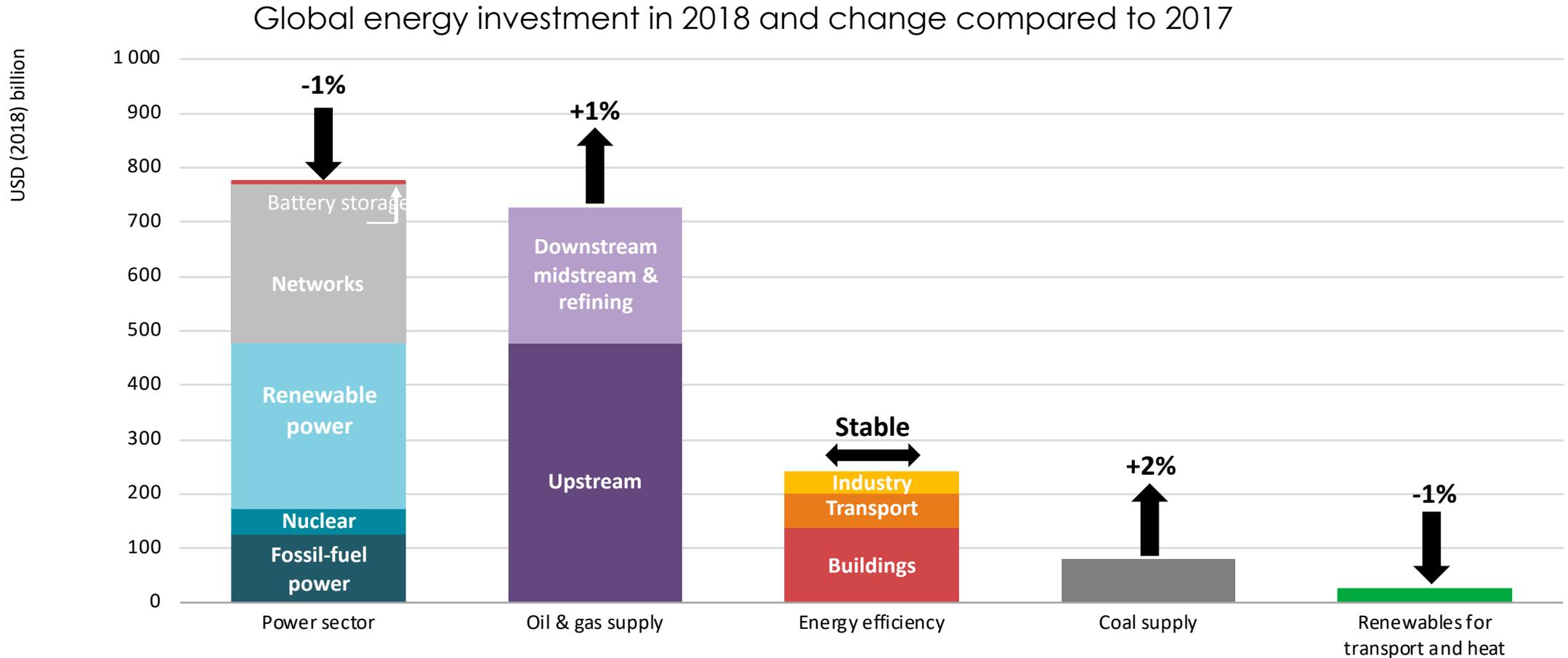


# iea

## Investment, technology and policy for a sustainable energy system

Laszlo Varro

# Global energy investment today



Energy investment was over USD 1.8 trillion in 2018. A rise in fossil fuel supply investment offset lower power and stable efficiency spend. Power was the largest sector for the third year in a row.

# Today's mature renewables benefited from decades of public R&D



The soviet space program as an early PV competitor

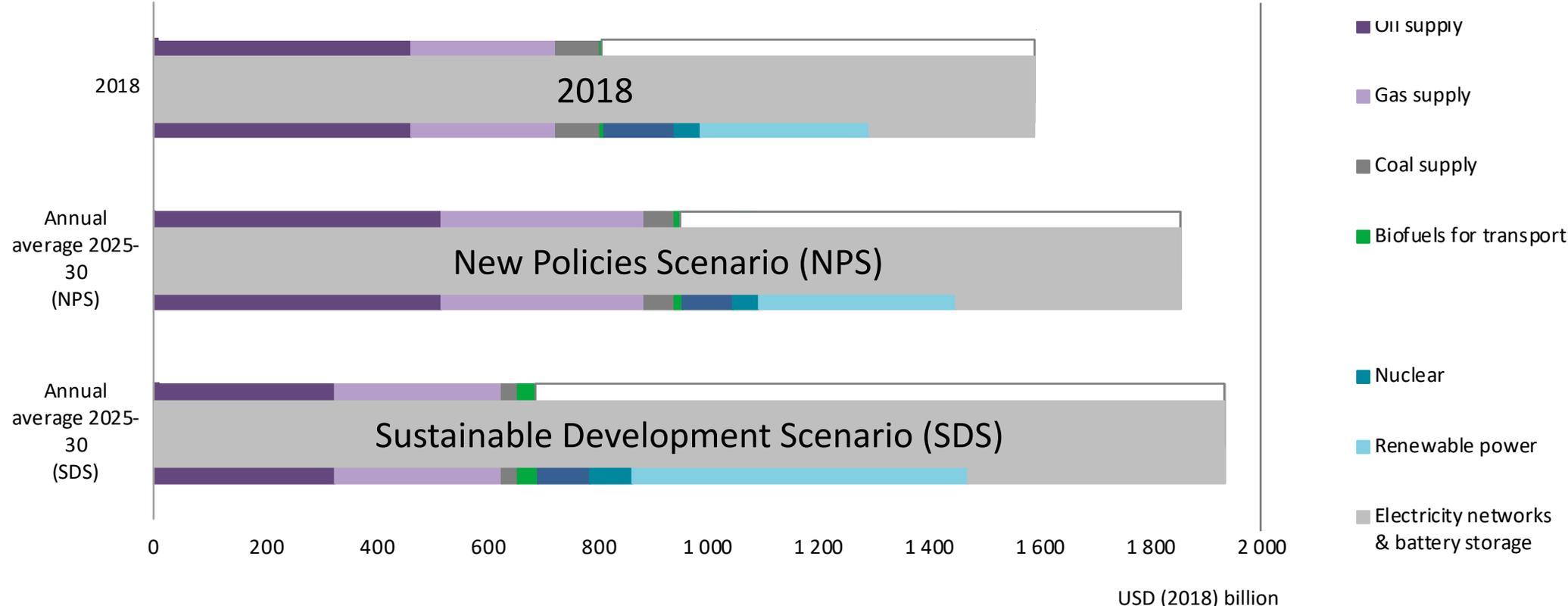


A Boeing experimental wind turbine funded by the Reagan Administration

Long term funding for innovation continues to play a key role to accelerate clean energy progress

# Energy supply investment needs to rise, whatever the scenario

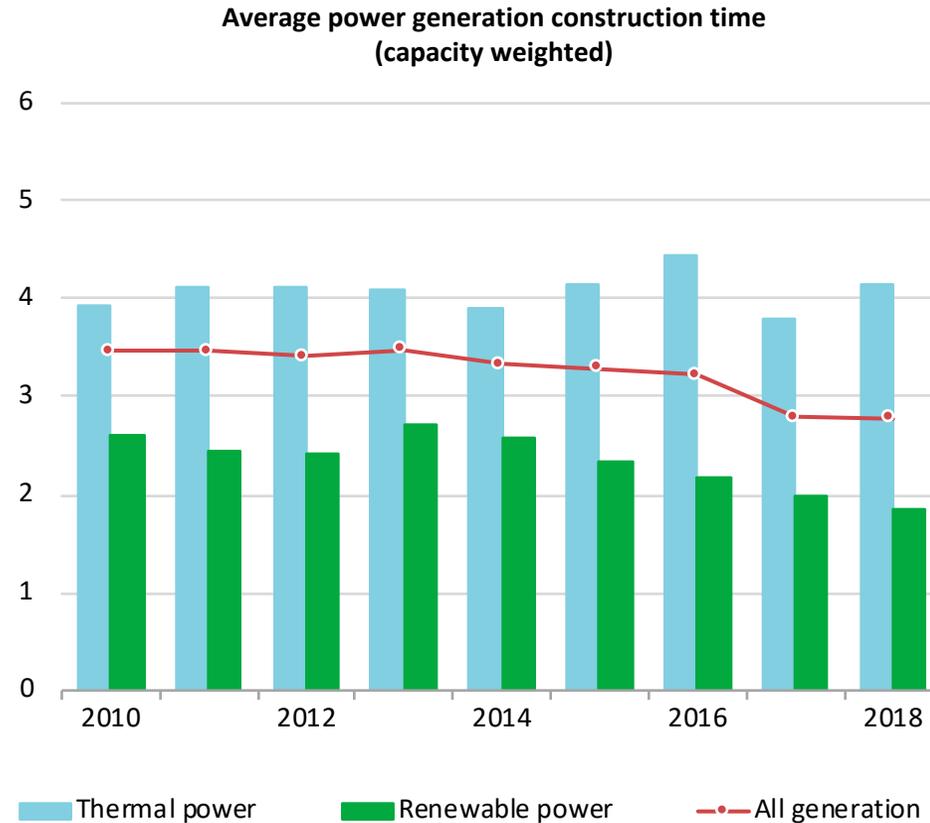
Global energy supply investment compared with annual average investment needs 2025-30 by IEA scenario



Today’s capital allocation would need to shift rapidly towards cleaner sources and electricity networks in order to align with the Sustainable Development Scenario and the Paris Agreement.

# A preference for projects that deliver more quickly

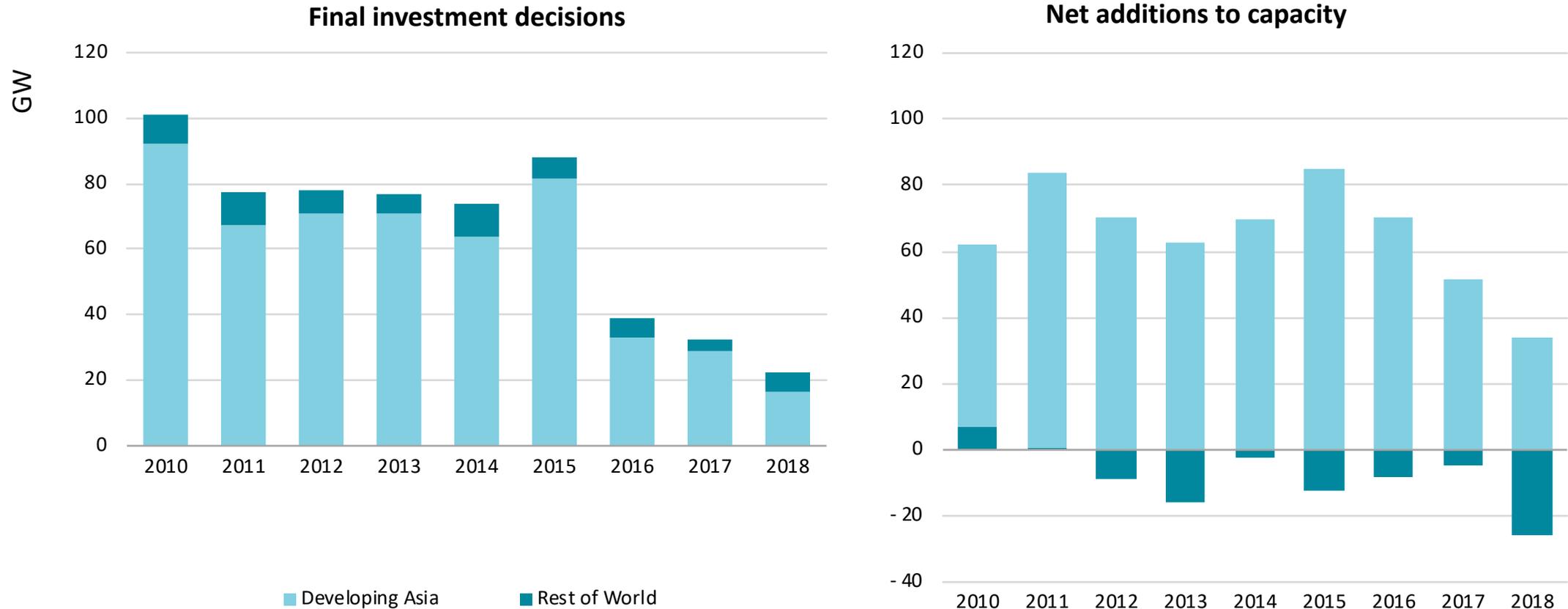
Trends in project timelines for power generation



Given perceptions of policy and technology uncertainty the industry prefers short lead time modular developments

# Coal power investments are down, but the fleet is still growing

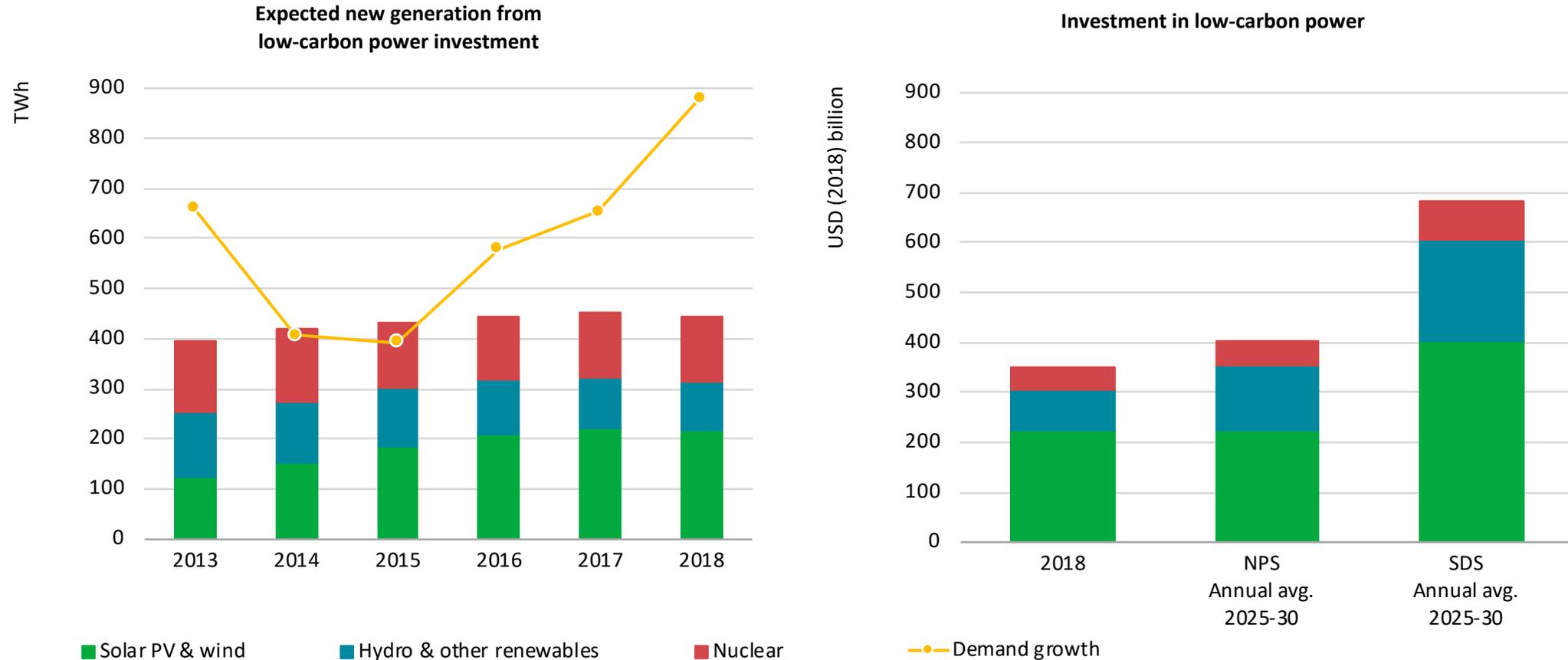
Final investment decisions (FIDs) for coal-fired generation and net additions to capacity



Investment decisions for new coal-fired generation are down 80% from 2010 and retirements of older plants are higher than ever, but the world still added almost 10 GW to its coal-fired fleet in 2018.

# Low-carbon investment is not keeping pace with power demand

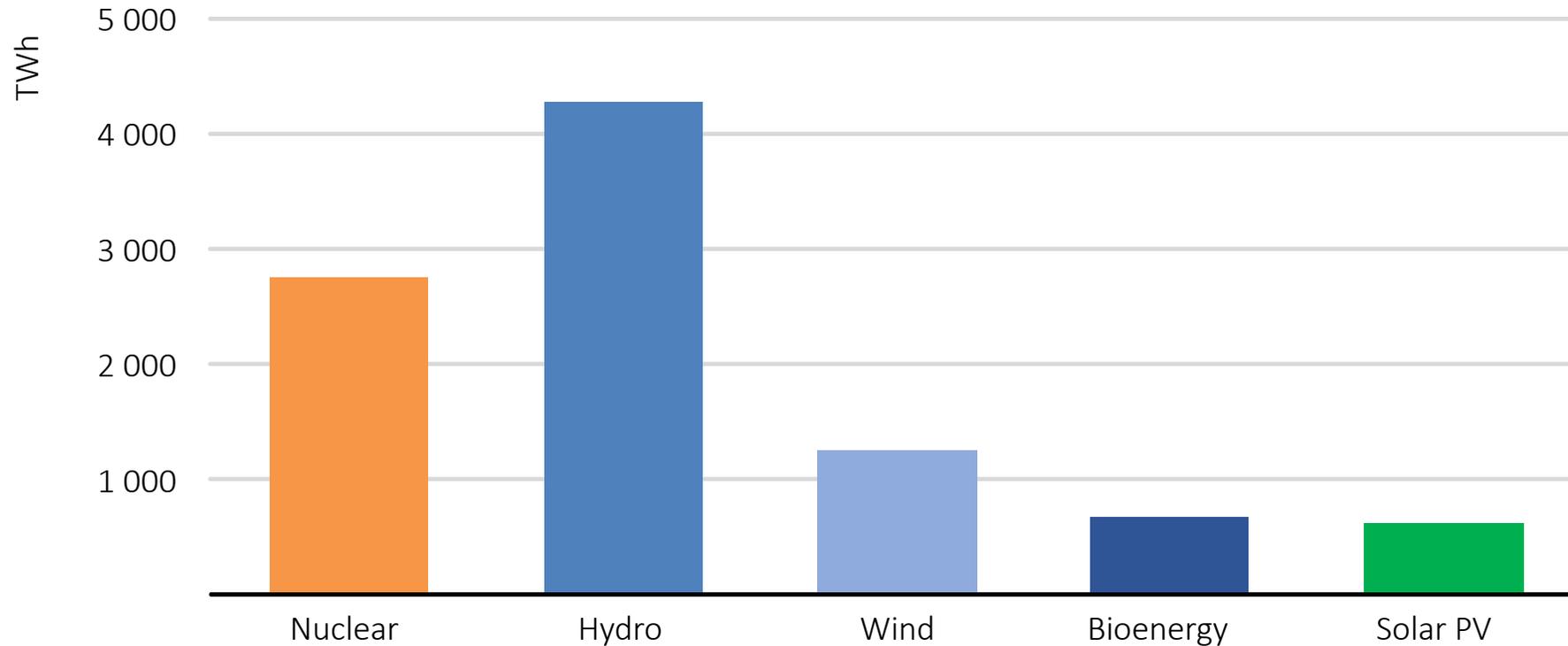
Expected generation from low-carbon power investments and annual investment needs by scenario



The output expected from investment in renewable & nuclear power levelled off in 2018 while demand growth soared. To meet sustainability goals, spending on renewable power would need to double.

# Nuclear is a leading source of clean electricity today

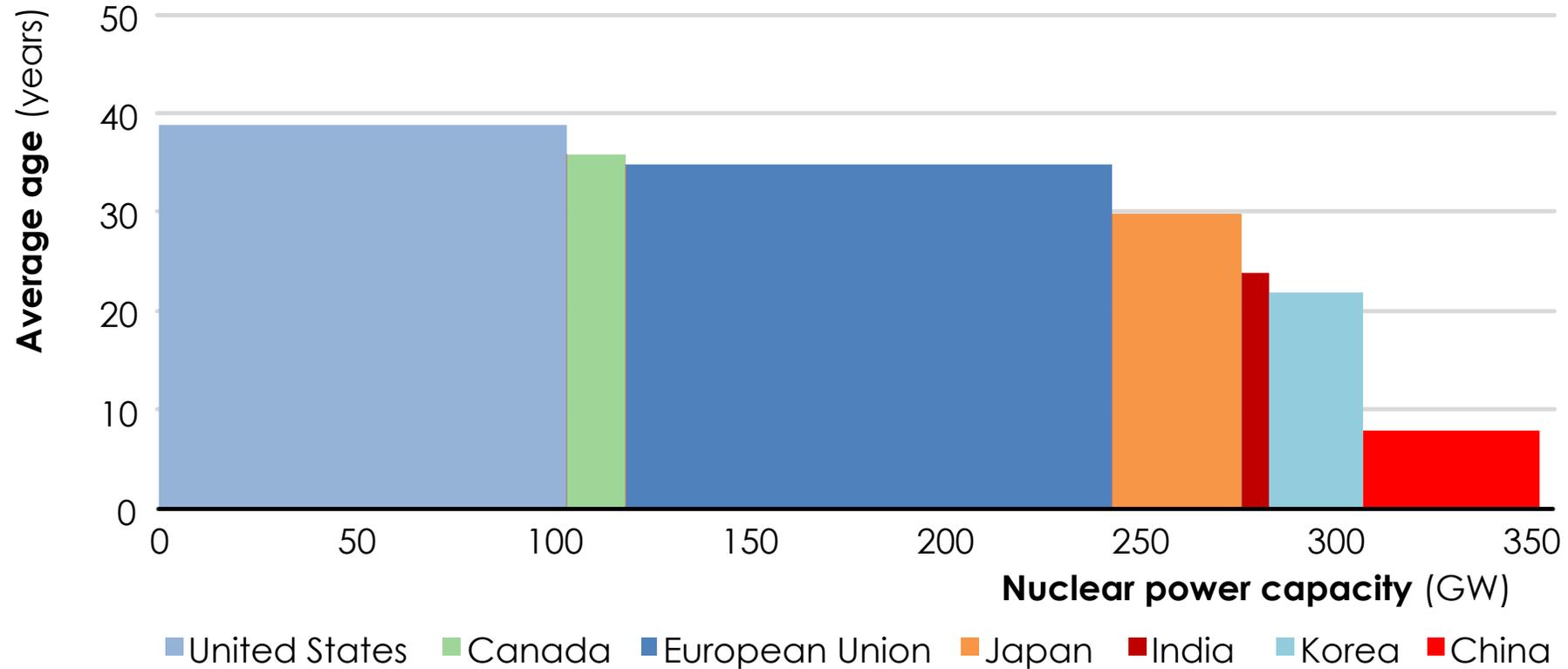
Low-carbon electricity generation in advanced economies by source, 2018



**Nuclear power provided 10% of electricity supply worldwide in 2018, while in advanced economies, it has been the largest clean source of electricity for over 30 years.**

# The nuclear fleet is ageing

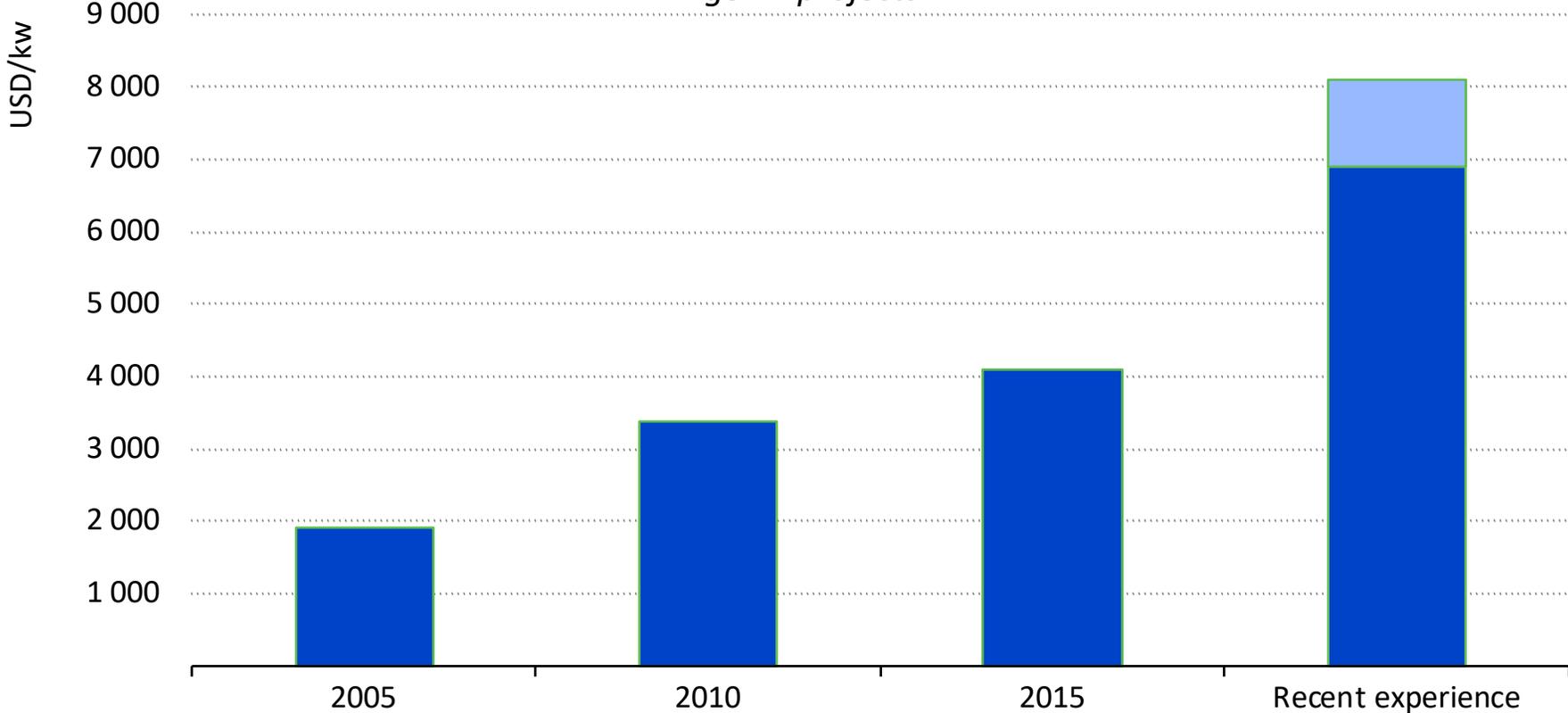
Age profile of nuclear power capacity in selected regions



Many nuclear power plants in advanced economies are facing retirement as they approach the end of their original 40-year design lifetime.

# Unfavorable new construction experience both in the US and Europe

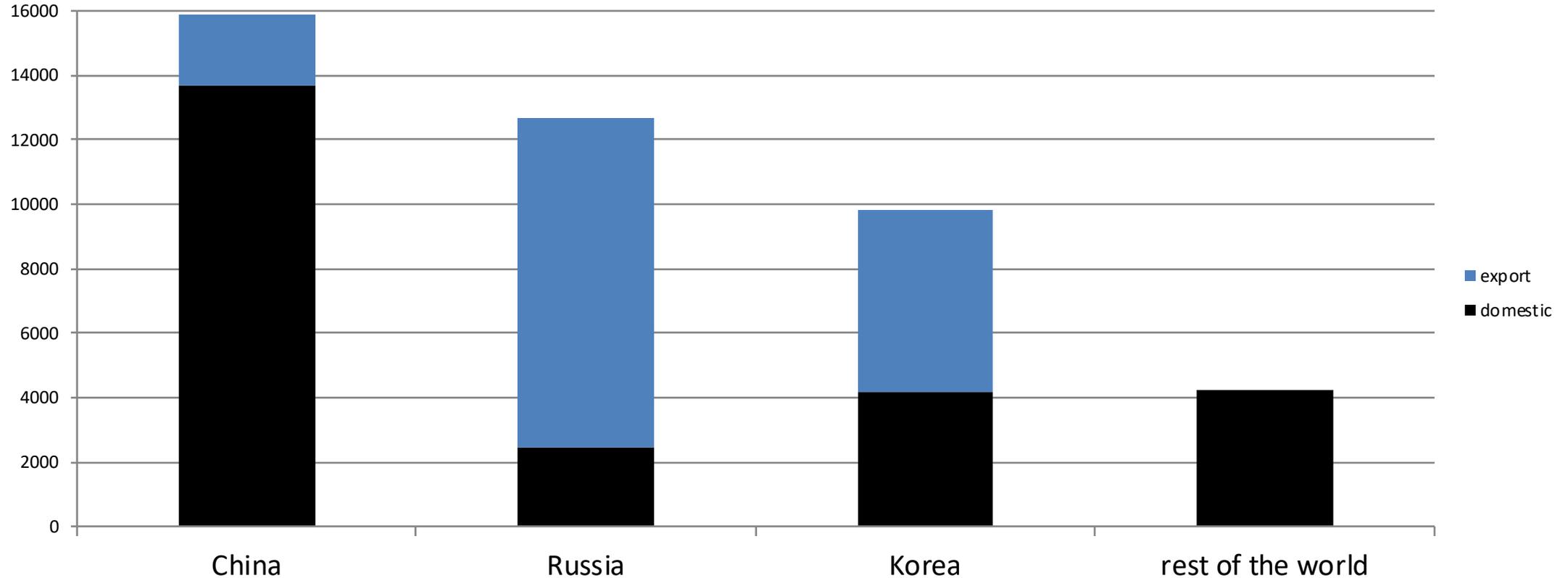
*Nuclear investment costs from the 2005 - 2015 editions of Projected Cost of Power Generation and recent US/EU experience with III gen + projects*



**Project management problems, cost inflation and competition from gas and renewables hit the investment appetite for nuclear**

# An emerging China – Russia dominance in nuclear development

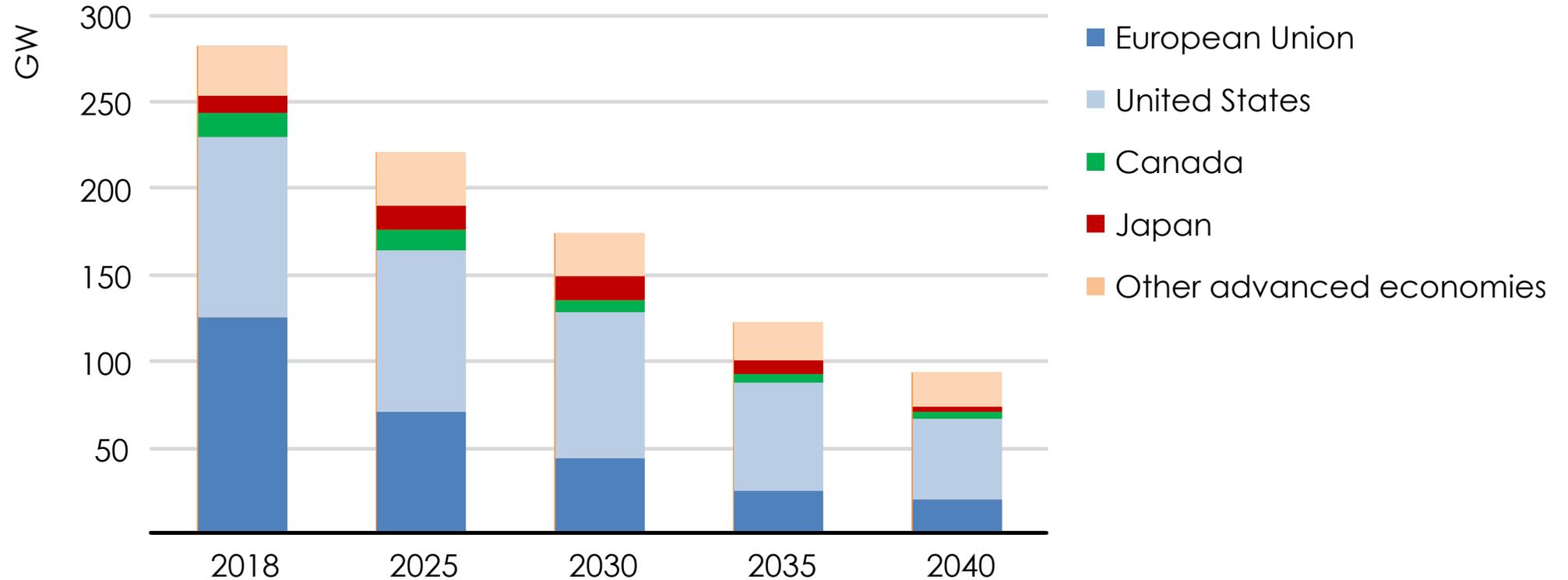
*New nuclear construction starts by technology provider, 2012 – 2018*



**The last Korean export project started in 2015, recent policy decisions by the Korean government are less favorable to nuclear**

# Nuclear could face a steep decline in advanced economies

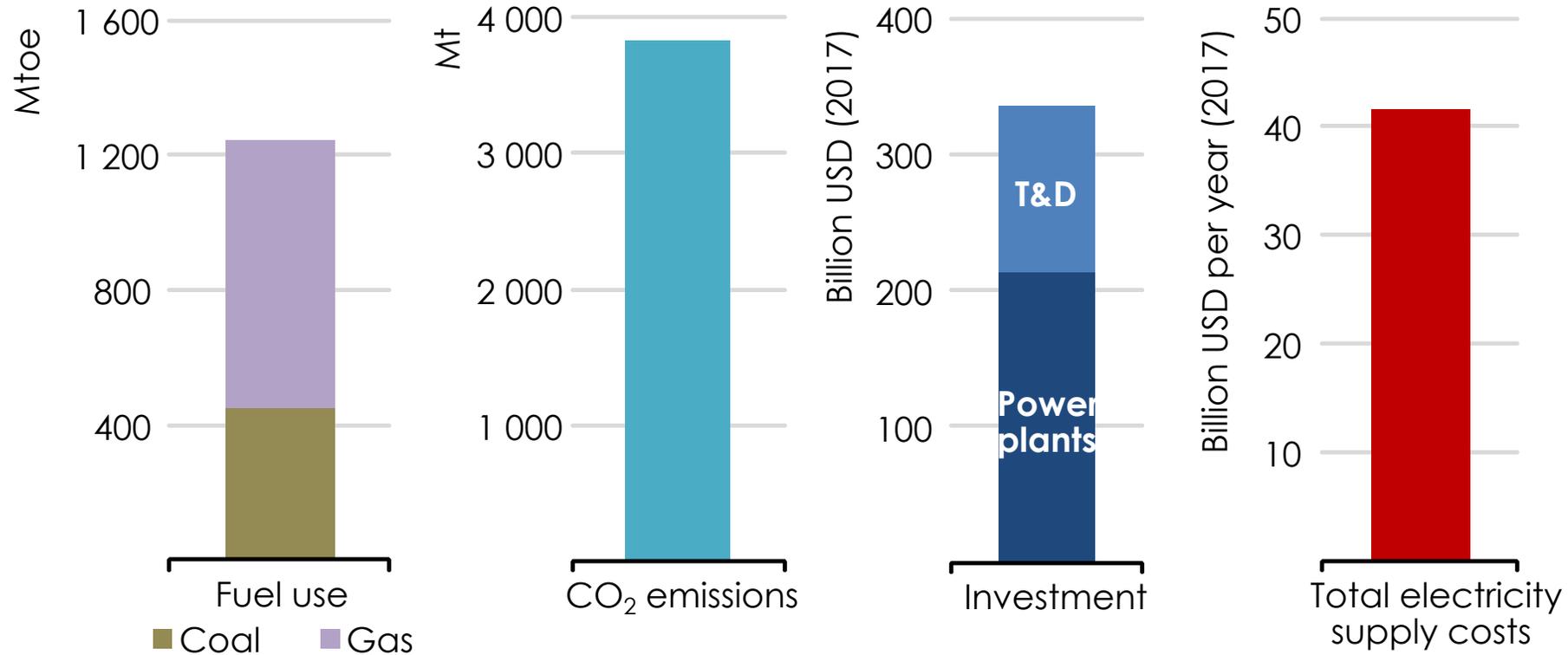
Nuclear power capacity (operational) in advanced economies in the *Nuclear Fade Case*, 2018-2040



**Without additional lifetime extensions or new projects, nuclear capacity in advanced economies would decline by two-thirds by 2040.**

# Lower nuclear raises CO<sub>2</sub> emissions and supply costs

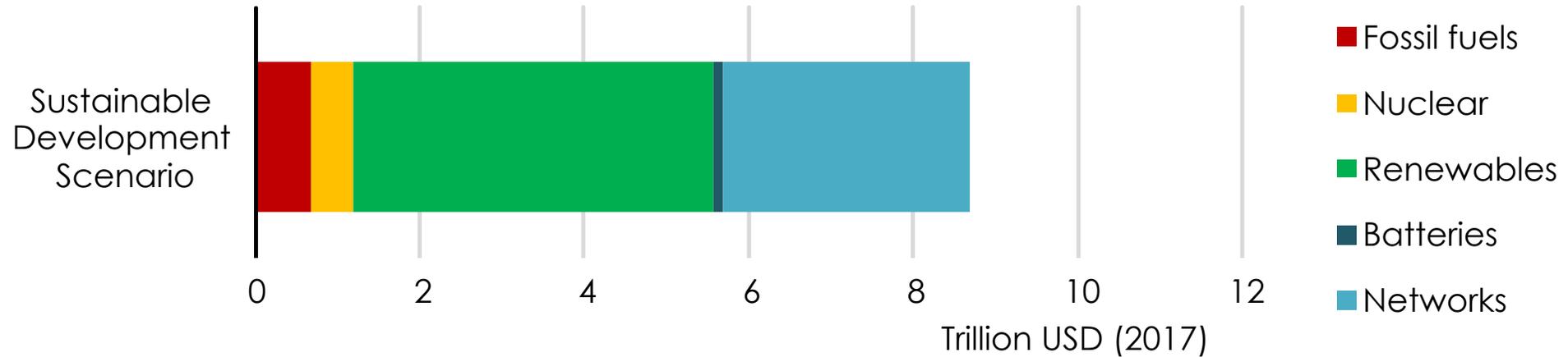
Change in key indicator in advanced economies in the *Nuclear Fade Case* under current policies, 2019-2040



**Lower nuclear raises fossil fuel use and power sector CO<sub>2</sub> emissions by 5% to 2040, raising investment needs by close to \$600 billion to 2040 and supply costs to consumers.**

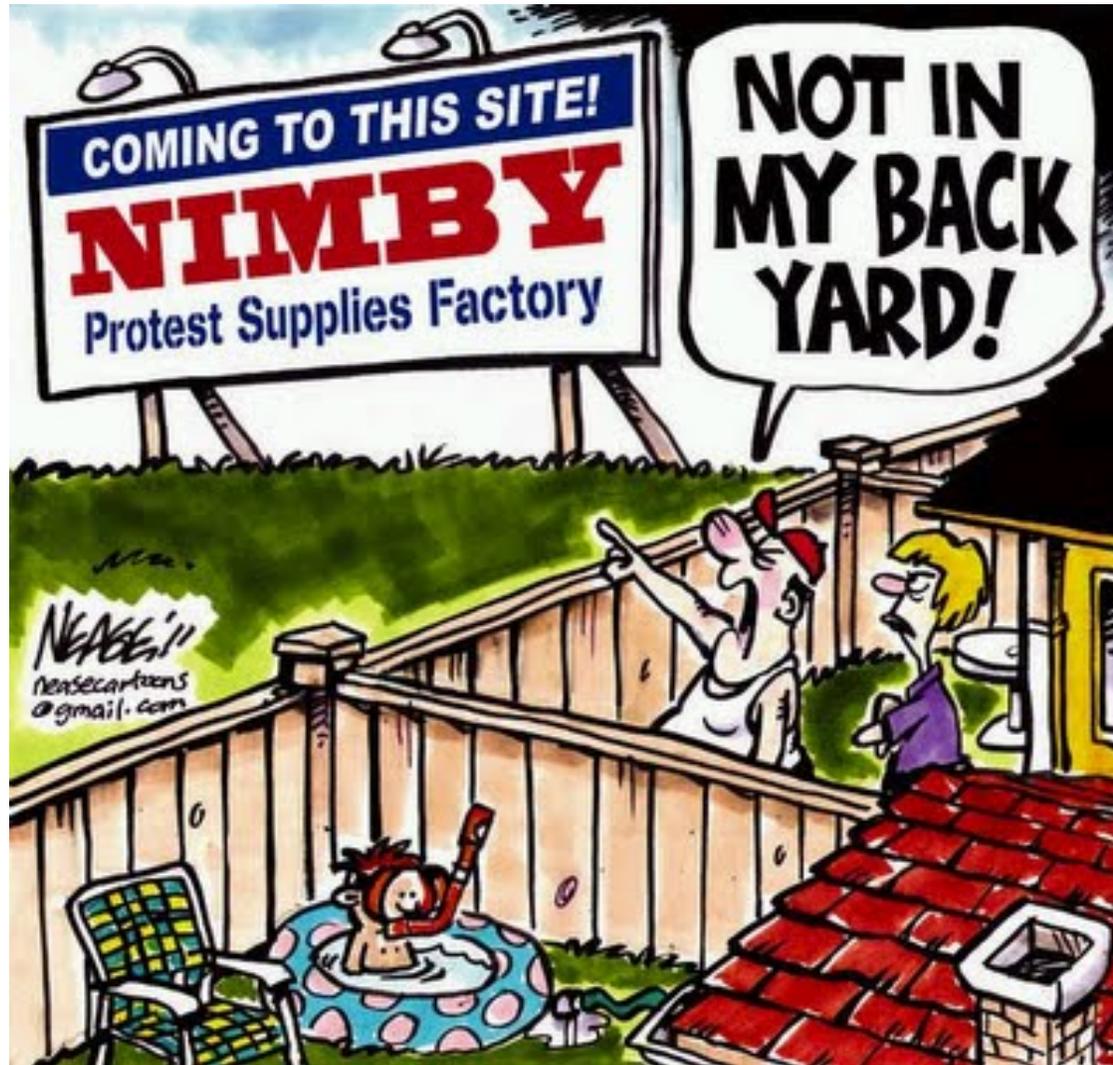
# Nuclear power is part of a cost-effective clean energy transition

Power sector investment needs in advanced economies on a sustainable energy pathway, 2019-2040



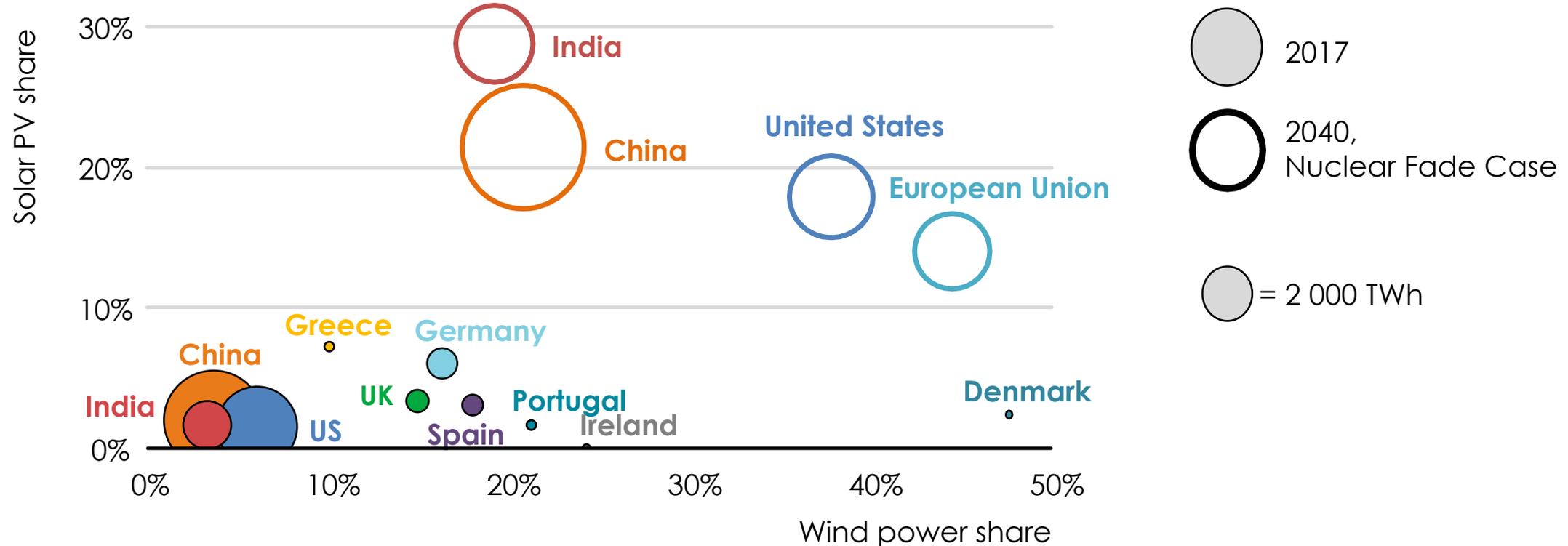
Investment needs to achieve the energy transition are \$1.6 trillion higher without nuclear complementing renewables in the fight against climate change.

# Increasing network investment is not only a financial issue



# Further emphasis on solar and wind raises integration challenges

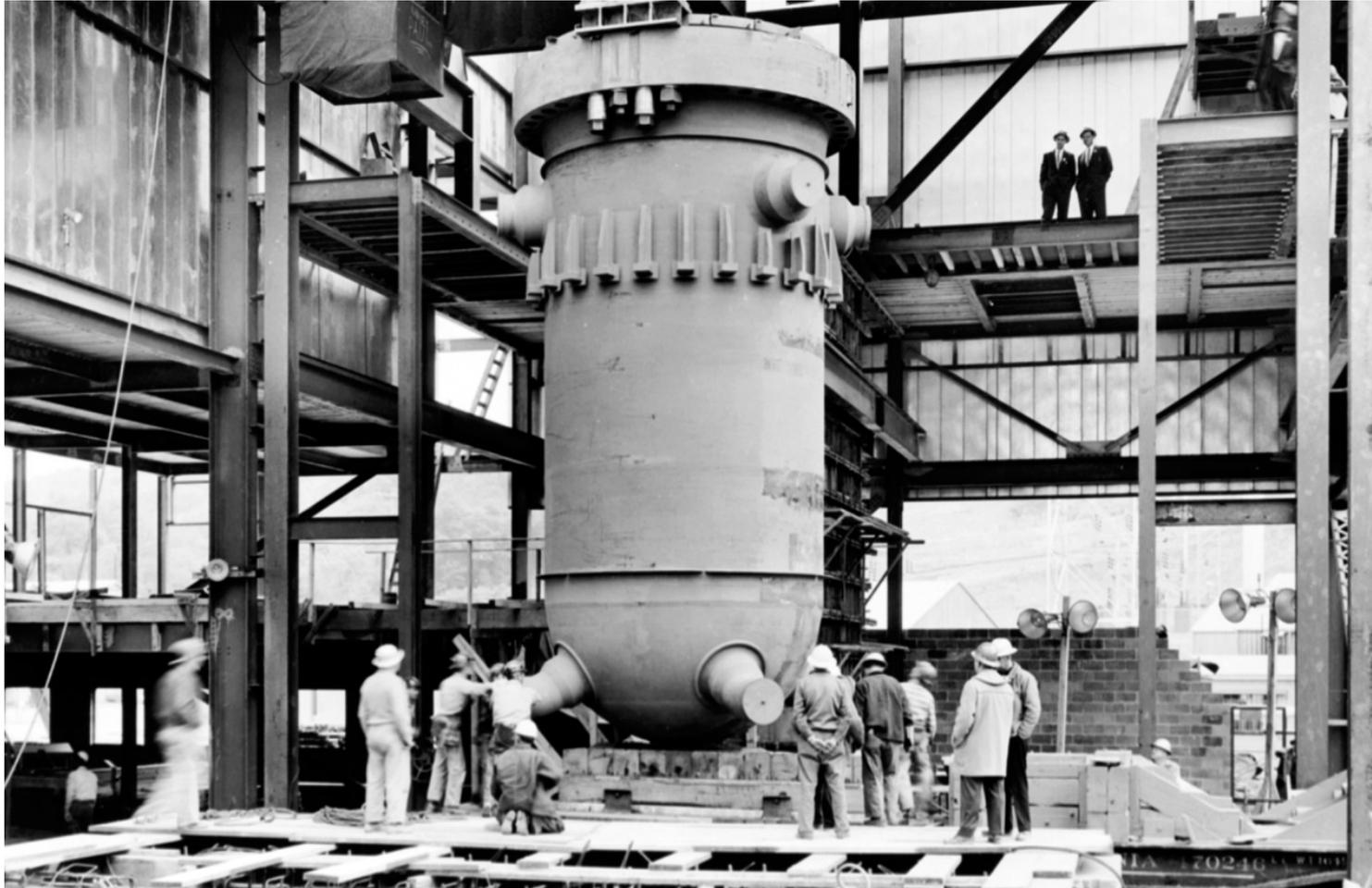
Wind and solar PV shares of generation by region in the *Nuclear Fade Case* on a sustainable energy pathway



**Rising shares of wind and solar PV require more flexibility in power systems, calling on power plants, grids, storage technologies and demand-side management.**

# Small modular reactors, this time for real?

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**Nuclear innovation and early deployment of advanced technologies needs to accelerate for nuclear to play a meaningful role in the low carbon system**

# Policy recommendations for countries pursuing nuclear power

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## Ensure a sound framework for lifetime extensions:

- Value the clean nature of nuclear power and contributions to electricity security
- Clarify safety requirements for longer life and more flexible operations

## Support new construction:

- Establish appropriate frameworks to reduce financial risks
- Maintain technical competencies related to nuclear power
- Pursue research & development of new technologies (e.g. small modular reactors)