Positioning Nuclear Power in the Low-Carbon Electricity Transition

21st REFORM Group Meeting, Salzburg
August 28 – September 1, 2017

Aviel Verbruggen and Yuliya Yurchenko

Department of Engineering Management, University of Antwerp,
2000 Antwerp, Belgium aviel.verbruggen@uantwerpen.be

PSIRU, Department of International Business and Economics,
University of Greenwich, SE10 9LS London, UK

Decarbonisation options, IPCC, and IAE (2014)

Global green transition leadership must address contradictory economic regulation in the context of austerity

There is an urgent need for a comprehensive technological transformation of supply and demand: what, where, how, and by whom?

Energy tripod mantra: 'renewable energy, nuclear power and fossil fuels with carbon capture and storage'

BUT: The Trojan horse of decarbonisation: atomic power that is not a sustainable solution

- **How did we get at this "mantra" despite multiple evidence against nuclear?!**

Five post-WWII legacies:

1. Expansion in fossil fuel use supports growing economies in industrialized and industrializing nations.
2. From ‘Atom for peace’ in 1953 to ‘no solution without nuclear’ presently.
3. Speedy and far-reaching scientific and technological advances allow renewables to benefit from transfer.
4. ‘Our Common Future’, Agenda 21, and Rio Summit 1992 – no future without sustainable turn in energy-intensive, nature-exhausting growth paradigm.
5. UN Framework Convention on Climate Change (UNFCCC) aimed to ‘avoid dangerous climate change’ and following annual COPs.

The ‘tedious’ axiom of nuclear power

“The atomic legacy matches the Rio legacy in reducing global carbon dioxide emissions”

This however does not hold!

Because…

1. **Nuclear power does not satisfy the basic sustainable development conditions.**
2. **Nuclear power is incompatible with the full deployment of variable renewable power supplies.**

Nuclear power does not satisfy the basic sustainable development conditions

- **There is no solid argumentation as to why the assertion of nuclear being an option for sustainable energy supply is valid**

- **Effective assessment of nuclear fission power in terms of sustainability requires an elaborated set of nineteen criteria on the four main sustainability dimensions:**
  - Planet
  - Prosperity
  - People
  - Politics with sustainable development dimensions of Peace and Partnership
  - (PLUS) Special attention to risks.

- **Planet/environmental preservation**

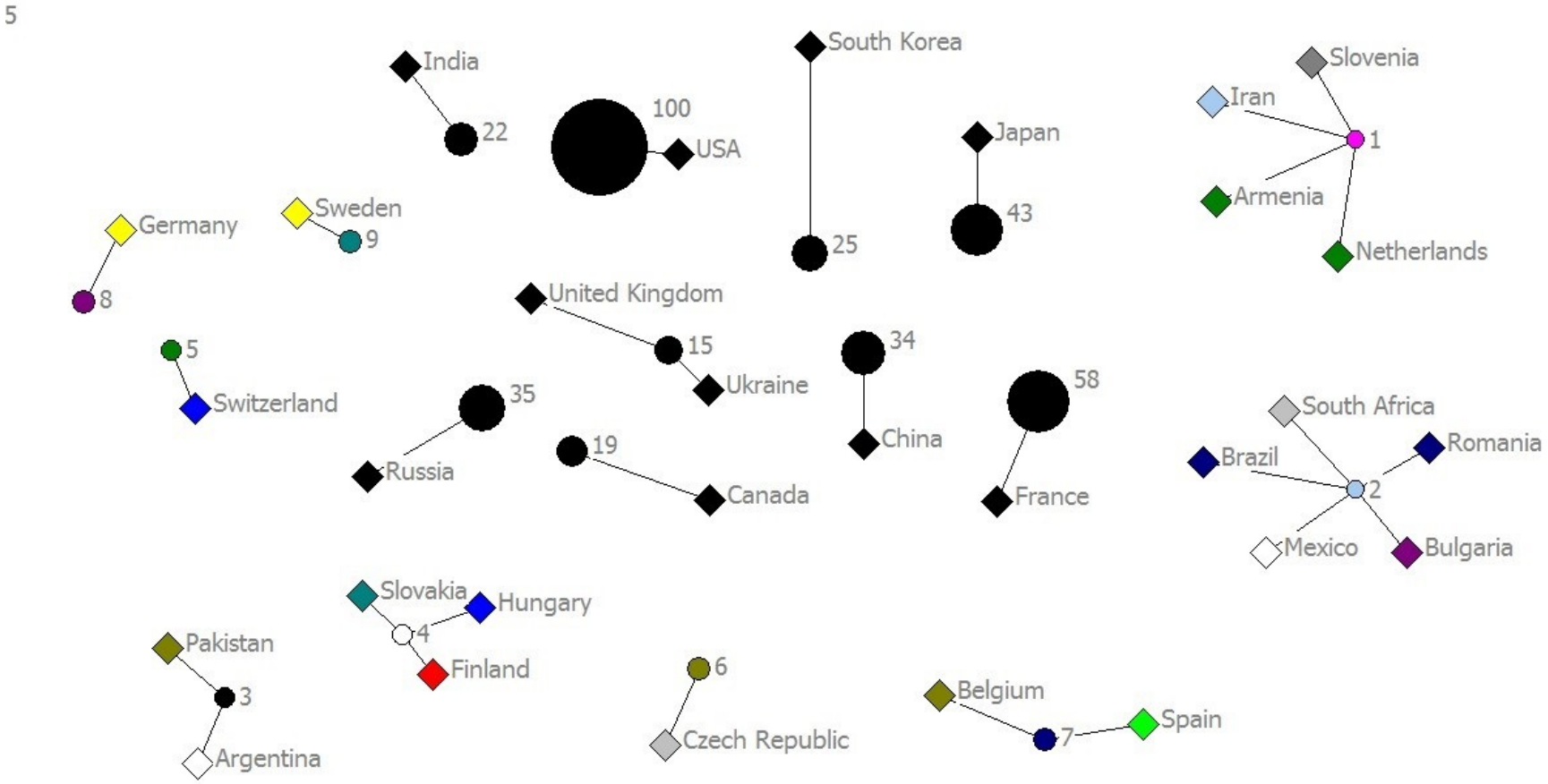
The only criterion nuclear meets is low carbon –

Nullified by incompatibility of the nuclear expansion with full deployment of renewable capacity.

- **Prosperity**
  - Externalities are impossible to estimate (unknown future risks, distant time horizons, etc.)
  - Construction costs are too high
  - Problems with insurance.
- **People** (harder to estimate; linked to all other)
  - High and often hidden costs (as above)
  - High risks security risks, risks to people's and planetary health
- **Politics with sustainable development dimensions of Peace and Partnership**
  - private supplier and engineering companies and 'government technocracy' take precedence over democratic engagement, let alone control

<u>Special attention to risks</u>.

Nuclear energy producing countries by number of operable reactors, 1 September 2016

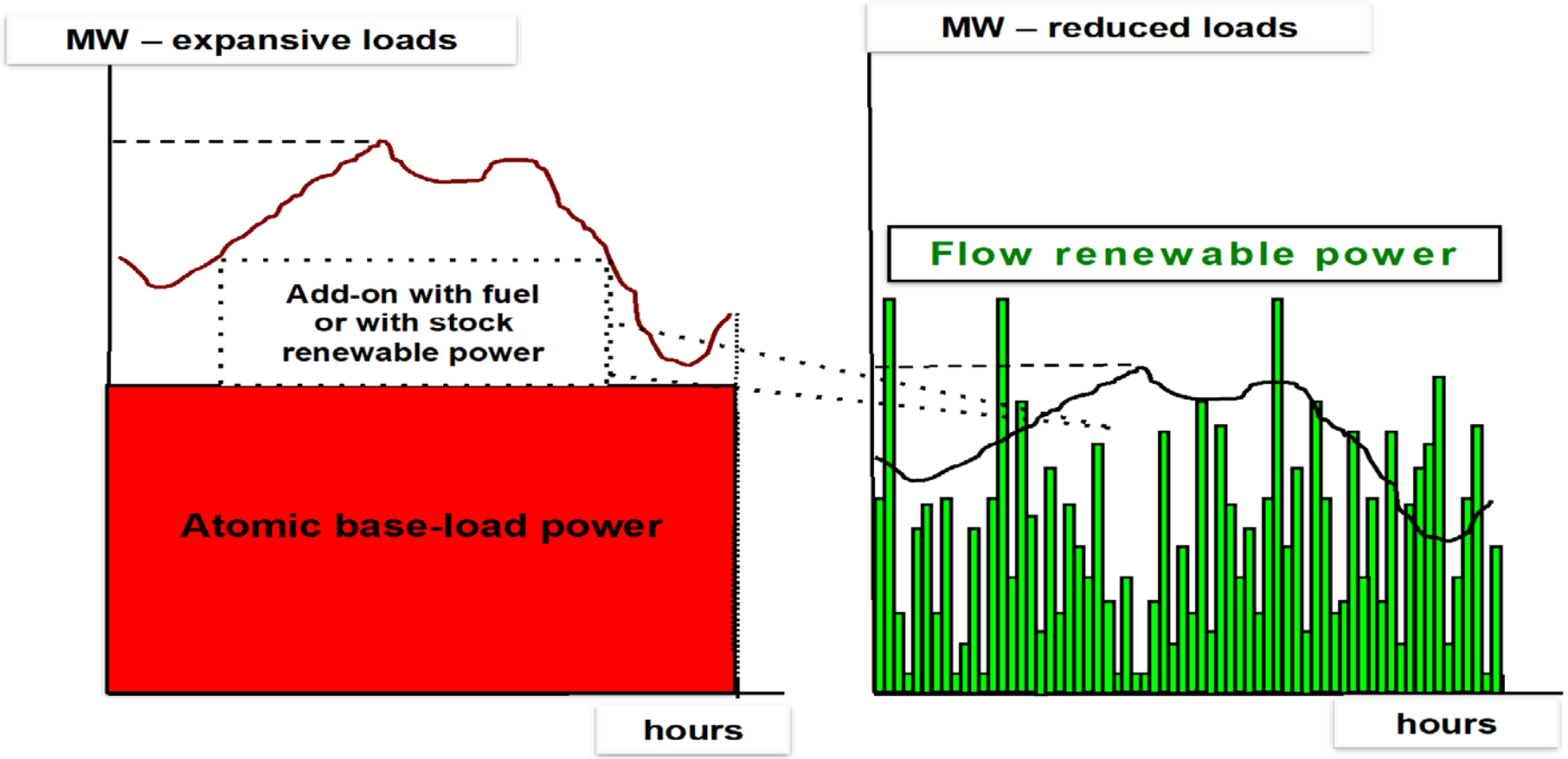


Key: Diamonds are countries, circles are representations of operable reactors size-adjusted by the indicated number of reactors

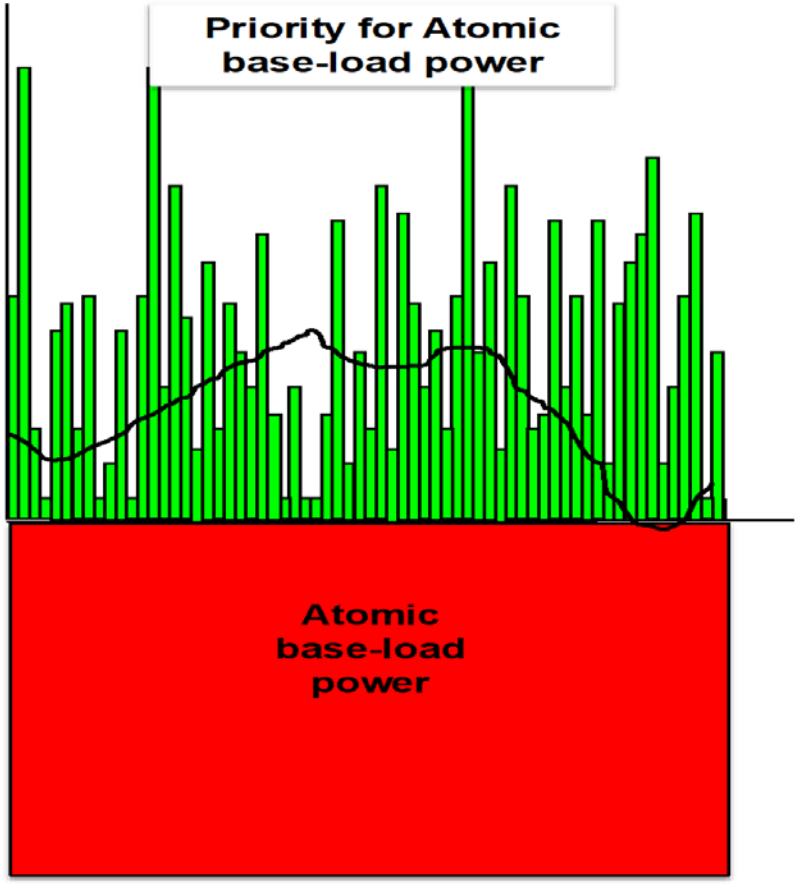
Nuclear power is incompatible with the full deployment of variable renewable power supplies

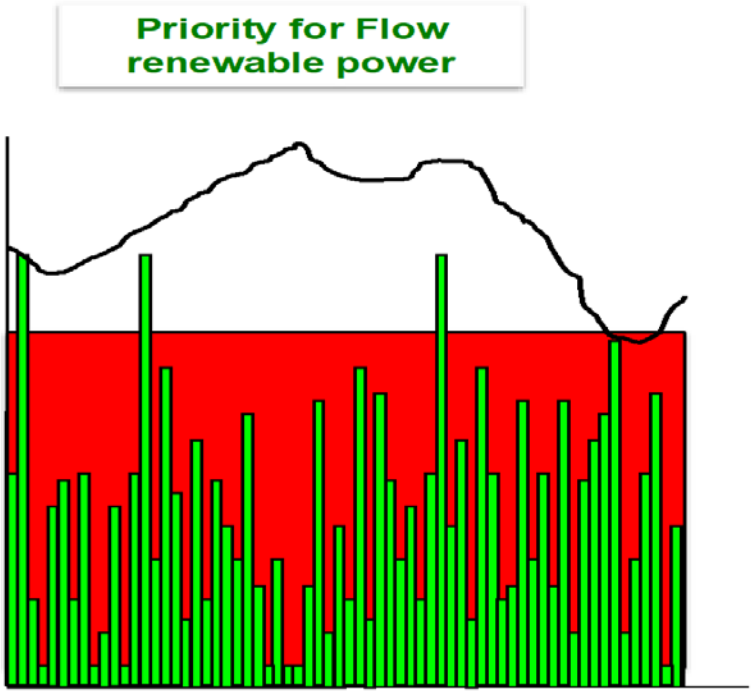
- Transitional planning is erroneous when anchored on truths of the fossil fuel era, revealed by a vocabulary of 'integration of variable renewable power' in the existing power systems.
- Mode of deployment and thus grid structures need to be different, transformed in a manner incompatible with nuclear.
    - Nuclear is a 'blast from the past' (costly, unsustainable…)
    - Requires different ways to balance power supply than RE
    - Different grid requirements
    - Risk, externalities, waste
    - R&D/technological competition for "investment" between RE and nuclear

Atomic versus flow renewable supply as separately serving electric loads

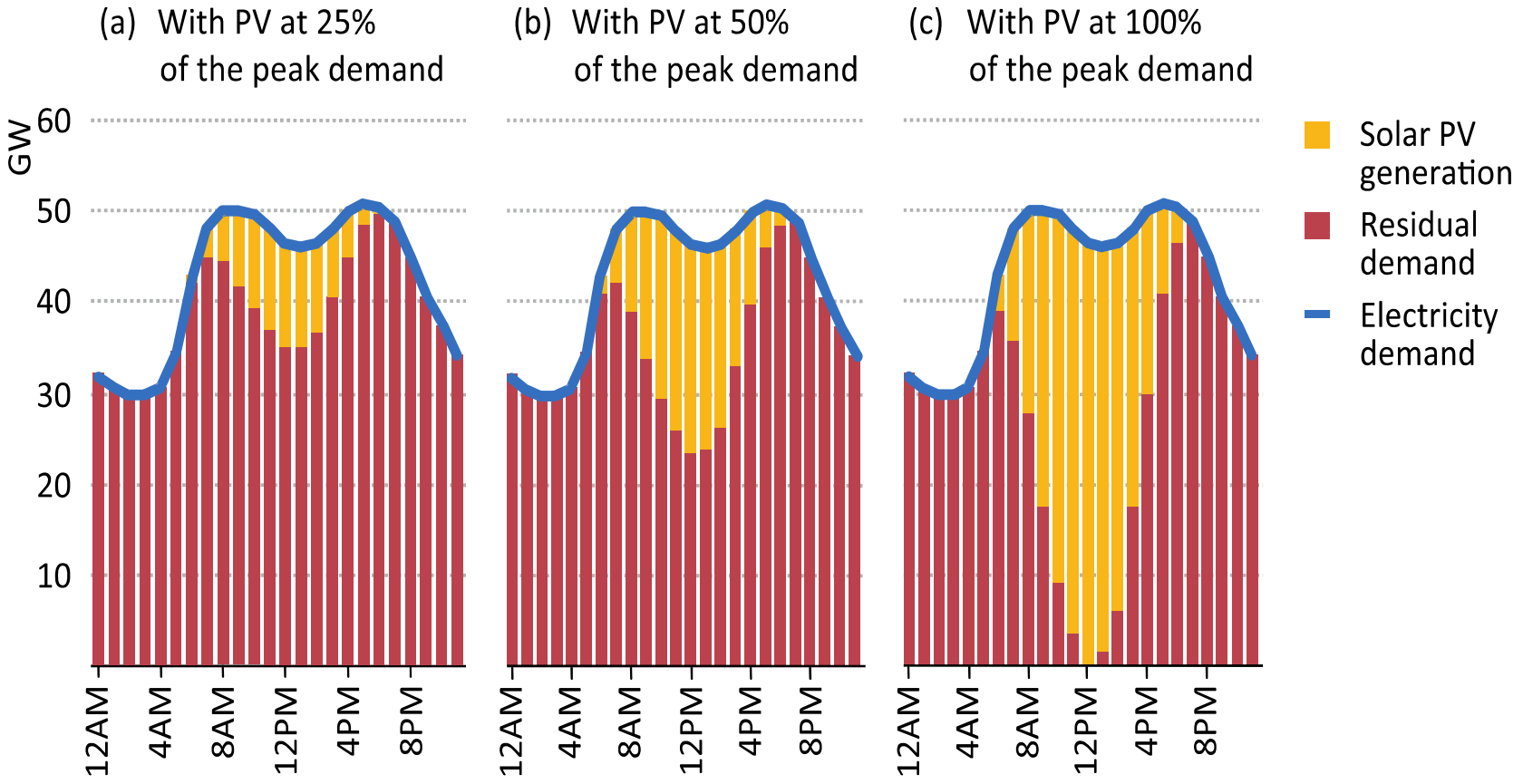


Atomic and flow renewable supplies mutual impact when operational in the same power system.





Indicative hourly electricity demand and residual electricity demand with expanding deployment of solar PV



High deployment of photovoltaic panels carves the electric loads during daytime (Source: IEA World Energy Outlook 2013)

Five arguments for the end of nuclear:

1. **Replacing agnotology by transparency on nuclear technical-economic performance and sustainability merits**
2. **The mission and activities of the IAEA need revision**
3. **The nuclear sector and governments who advocate nuclear power must acknowledge the likelihood of accidents and the extent of their impacts**
4. **IEA and IPCC are to take people's (justified) fears seriously**
5. **IAEA, Foratom, Nuclear Forums in the EU must re-focus from the 'necessity of nuclear power for addressing climate change' to explaining why nuclear power failed in its intended energy transitions over the last 60 years.**

Extensive state investment with democratic control of grids and utilities, and democratic engagement in the decision-making process are what is needed for sustainable transition to occur and succeed.

THANK YOU!