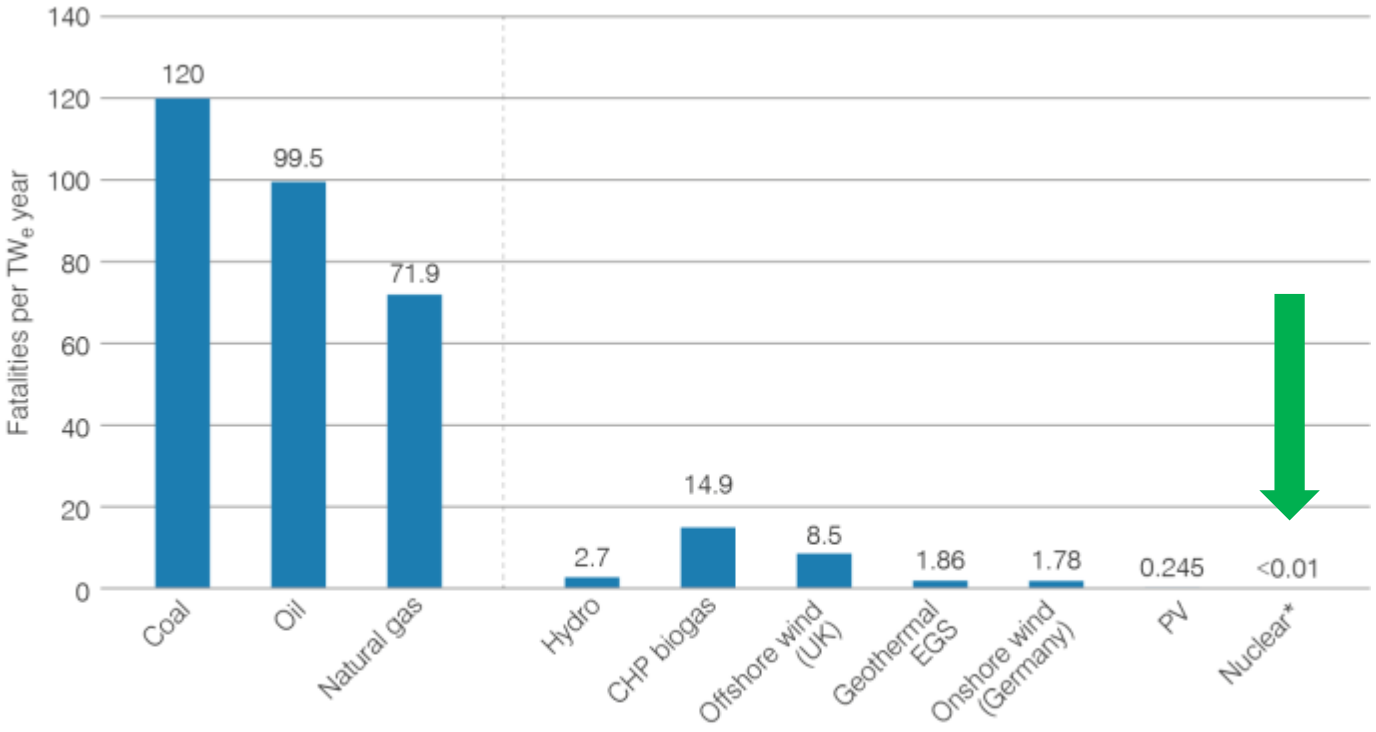
Energy accident fatalities for OECD countries



* Gen II PWR, Swiss

Source: Paul-Scherrer Institut. Data for nuclear accidents modified to reflect UNSCEAR findings/recommendations 2012 and NRC SOARCA study 2015

Source: Paul Scherrer Institut. Data for nuclear accidents modified by WNA to reflect UNSCEAR recommendations 2012 and NRC SOARCA study 2015

Effective safety paradigm

Focus on addressing public concerns, not only dealing with safety issues, as part of the engagement on public confidence

Support balanced approach to energy policy where the health, environmental and safety risks and benefits of nuclear are recognised and assessed alongside those of other power generation technologies

Increase awareness of the social and economic benefits of nuclear energy

Drive the nuclear debate not on ‘safety first’ but on values the public care about – economic, social, public health and environment

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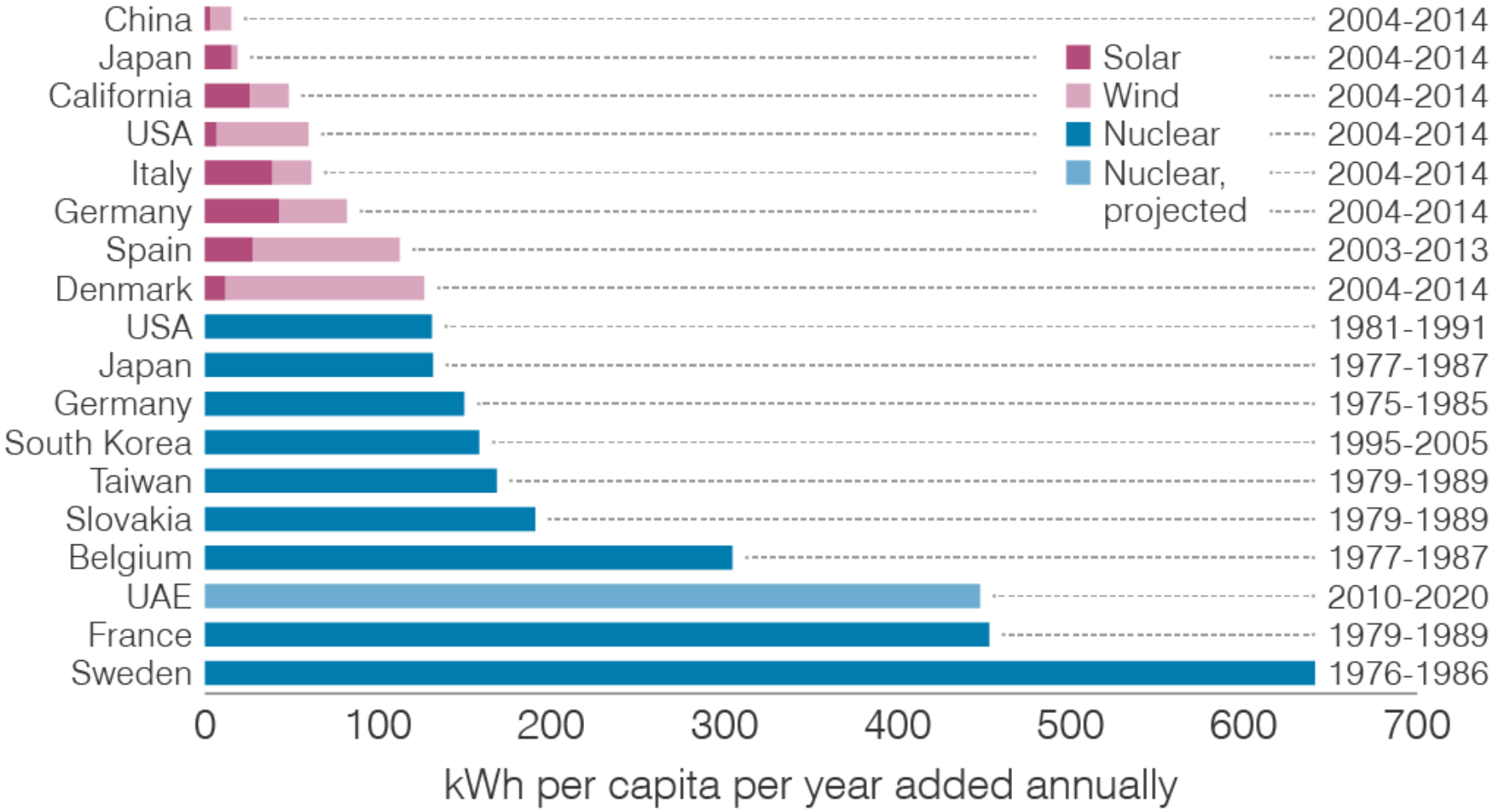
Nuclear makes quick, lasting decarbonisation possible



Source: Cao et al, Science, August 2016. UAE projections by WNA

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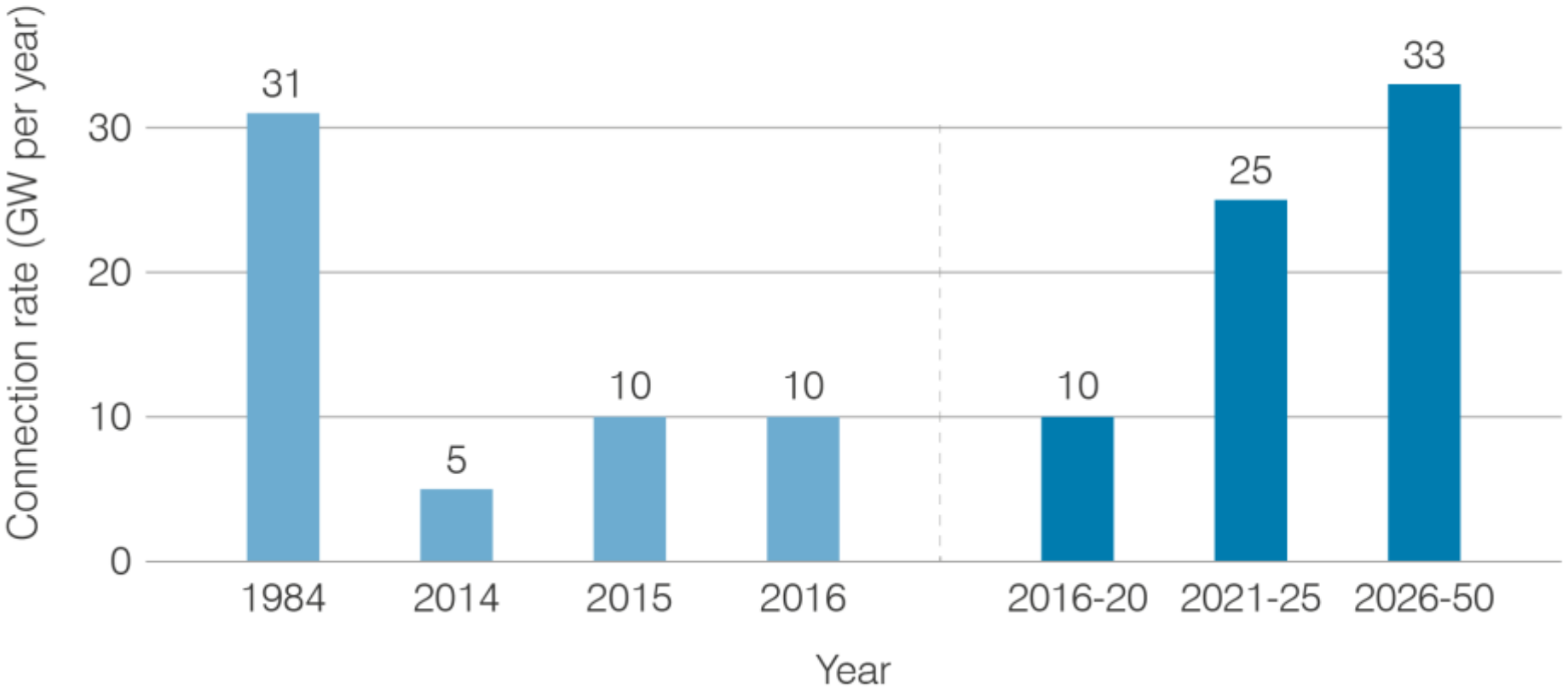
Harmony programme 2016-2050

Cumulative 1000 GW new nuclear capacity to 2050

Construction rate doubled from trend of 5GW/y or less to 10GW/y

We must maintain 10GW/y to 2020, then ramp back up to 1980s level



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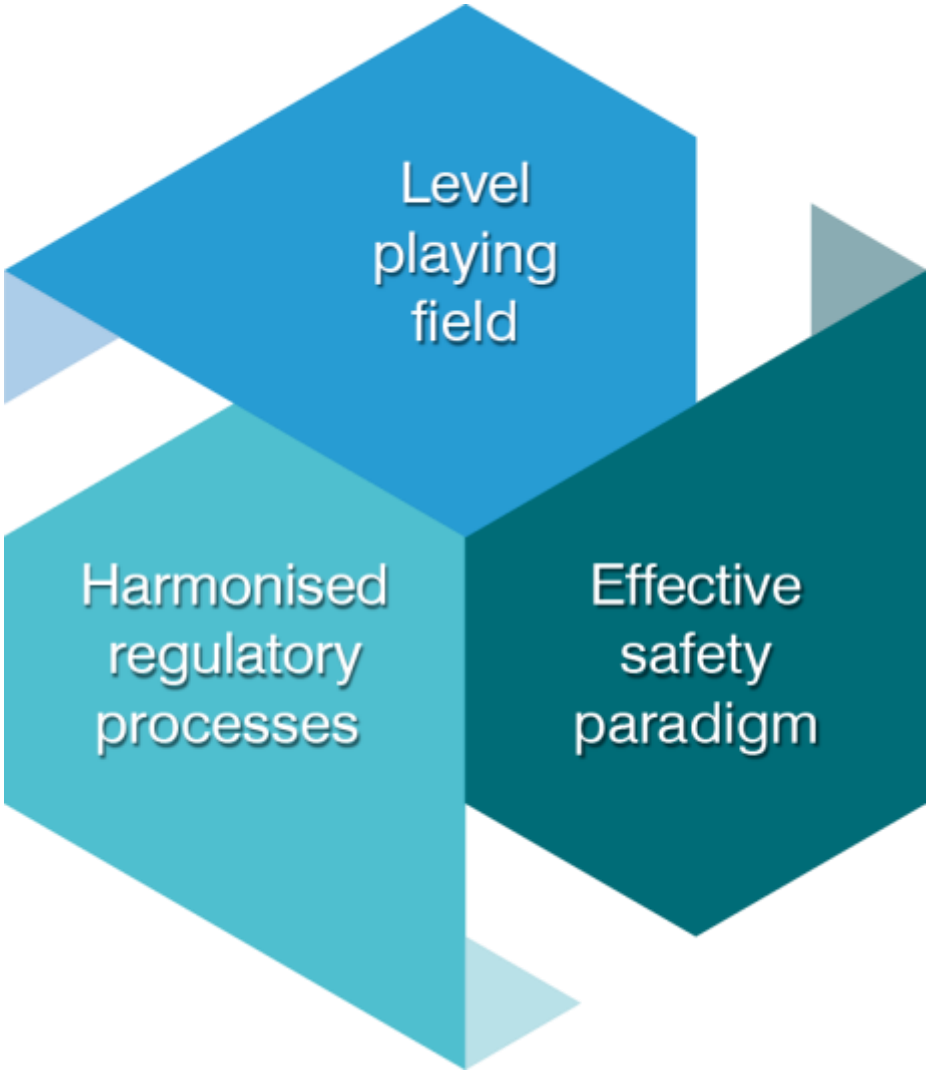

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www.world-nuclear.org