

NUCLEAR POWER AND CLIMATE CHANGE

THE NETHERLANDS, 29TH OCTOBER 2021

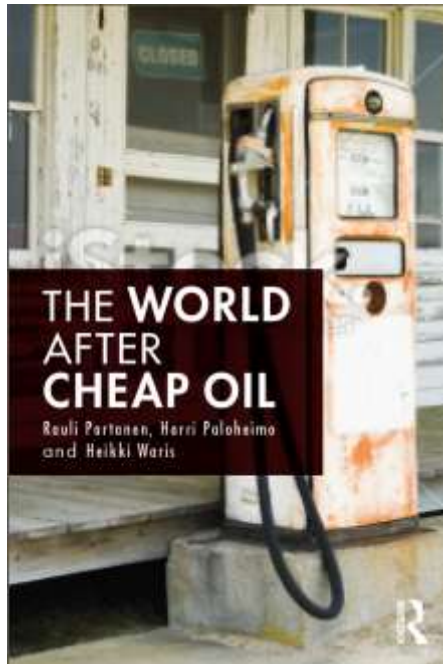
RAULI PARTANEN

THINK ATOM

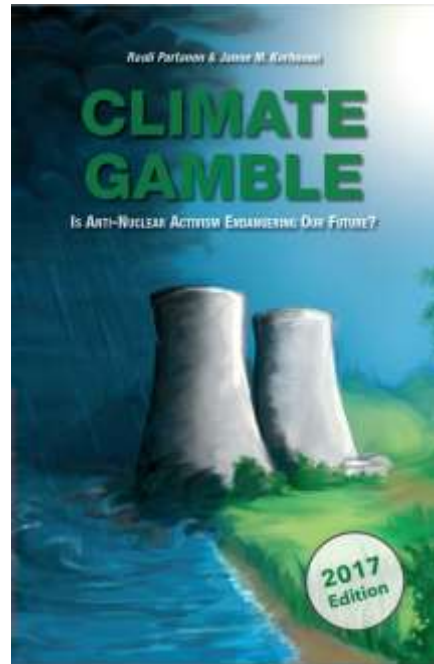
RAULI WHO?

- 🧪 Science writer & analyst
- 🧪 Activist (Ecomodernist Society of Finland)
- 🧪 Co-founder & CEO of Think Atom

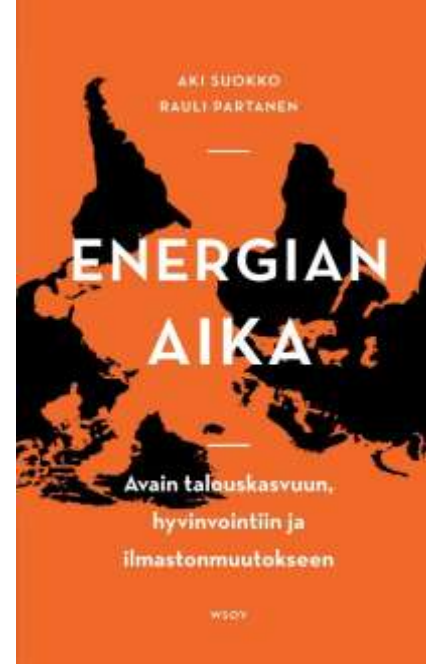
Sciencebook of the year



2014



2015



2017

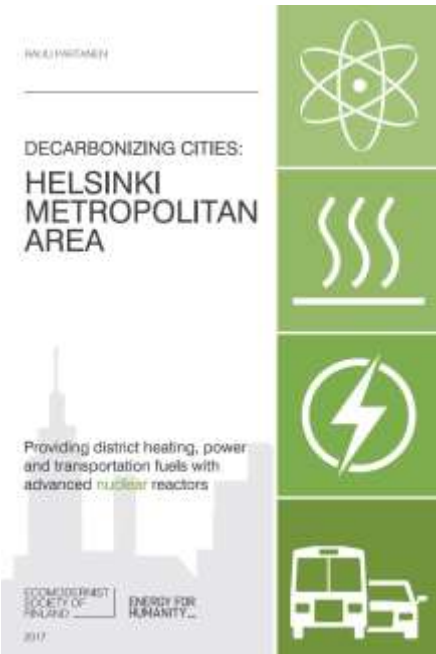


2020

WHAT IS THINK ATOM

- ☛ Non-profit, independent think tank & consultancy.
- ☛ In a nutshell: How to use nuclear to decarbonize different sectors of our economy (power, heat, transportation).
- ☛ <https://thinkatom.net/publications/>

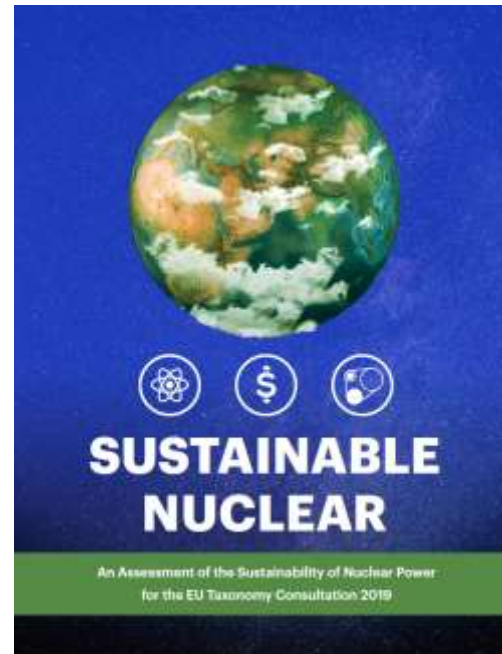
(contributor)



2017



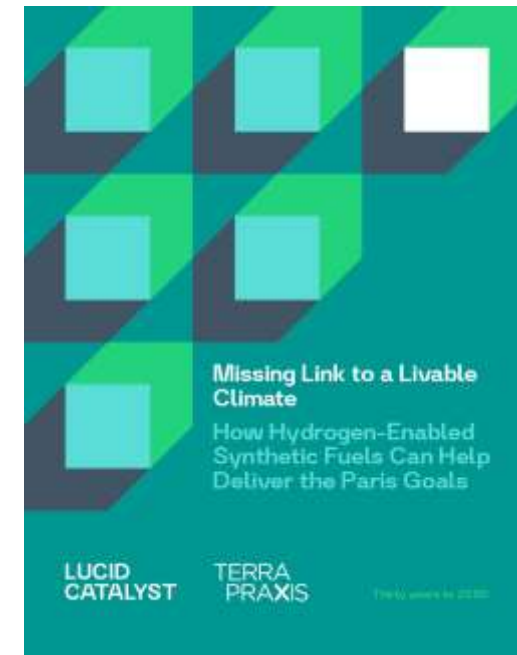
2019



2019

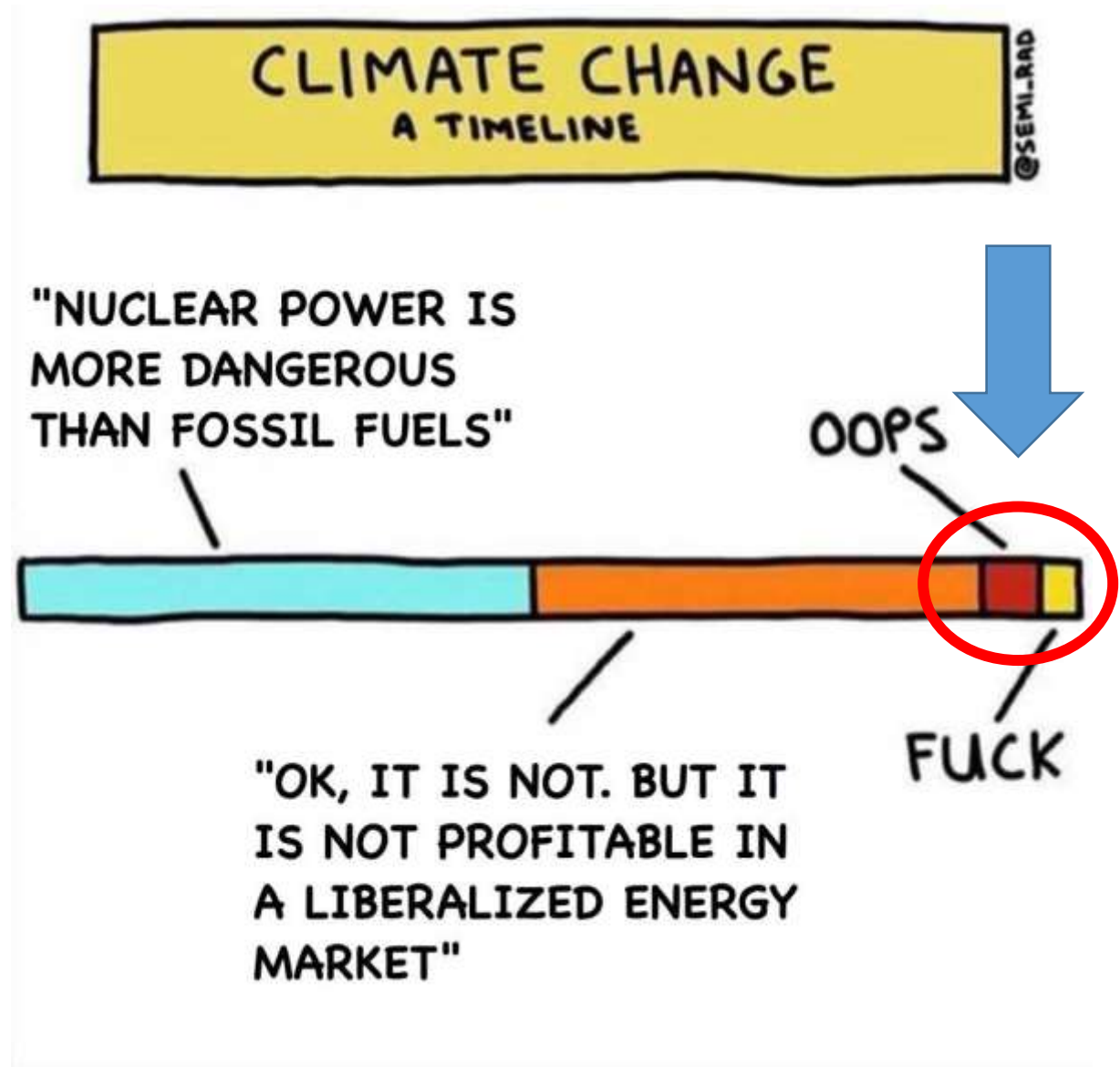


2020



2020

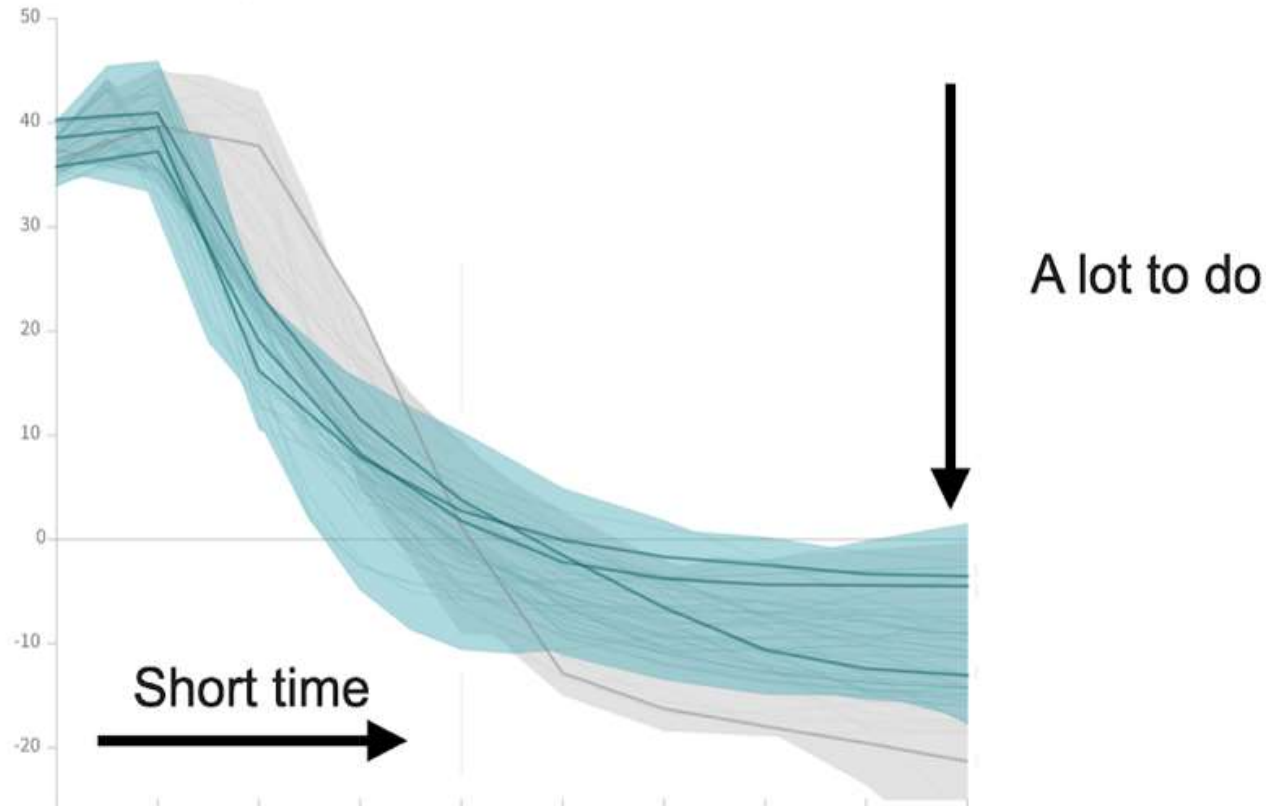
WE ARE
HERE...



THE GLOBAL GAP

Global total net CO₂ emissions

Billion tonnes of CO₂/yr

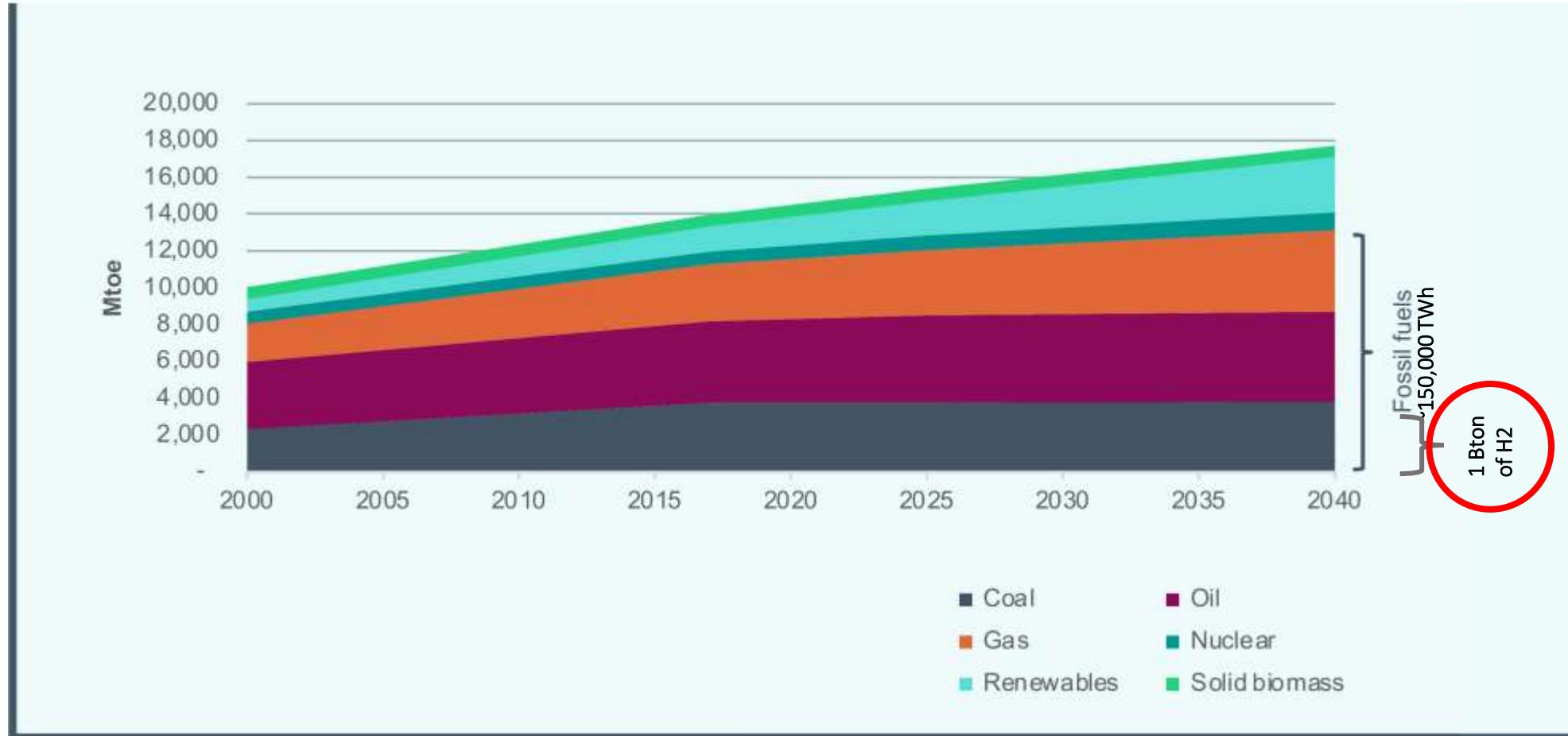


- Repower all coal plants
- Replace flexible gas plants
- Replace gas for industrial heat
- Replace liquid fossil fuels
- While growing the energy system to supply the developing world

THINK ATOM

Graph: IPCC 2018 SPM & LucidCatalyst

THE GLOBAL GAP



THINK ATOM

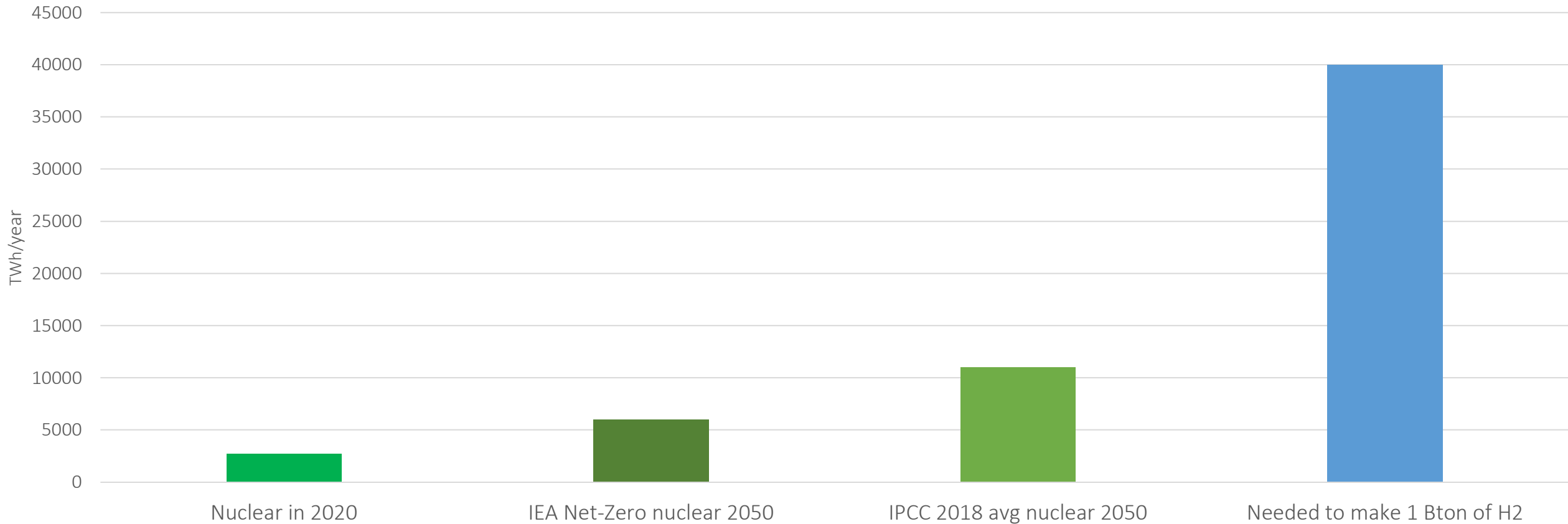
Graph: IEA 2019 & LucidCatalyst

SCALE MATTERS

Nuclear in 2020

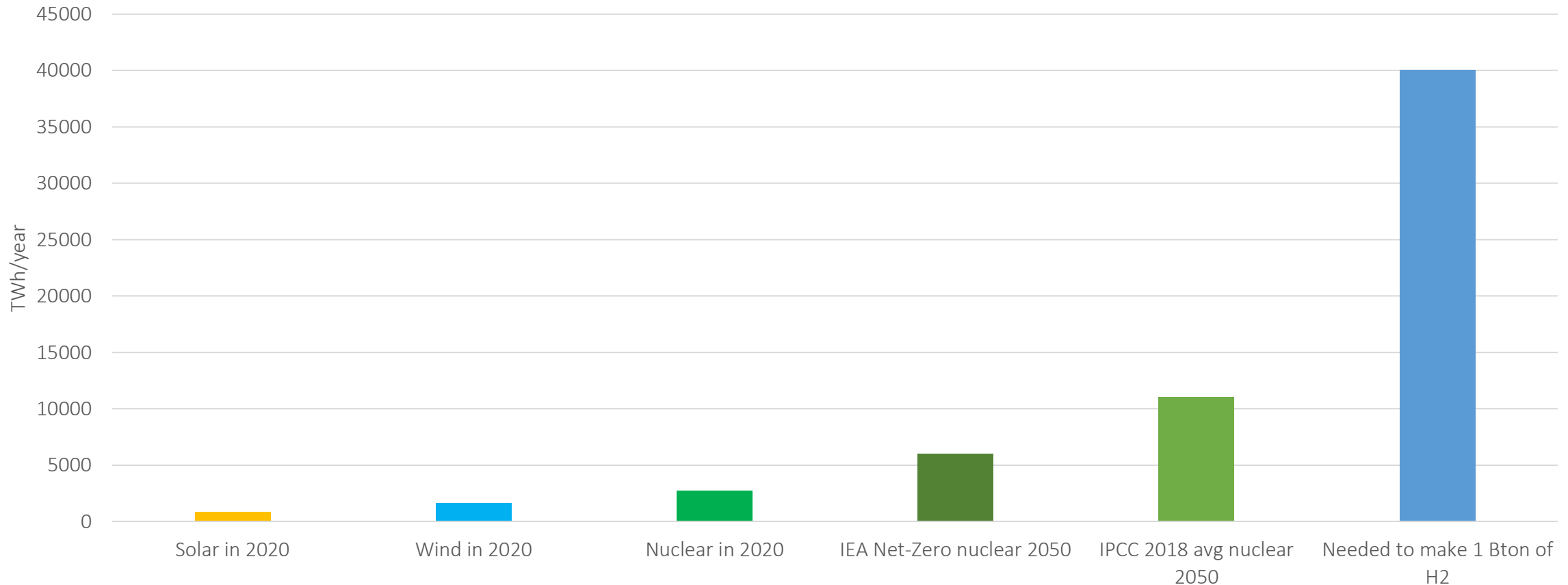
Nuclear Production in IEA and IPCC Scenarios by 2050

Making One Billion Tons of Hydrogen



CAN'T WE JUST BUILD MORE RENEWABLES...?

Solar, Wind, Nuclear in 2020,
Nuclear Production in IEA and IPCC Scenarios in 2050,
Making One Billion Tons of Hydrogen



CAN'T WE JUST BUILD MORE RENEWABLES...?

Nuclear power and wind power

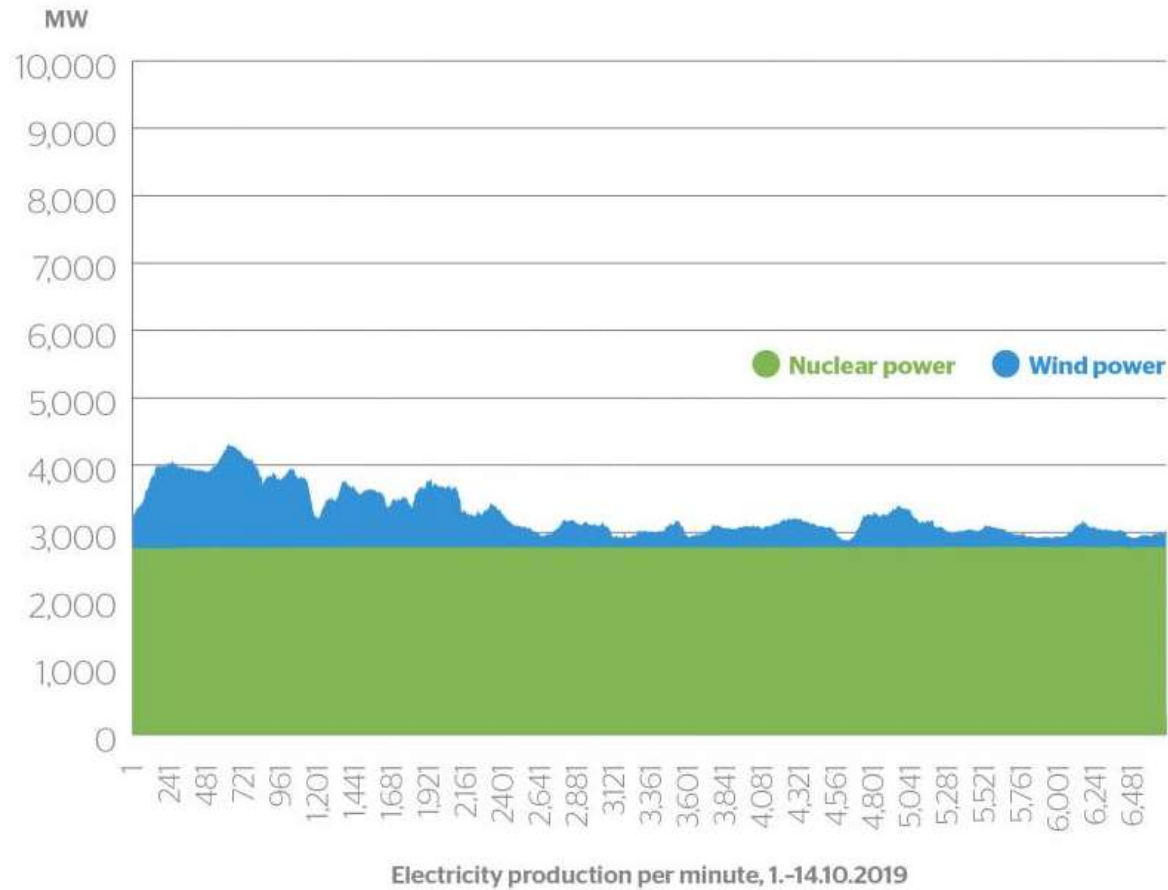


Figure 1: Combined production of nuclear and wind power in Finland, 3 min resolution. Output fluctuates between three and four gigawatts due to the variability of wind power in the mix.

Wind power × 6

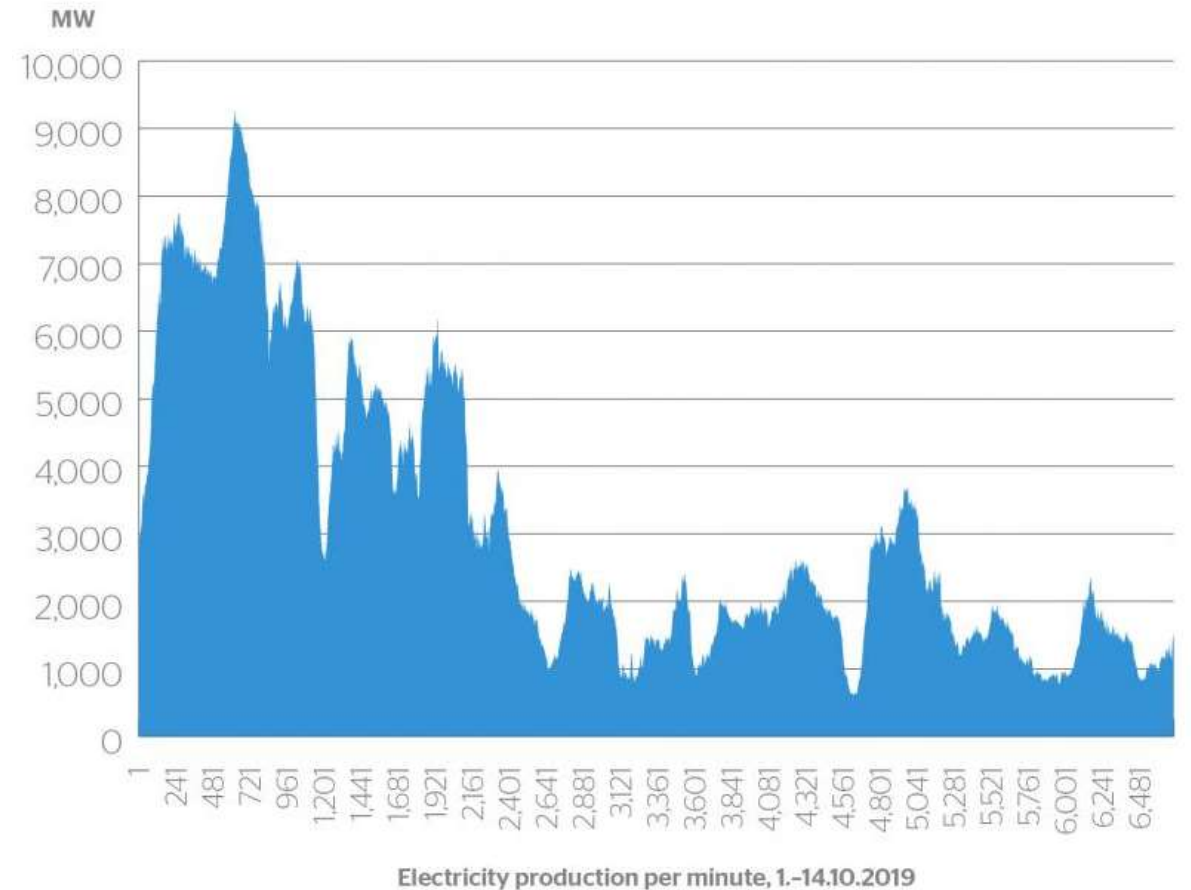
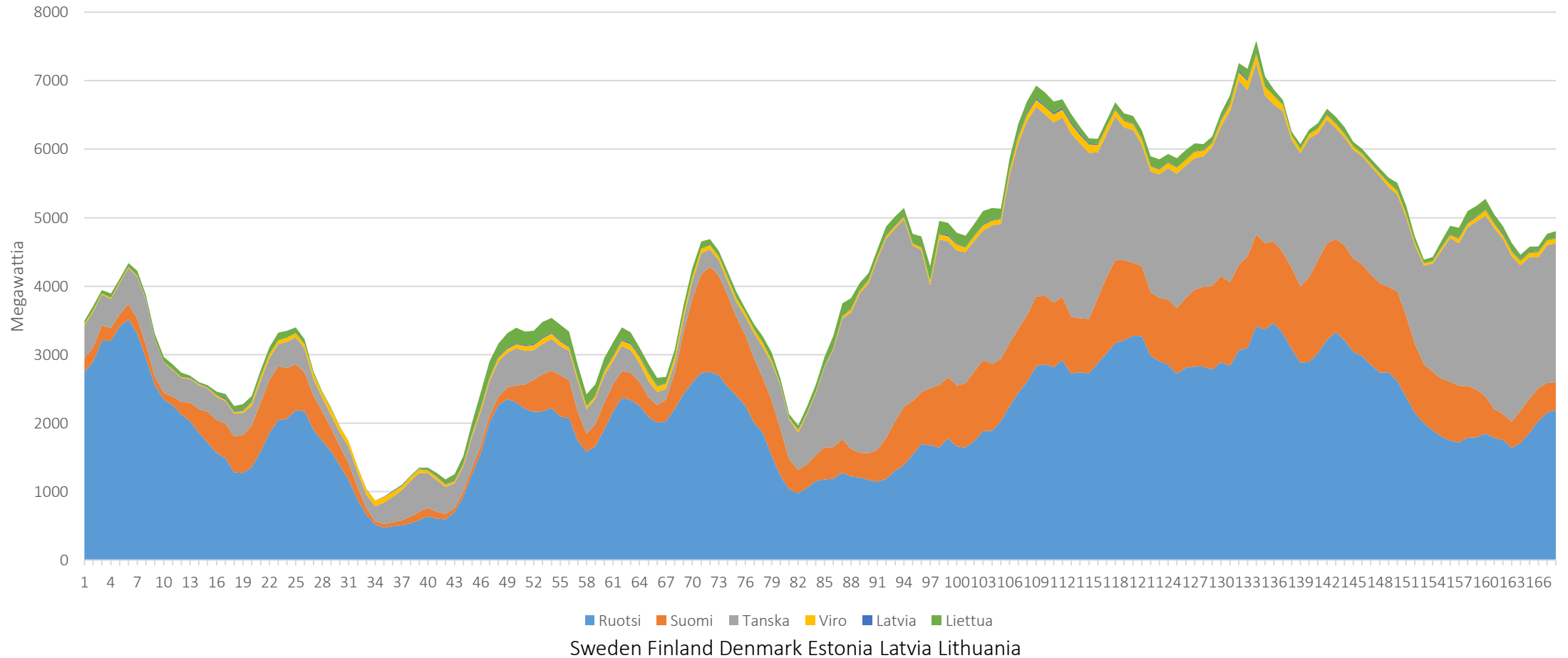


Figure 2: Roughly the same amount of energy as in figure 1 produced with wind power only by multiplying wind output by six.

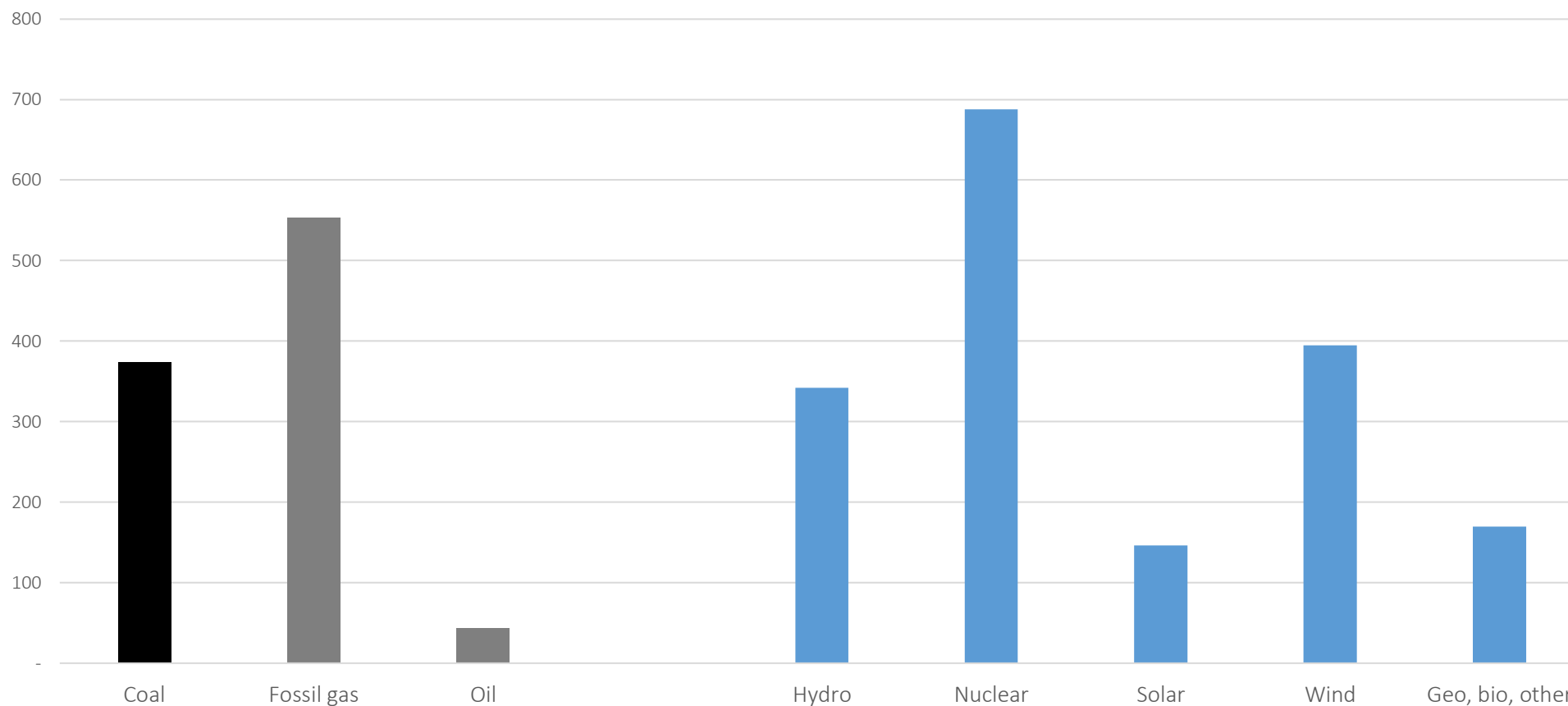
CAN'T WE SPREAD THE RENEWABLES ON A WIDER AREA?

Nordpool area wind production
Week 36 / 2020 (hourly data)



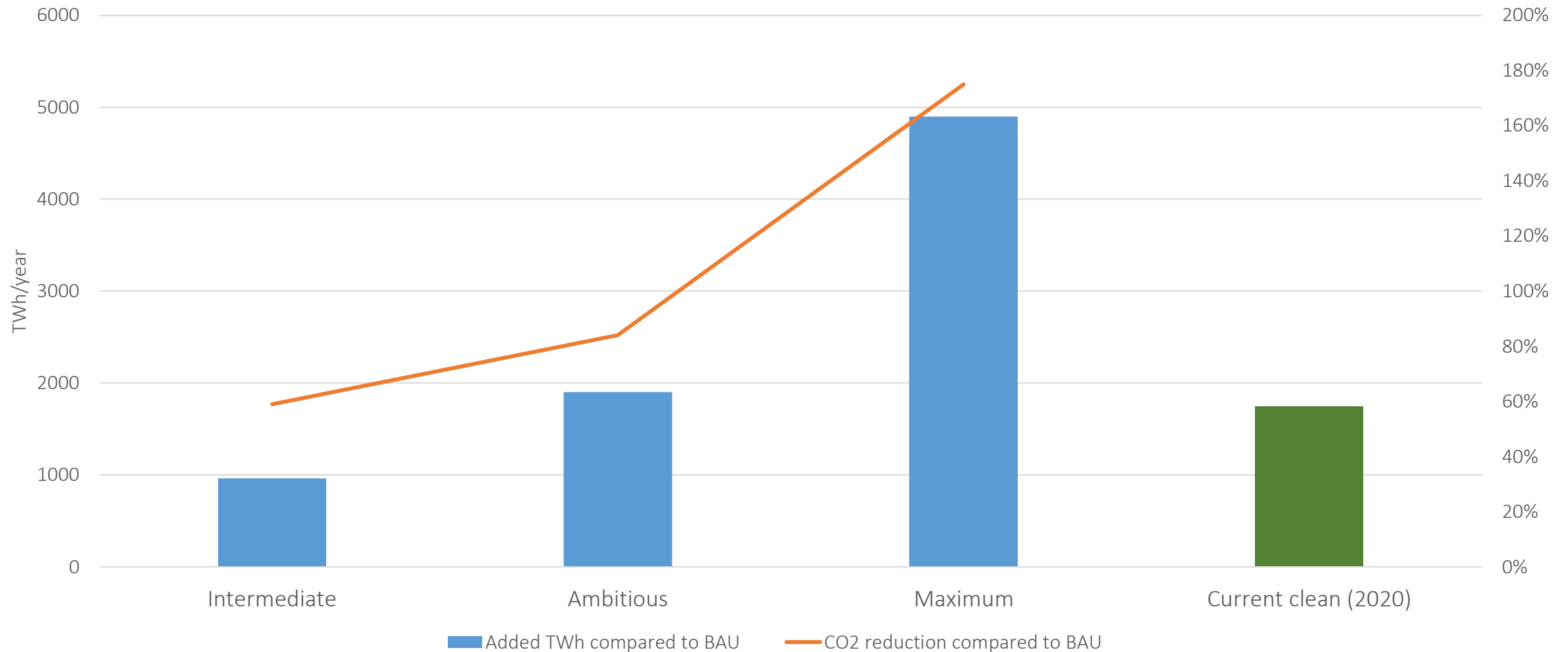
ZOOMING IN ON EUROPE

EU Power Generation 2020, TWh/y



THINK ATOM

EU Chemical Industry Additional Clean Energy Demand by 2050



THINK ATOM

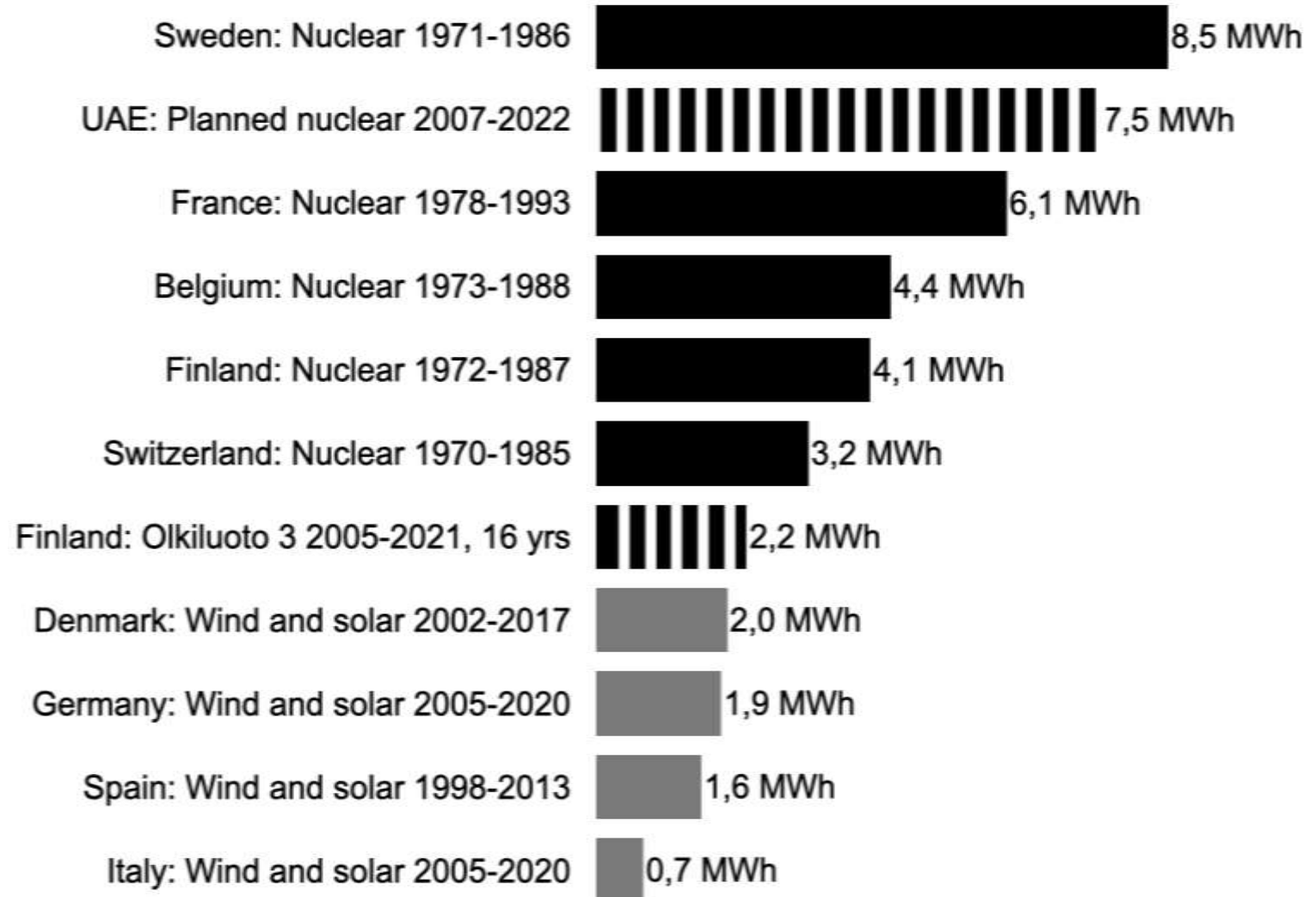
WHAT ABOUT NUCLEAR THEN?

- What are the most common misconceptions we have about nuclear?
- Why that is?
- What to do about it?
(one thing is to try NOT to repeat the misconceptions. It's a bit hard to do if I am here to tell you about them...)

NUCLEAR IS
FAST

('COS IT'S
BIG)

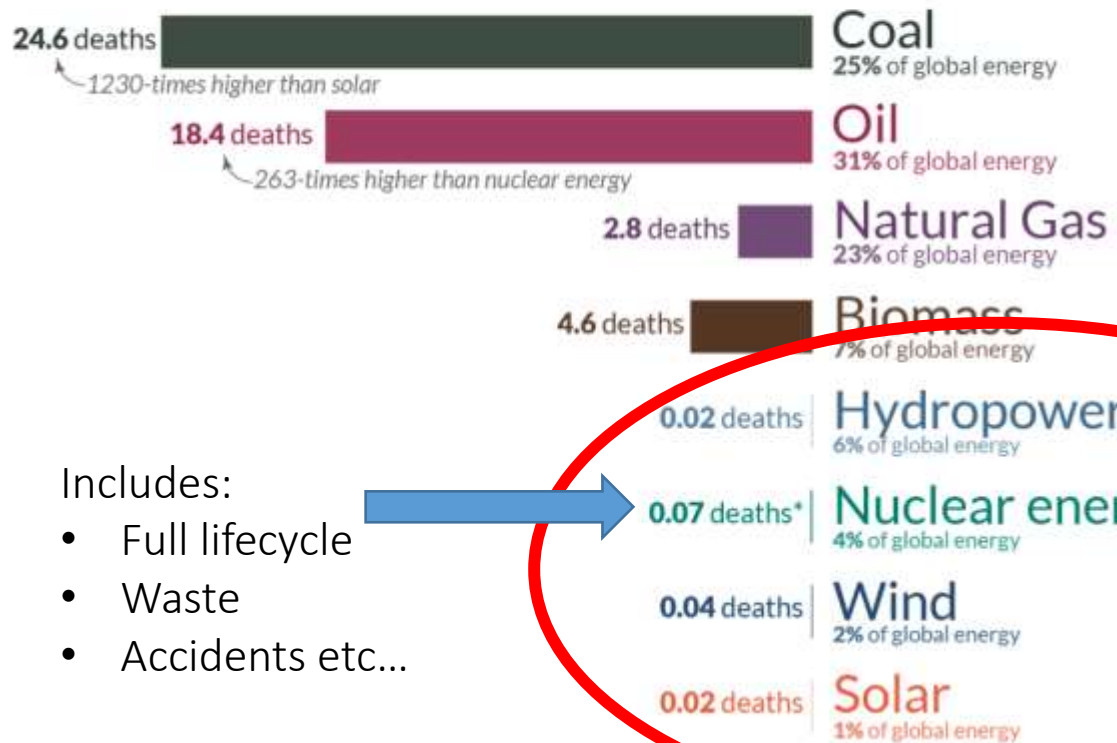
Best increase in electricity generation per capita over 15-year period



What are the **safest** and **cleanest** sources of energy?

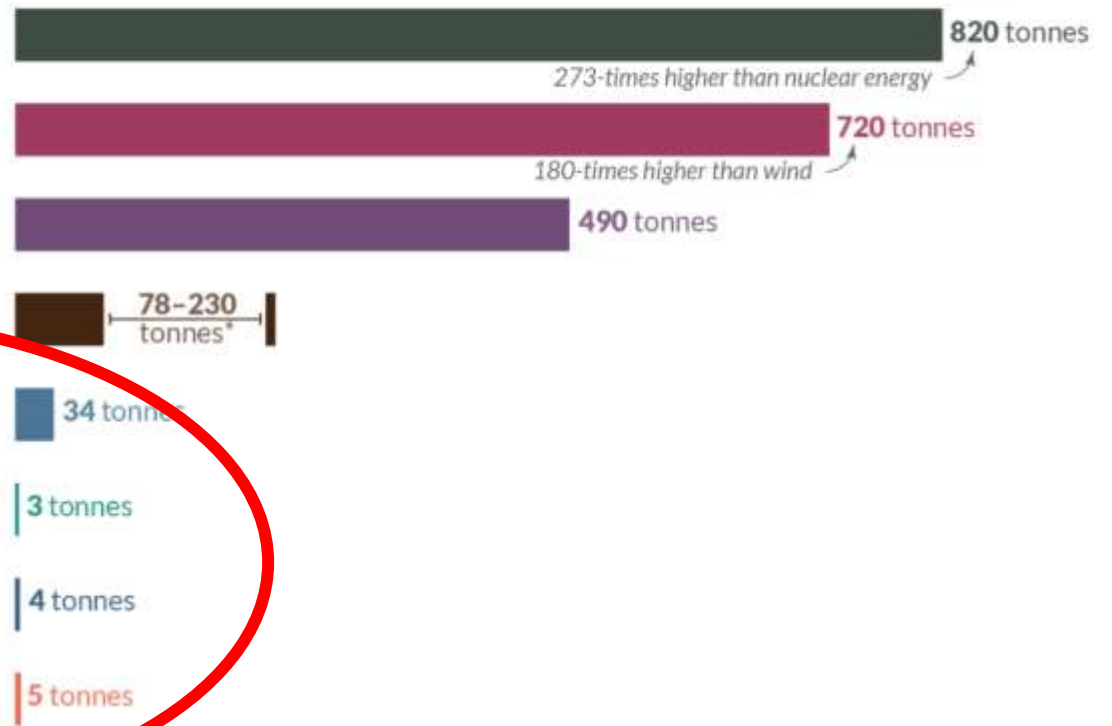
Death rate from accidents and air pollution

Measured as deaths per terawatt-hour of energy production.
1 terawatt-hour is the annual energy consumption of 27,000 people in the EU.



Greenhouse gas emissions

Measured in emissions of CO₂-equivalents per gigawatt-hour of electricity over the lifecycle of the power plant.
1 gigawatt-hour is the annual electricity consumption of 160 people in the EU.



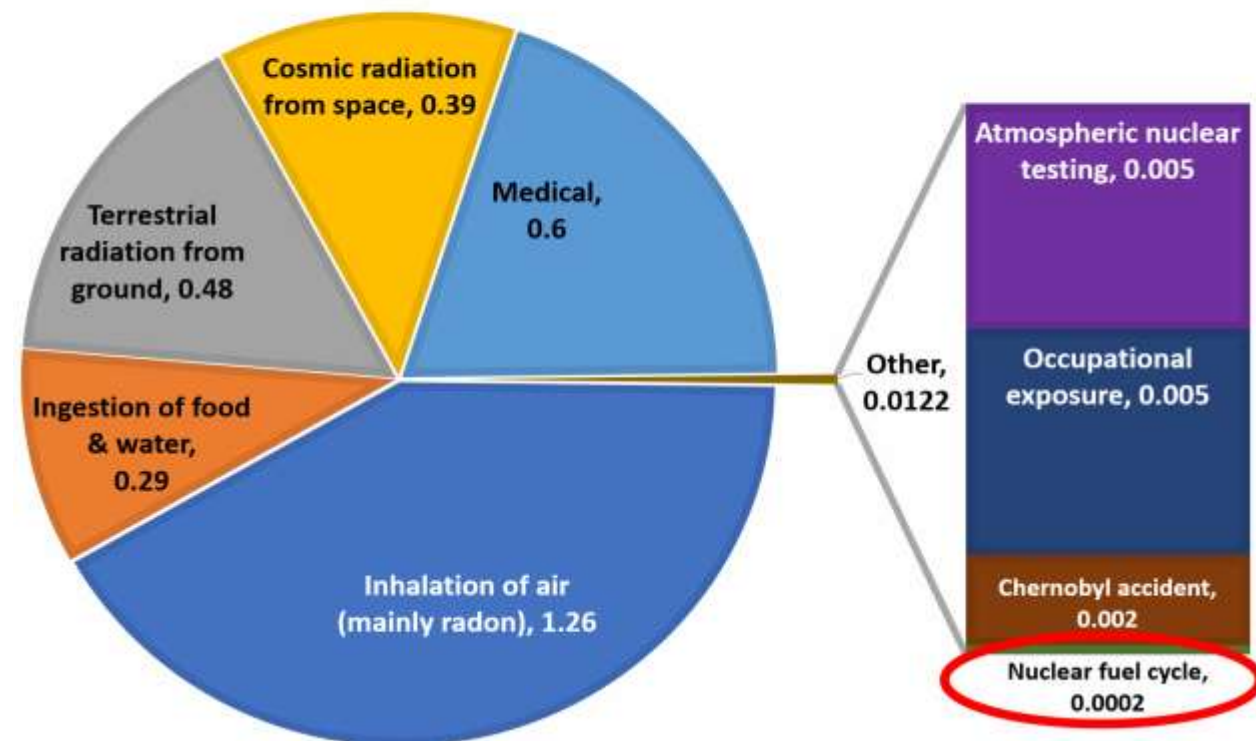
Includes:

- Full lifecycle
- Waste
- Accidents etc...

WHAT KIND OF WASTE PROBLEM?

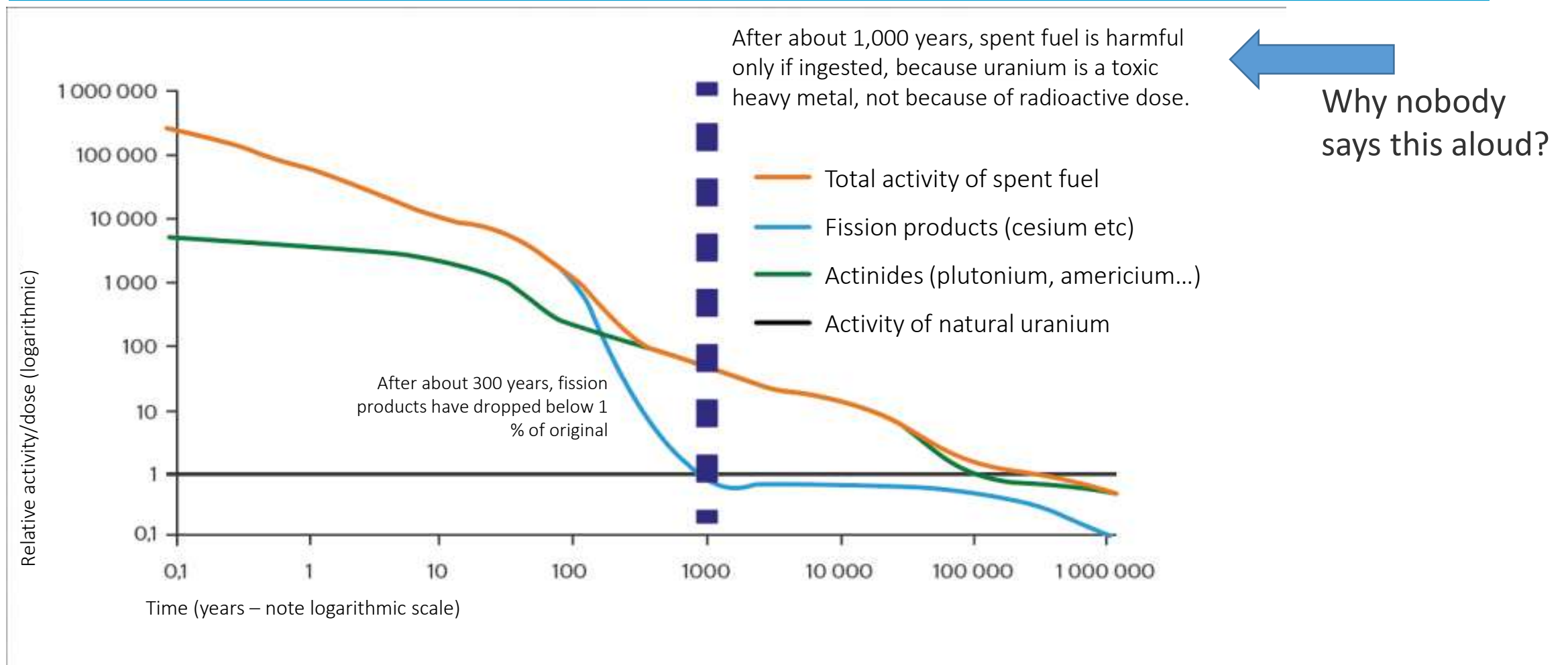
- Spent fuel is so well managed that it has never hurt anyone.
- It gets less harmful with time.
- Deep geological storage has a safety margin of roughly one million times:
 - Absolute worst case scenario, max dose: 0.00018 mSv/year*
 - Threshold for health hazard: 100+ mSv / year

GLOBAL AVERAGE RADIATION SOURCES,
MILLISIEVERTS / YEAR



* Based on Onkalo Deep Repository's environmental assessment.
http://www.posiva.fi/files/3195/Posiva_2012-10.pdf

GOING SCIENTIFIC ON SPENT FUEL...



An aerial photograph of the Onkalo final repository site in Finland. The image shows a large, rectangular concrete structure under construction, surrounded by a network of roads and utility lines. The site is located in a coastal area with a body of water visible in the background. The text is overlaid on the image in white, sans-serif font.

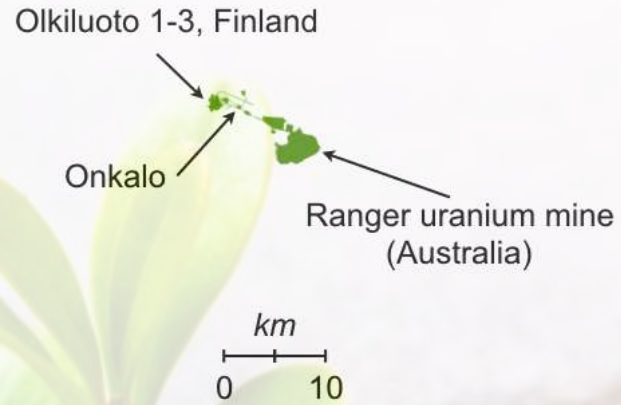
WHY DO WE THINK WE NEED
THIS?

(ONKALO FINAL REPOSITORY)

**8910 wind turbines,
roads and power connection**



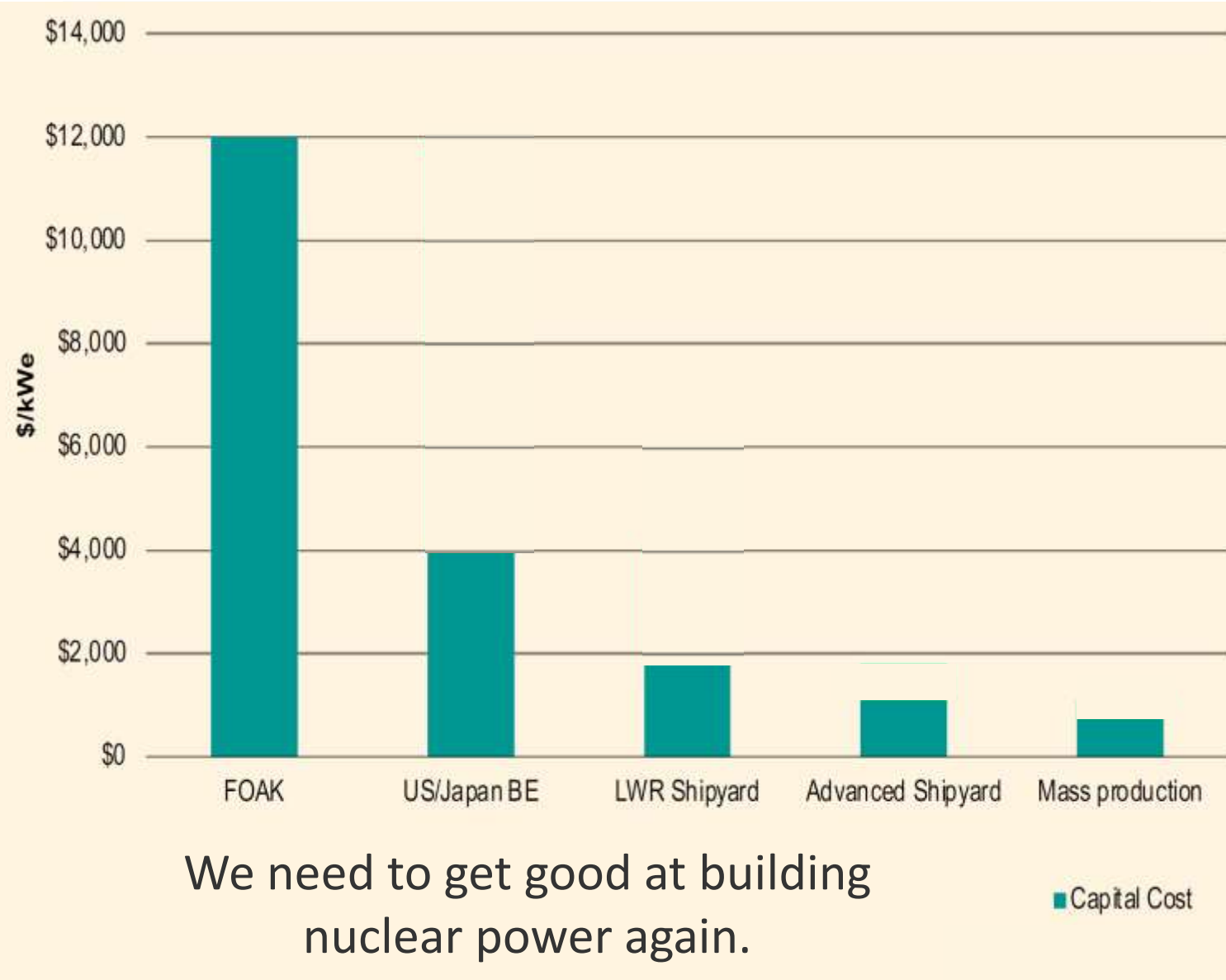
**Three nuclear reactors, roads,
power connection, uranium
mine, and final disposal:
equivalent annual generation**



**NUCLEAR HAS THE
SMALLEST
ENVIRONMENTAL
FOOTPRINT**

NUCLEAR IS
EXPENSIVE.

AND CHEAP!





Climate is a big challenge.
Nuclear can be a big solution.

THANK YOU.

RAULI PARTANEN

THINK ATOM

think deep decarbonization