Rethinking how we talk about energy and climate

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Overview

1. The climate challenge
2. How we talk about energy today
3. How we should talk about energy
4. Finnish perspectives on nuclear debate
5. Conclusions

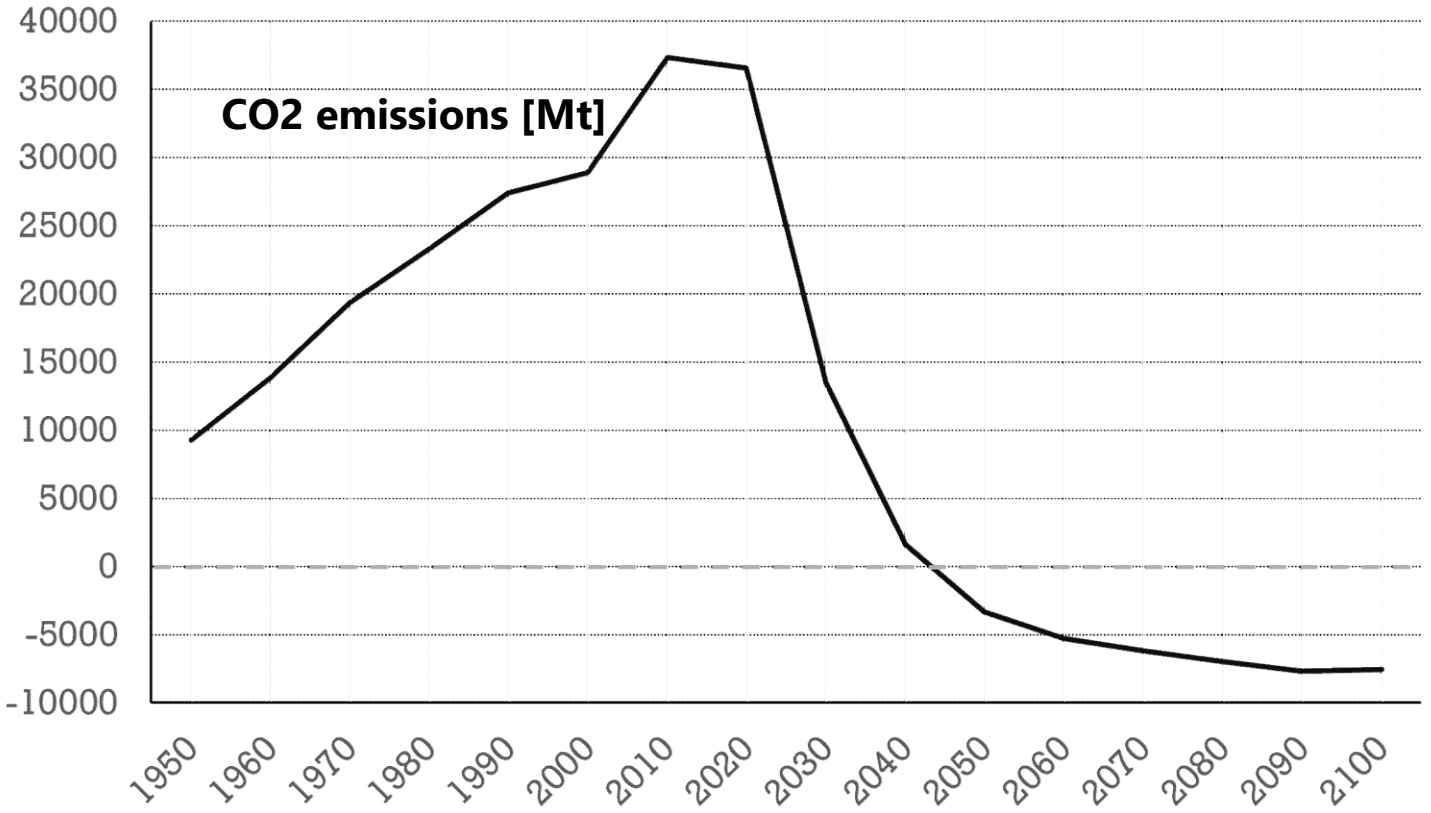
1. The climate challenge

IPCC SR15 in a nutshell

- Global warming of 2 degrees is already quite bad compared to 1.5 degrees.

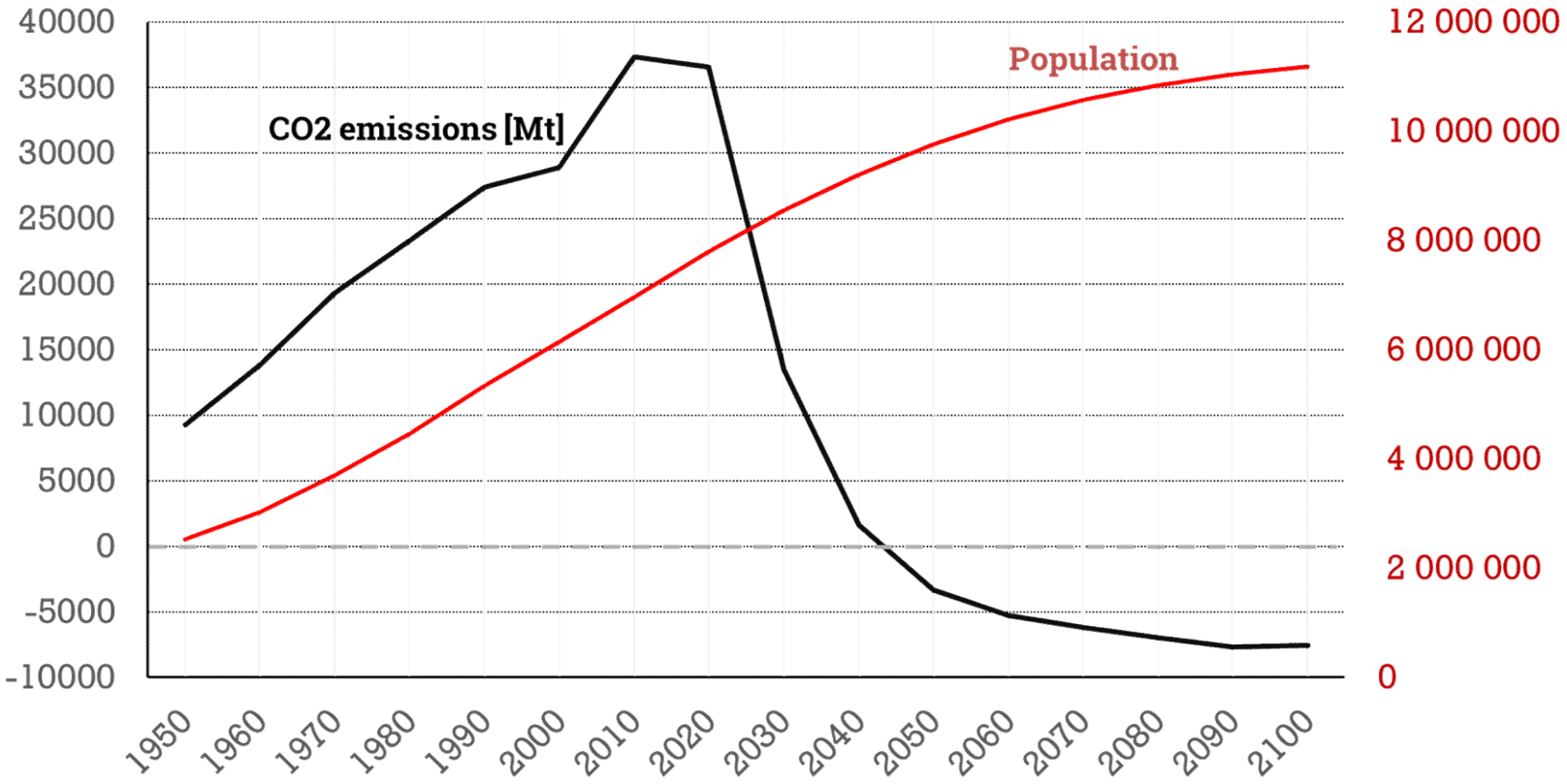
- Warming can *maybe* be limited to 1.5 degrees if energy production and land-use are transformed in an *unprecedented* scale.

Scale of the challenge



Sources: IIASA IAMC 1.5°C Scenario Explorer, IIASA RCP Database v. 2.0.5. The figure combines selected scenario data and is meant to represent the nature of the change, not a detailed path.

Scale of the challenge



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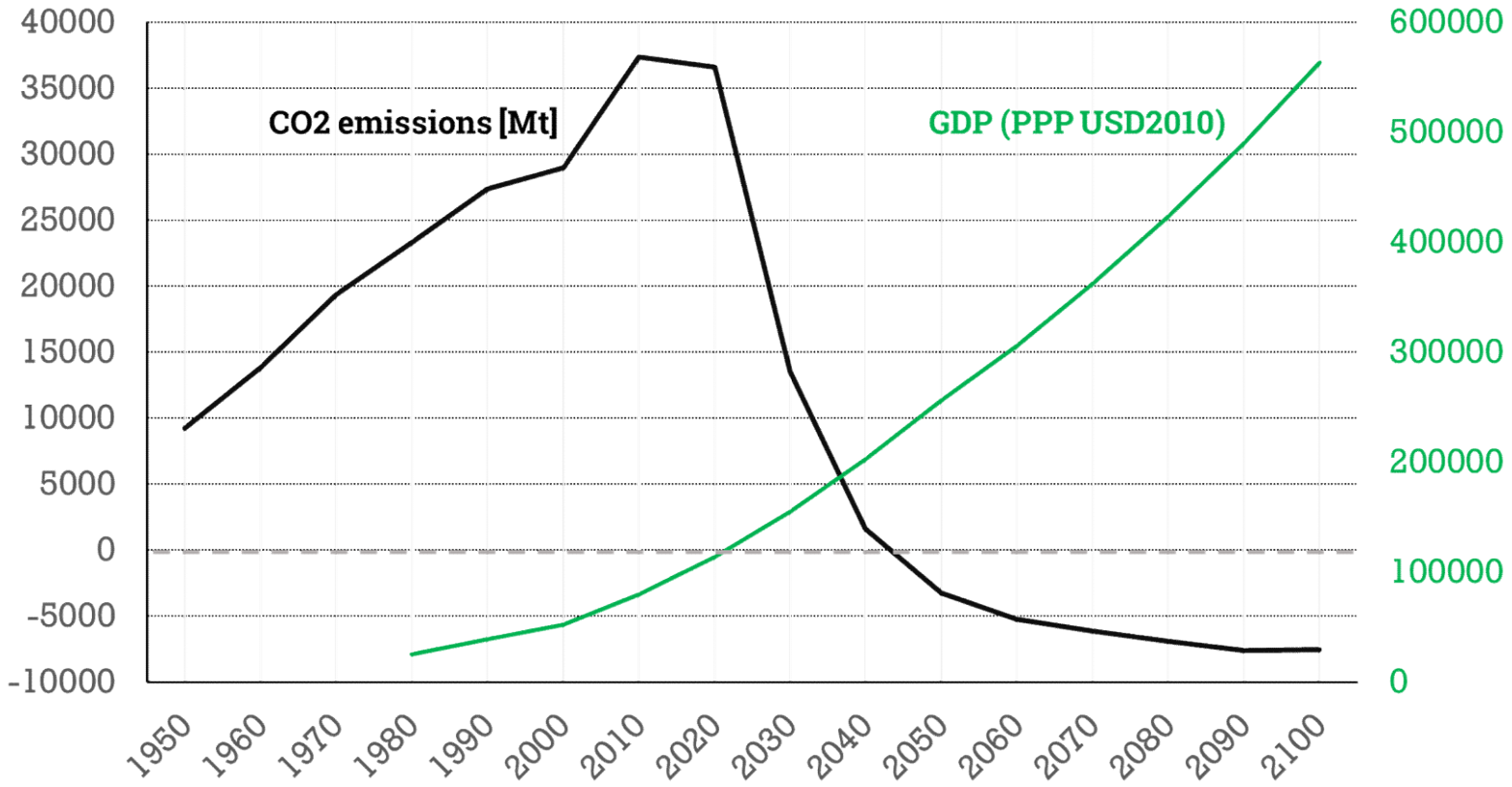

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Climate change is not the only challenge

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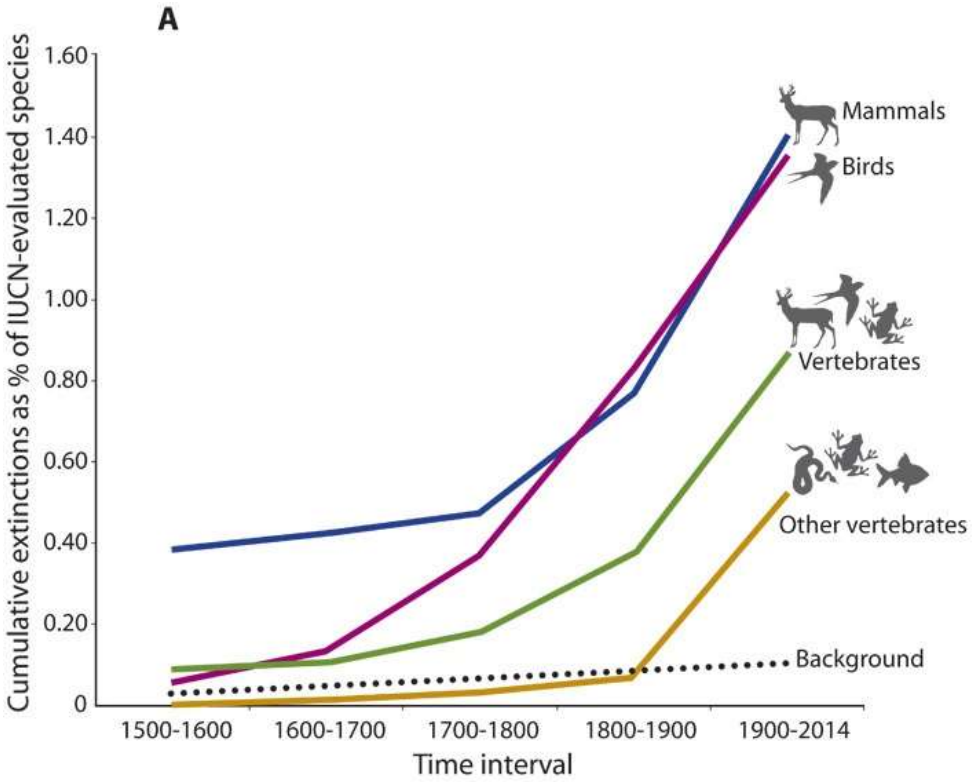
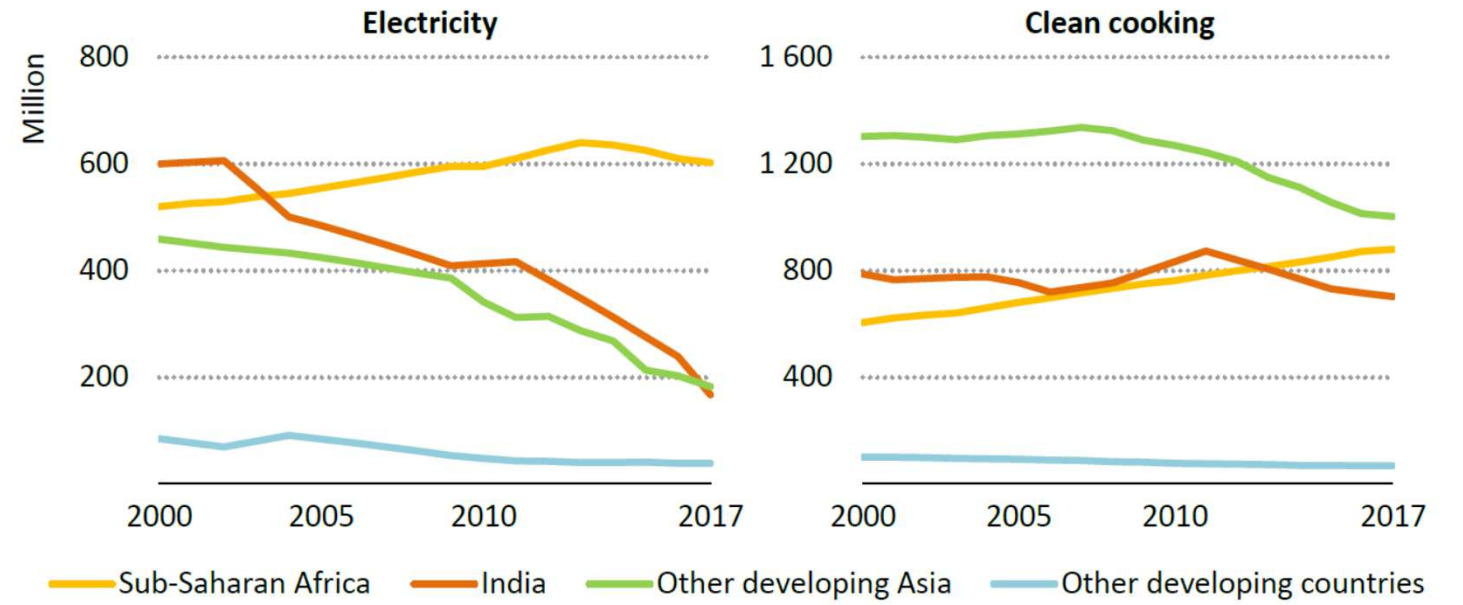
Biodiversity



Source: Accelerated modern human–induced species losses: Entering the sixth mass extinction BY GERARDO CEBALLOS, PAUL R. EHRLICH, ANTHONY D. BARNOSKY, ANDRÉS GARCÍA, ROBERT M. PRINGLE, TODD M. PALMER *SCIENCE ADVANCES*19 JUN 2015 : E1400253

Climate change is not the only challenge

Figure 2.7 ▷ Population without modern energy access

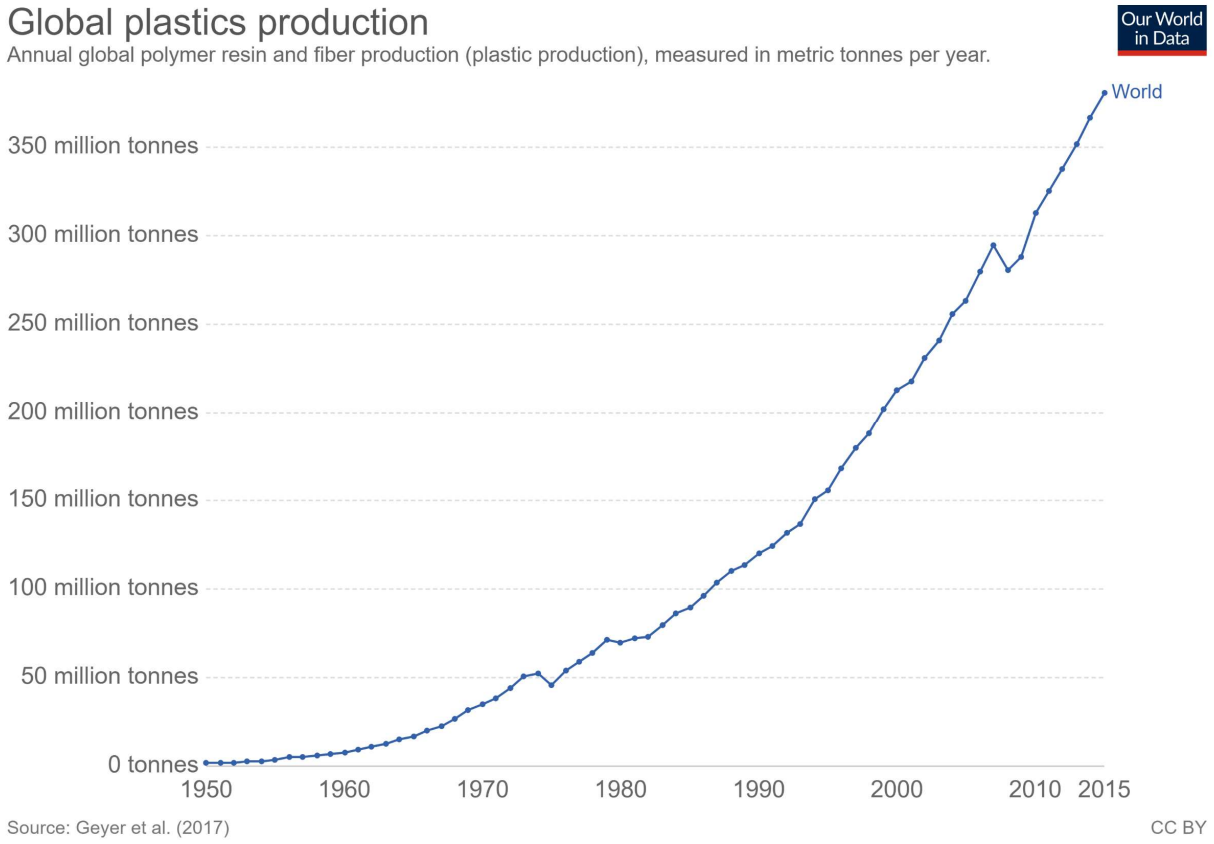


Poverty

Source: World Energy Outlook 2018

Climate change is not the only challenge

Linear economy



Source: Our World in DAta

Energy is the key to sustainable development

Climate change

Global poverty

Loss of biodiversity

Growing resource use

Sufficient supply of electricity and heat with low emissions and low environmental impact.

2. How we talk about energy today

What’s wrong?

1. Focus on renewables, not emissions
2. Problematic mental models
3. Limited market perspective
4. Nuclear taboo

Issues with the concept of RE

- Wind, solar, geothermal etc. are excellent sources of energy, but ...

1) Renewable does not mean sustanaible
2) The concept is inconsistent
3) RE emphasis has brought mixed policy results
4) RE enables problematic bait-and-switch

See:

Harjanne, A. & Korhonen J.M. (2019), Abandoning the concept of renewable energy, *Energy Policy*, Vol. 127, pp. 330-340. https://doi.org/10.1016/j.enpol.2018.12.029

Everything has consequences

- **Bioenergy:** Land use intensity, competition with nature conservation and food production
- **Hydro**: Fish populations, GHG emissions, population displacement
- **Geothermal:** Rate of replenishment
- **Wind & solar:** Mineral use, need for storages and/or overbuilding, lower service level
- **For all**: Scalability!
- *Decentralized production does not necessary benefit the poor*

Apples and oranges

- Renewable energy covers very different physical processes
- Energy densities vary by orders of magnitude
- Capacity factor and its determinants are diverse

→ Problematic concept for describing or comparing energy systems

The varying nature of different renewable energy forms. Coal and nuclear energy included for comparison.

Energy source	Primary form of energy	Land use intensity[a] [m^2/MWh]	Capacity factor[d]	Power fluctuation
Solar photovoltaic panels	Electricity by photovoltaic effect	10	16–30%	Directly weather dependent. In northern latitudes, season dependent as well.
Concentrated solar power	Thermal energy	15	25 – 80%	Directly weather dependent, unless backed by heat storage.
Hydropower	Kinetic energy	10	12–62%	Dependent on seasonal precipitation and accumulating sedimentation
Wind power	Kinetic energy	1	26–52%	Directly weather dependent, with some seasonal dependency.
Biomass	Chemical energy	500[b]	70–90%	Dependent on fuel properties.
Geothermal	Thermal energy	2.5	72–98%	Dependent of local rate of depletion.
Wave power	Kinetic energy	4.6[c]	26%	Directly weather and tide dependent.
Coal and nuclear figures presented for comparison				
Coal	Chemical energy	0.2 (underground) 5 (open-cast)	75–93%	Fully controllable.
Nuclear	Nuclear fission	0.1	85–90%	Dependent on fuel and plant properties.

[a] Refers to the land area required for production of one megawatt hour of energy, according to the "typical" values by Fritsche et al. (2017). Such figures should always be considered indicative only, since their exact values are highly dependent on the background assumptions of the calculations. However, they clearly illustrate the differing scales of energy intensity.

[b] Figure for crop-based biomass.

[c] Tidal wave power is still largely under development. This figure is based on estimates presented by Waters (2008).

[d] Capacity factor is the ratio between average power and peak capacity. Presented figures are for utility scale technologies and based on Transparent Cost Database (2018).

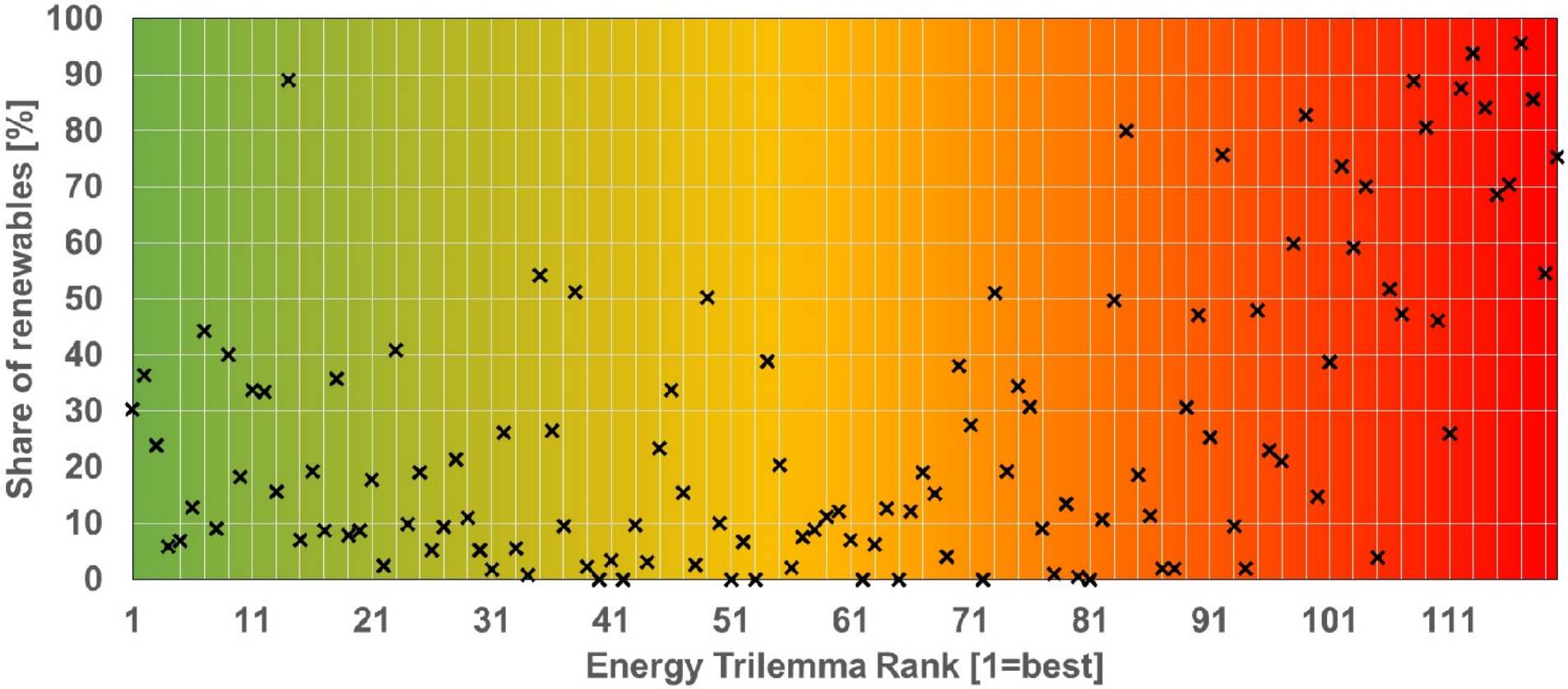
Harjanne, A. & Korhonen J.M. (2019), Abandoning the concept of renewable energy, *Energy Policy*, Vol. 127, pp. 330-340. https://doi.org/10.1016/j.enpol.2018.12.029

Mixed results

- Share of renewable energy is not a particularly good measure for energy policy in any meaningful way

- Renewable energy focused policies do not necessarily reduce emissions effectively

Energy trilemma index



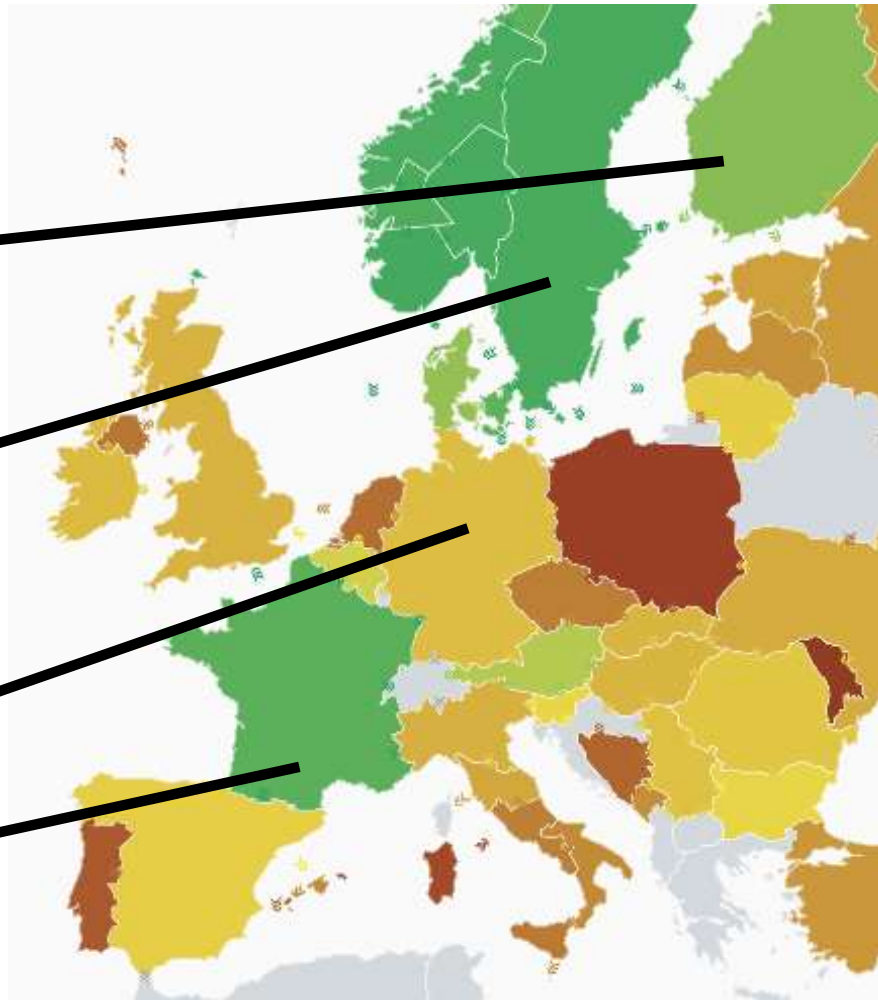
Some examples

Carbon intensity: 97 g
Low-carbon: 90 %
Renewable: 50 %

Carbon intensity: 34 g
Low-carbon: 95 %
Renewable: 58 %

Carbon intensity: 270 g
Low-carbon: 68 %
Renewable: 53 %

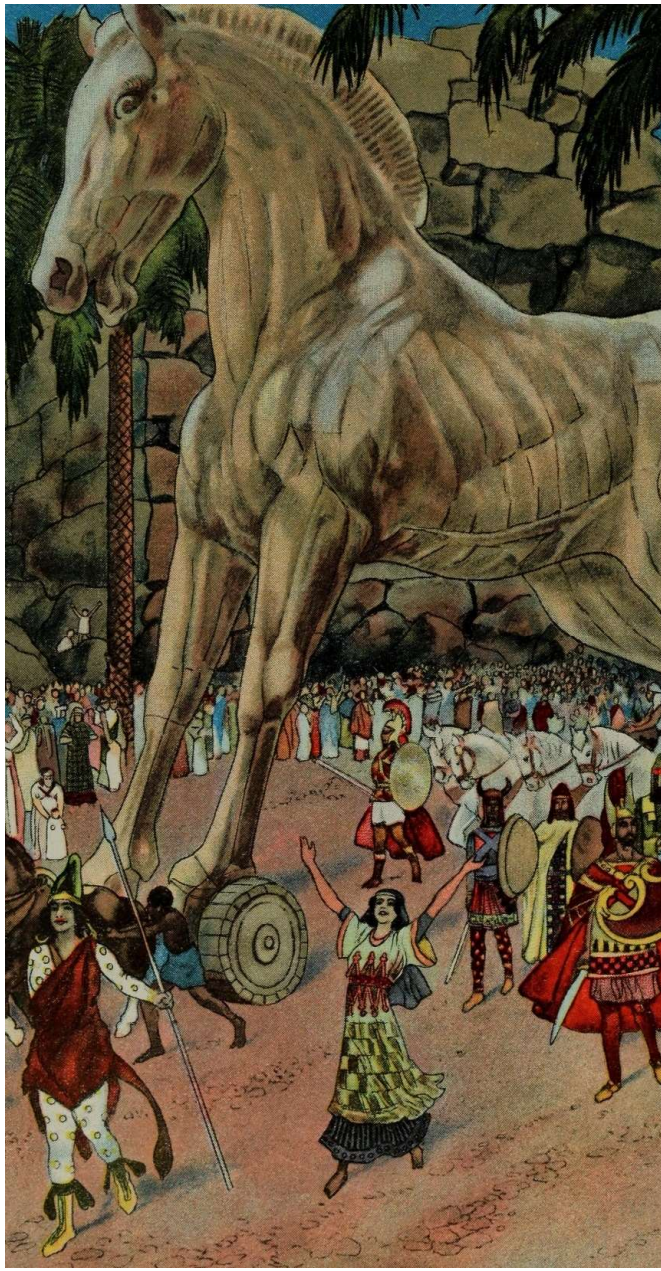
Carbon intensity: 52 g
Low-carbon: 93 %
Renewable: 25 %



Source: Electricitymap 27.6.2019 11:45

Things are not always what they seem to be

- The ambiguity and positive image of renewable energy enable misguiding communication and policies
- Increasing variable production can be a lucrative opportunity to natural gas businesses
- Ambitious renewable energy plans can actually be biomass and waste combustion plans
- Our visual culture is misguiding

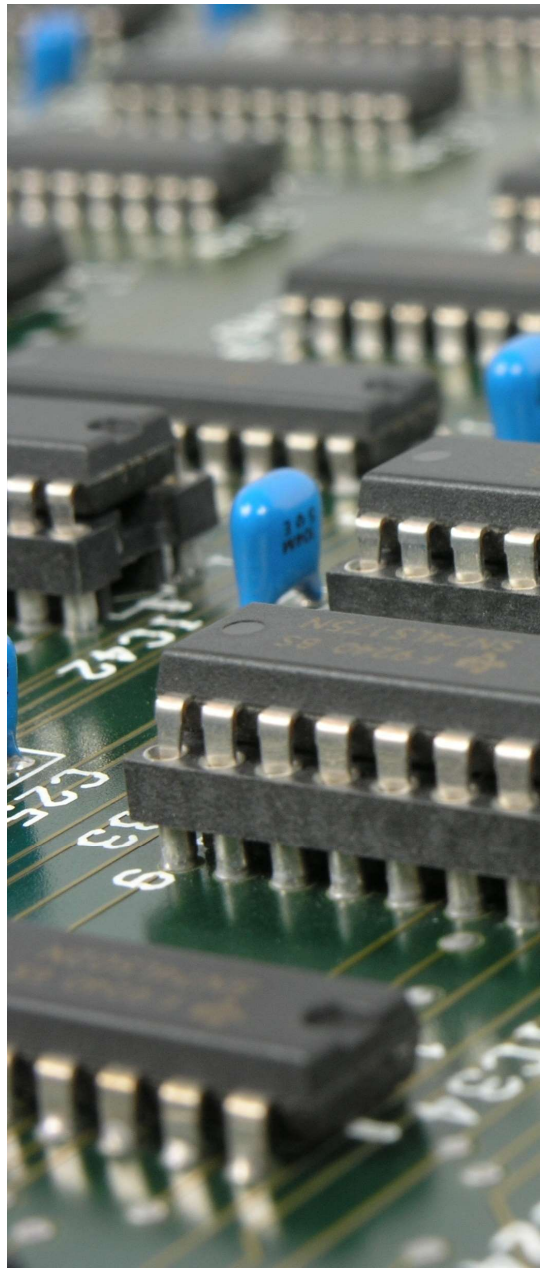


Problematic mental models

- Digitalization has enabled new kind of scalability
- Moore's law has held over 50 years
- Solar and wind have showed exponential growth and development curves

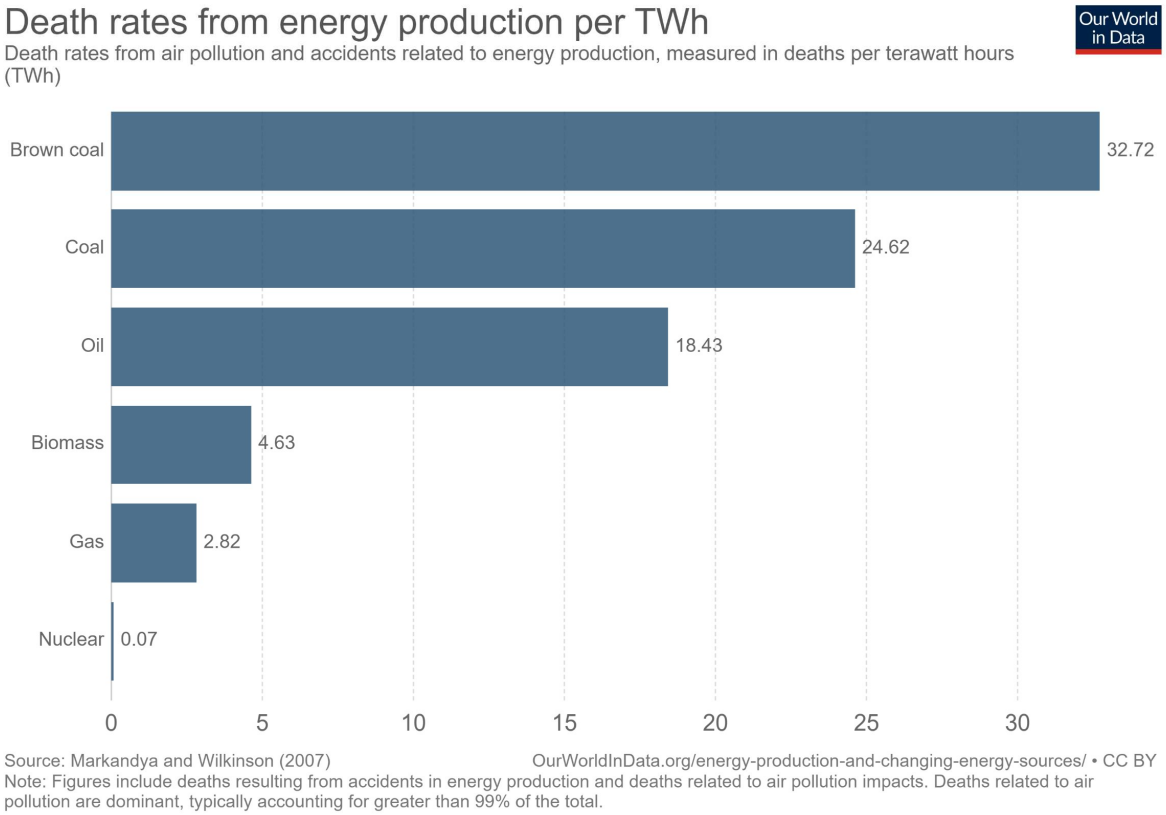
→But this is not a general rule in technological progress.

(Vaclav Smil: "Moore's curse")



Problematic mental models

- Biased risk perceptions
- Favorable connotations:
  - Small
  - New
  - Decentralized
  - Renewable
  - Local
  - ... Based on what?



Limited market perspective

106,471 views | May 29, 2019, 07:00am

Renewable Energy Costs Take Another Tumble, Making Fossil Fuels Look More Expensive Than Ever

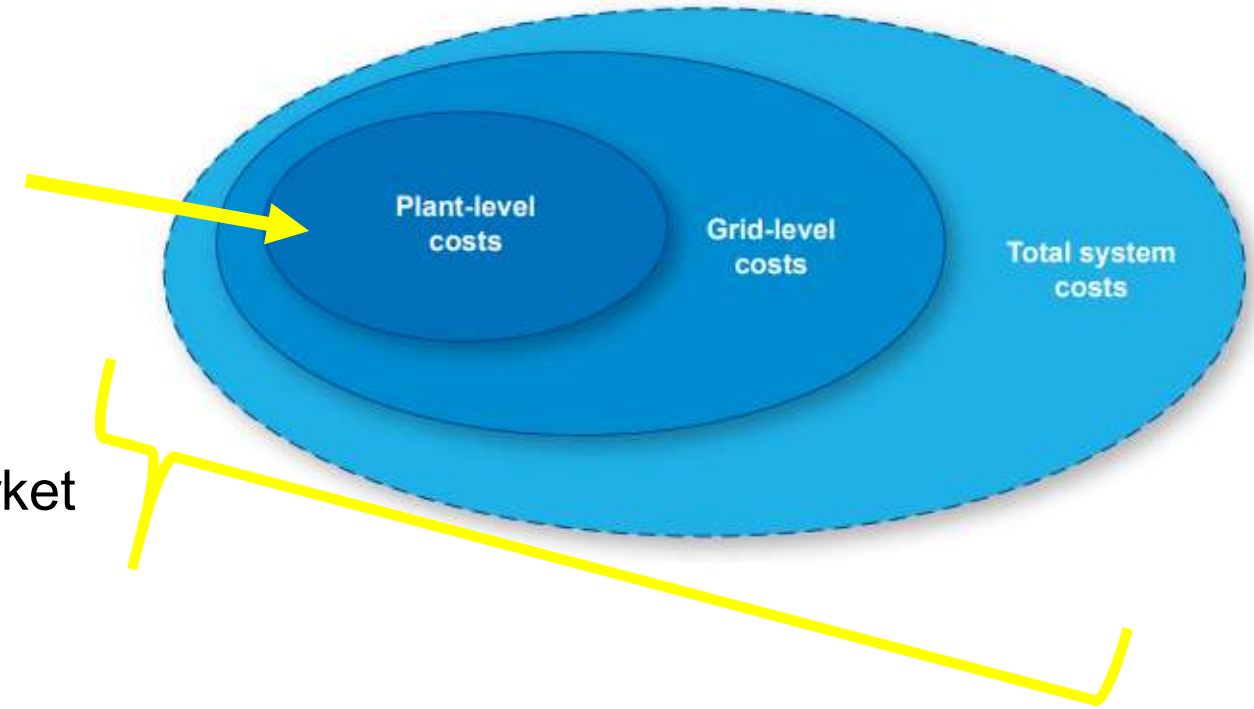
The Economic Viability of Nuclear Power Is Only Going Down

POLICY ANALYSIS

100% renewable electricity worldwide is a new cost-effective reality

Limited market perspective

Most of the discussion is about these



Very few if any policies or market incentives are driving system level deep decarbonization (not only electricity!)

Figure source: NEA (2012b), Nuclear Energy and Renewables: System Effects in Low-carbon Electricity Systems, Figure 4.1, p. 104, Table 4.8, p. 136, OECD, Paris, www.oecd-nea.org/ndd/pubs/2012/7056-system-effects.pdf.

Nuclear taboo

- Nuclear faces not only popular opposition but also wall of silence
- Examples:
  - European Commission - *A Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy* (2018). 25 pages, mentions:
    - ”nuclear” – 3 times
    - ”renewable” – 35 times
  - Finnish Government report on the National Energy and Climate Strategy for 2030 (2016). 119 pages, mentions:
    - ”nuclear” – 10 times
    - ”renewable” – 134 times

3. How we should talk about energy

The pespective we need

- Realize the scale and time scale of the challenge
- System level policy making and assessment
- Focus on **actual emissions & environmental impacts**
- Not a competition between renewables and nuclear, but a battle against climate disaster

”Carbon-combustion quadrant”

	Mostly combustion free	Mostly combustion based
Low carbon	1. Solar, wind, hydro, wave, tidal, geothermal, nuclear and energy systems based on these + low-carbon energy storage methods	2. Biomass (selected sources, long-term)
Too much carbon	3. Energy systems that have nominally high shares of low carbon generation but are backed up by high carbon fuels such as fossil methane or large-scale biomass	4. Fossil fuels, biomass (non-optimal sources, short-term)

Harjanne, A. & Korhonen J.M. (2019), Abandoning the concept of renewable energy, *Energy Policy*, Vol. 127, pp. 330-340. https://doi.org/10.1016/j.enpol.2018.12.029

Photo: Marco Verch [https://foto.wuestenigel.com/toolbox-on-a-white-background/?utm_source=39255740861&utm_campaign=FlickrDescription&utm_medium=link] CC BY 2.0

How to keep nuclear in the game

- Recall the big picture and grand challenges
- System level perspective
- Be open about challenges, but don't focus on risks and safety
- Do the math and use it
- Intervene ignorance
- Embrace innovations and new ideas (i.e. SMRs)

4. Finnish perspectives on nuclear debate

Political landscape in Finland

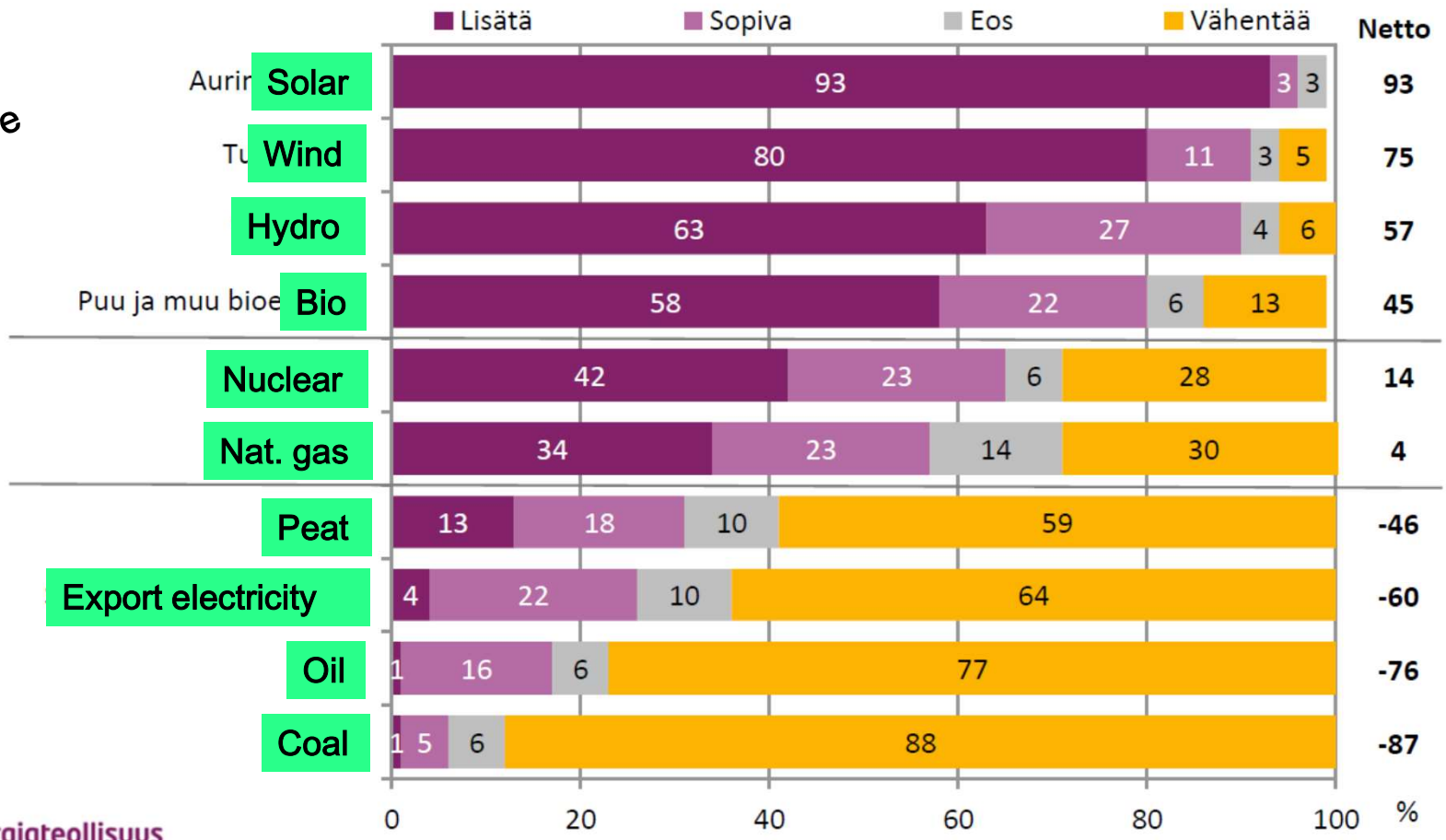
- Olkiluoto 3 and Hanhikivi 1
- Almost 20 TWh worth of wind power in preparation
- National coal ban starting from 1.5.2029
- Major debate on sustainable forest logging levels
- SMRs on the rise: First in public debate, now companies assessing as well
- New government programme: Continuing licences of current plants ok.

Greens supporting nuclear?

- Open to nuclear R&D in the newest political programme
- Green Youth published an even more positive statement
- Socially just and effective climate policy as the priority

Public perceptions 1/2

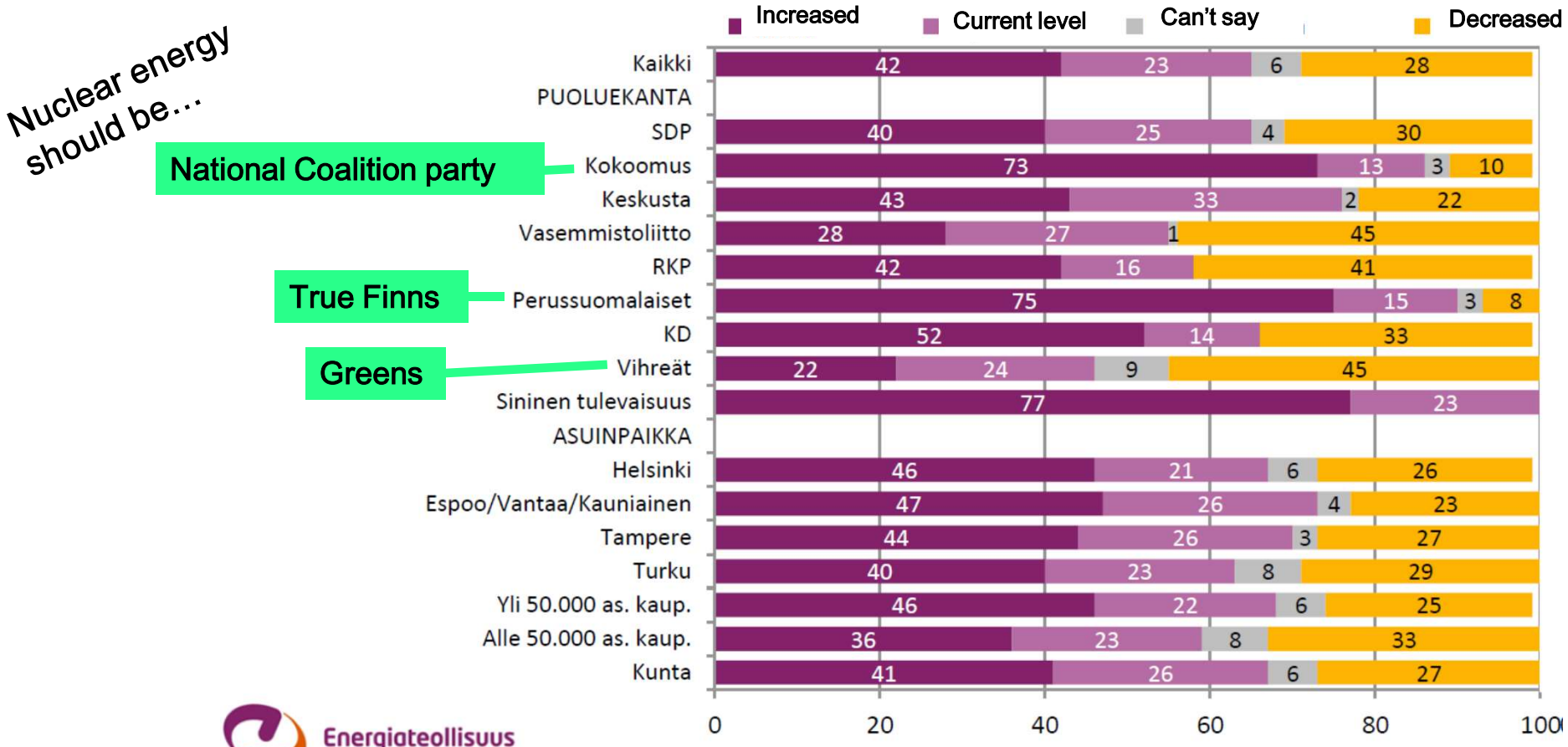
What should we build more?



Energiateollisuus
Suomalaisten energia-asenteet 2018

Source: Finnish Energy 2019

Public perceptions 2/2



Energiateollisuus
Suomalaisten energia-asenteet 2018

Source: Finnish Energy 2019

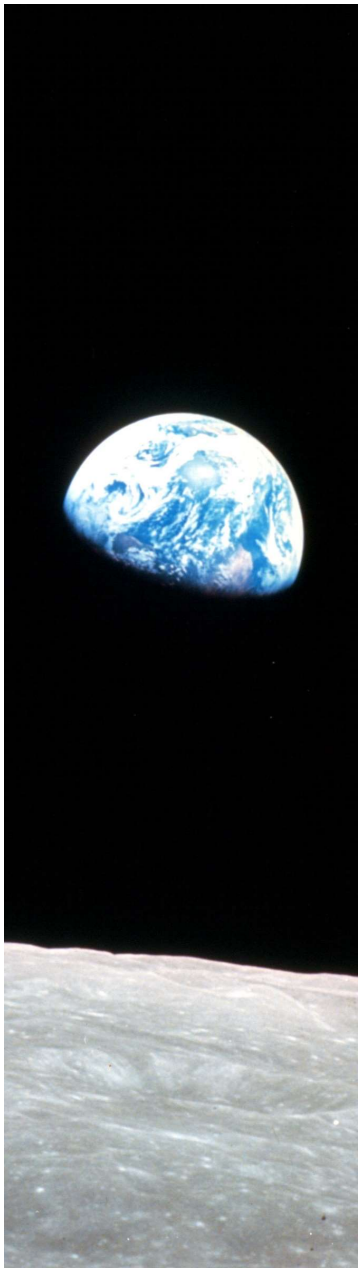
Public perceptions on SMRs

Source: Finnish Energy 2019

5. Conclusions

Conclusions

- We are facing a complex global challenge of an immense scale
- We need massive investments in all kinds of clean energy – including new nuclear power
- Much of today's energy debate forgets this big picture and is based on flawed assumptions or misconceptions
- We need more system level perspective – and to keep all the tools in the toolbox



Thanks!

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