

Global perspective on energy support and demand (and food)

by

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United Nation's 17 goals of sustainability to:

- Delete (extreme) poverty
- Exterminate inequalities
- Stop (human induced) climate change

→ →

- Developing countries need much more (clean) energy than today
- (2.4) 3 (4) kW/person will give a good standard of living

→ →

- Increase from 16 (today) to 30 (2050) billion kW (including increased population to 10 billion and some reduced energy spending in the western world due to energy efficiency)

Enormous amounts of clean energy available

- «A support of enough clean energy to everybody on earth is economically and technically possible within 2050»

This statement is taken from the textbook:

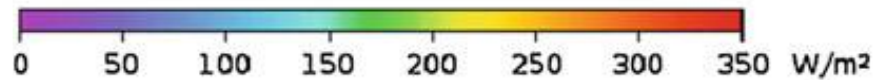
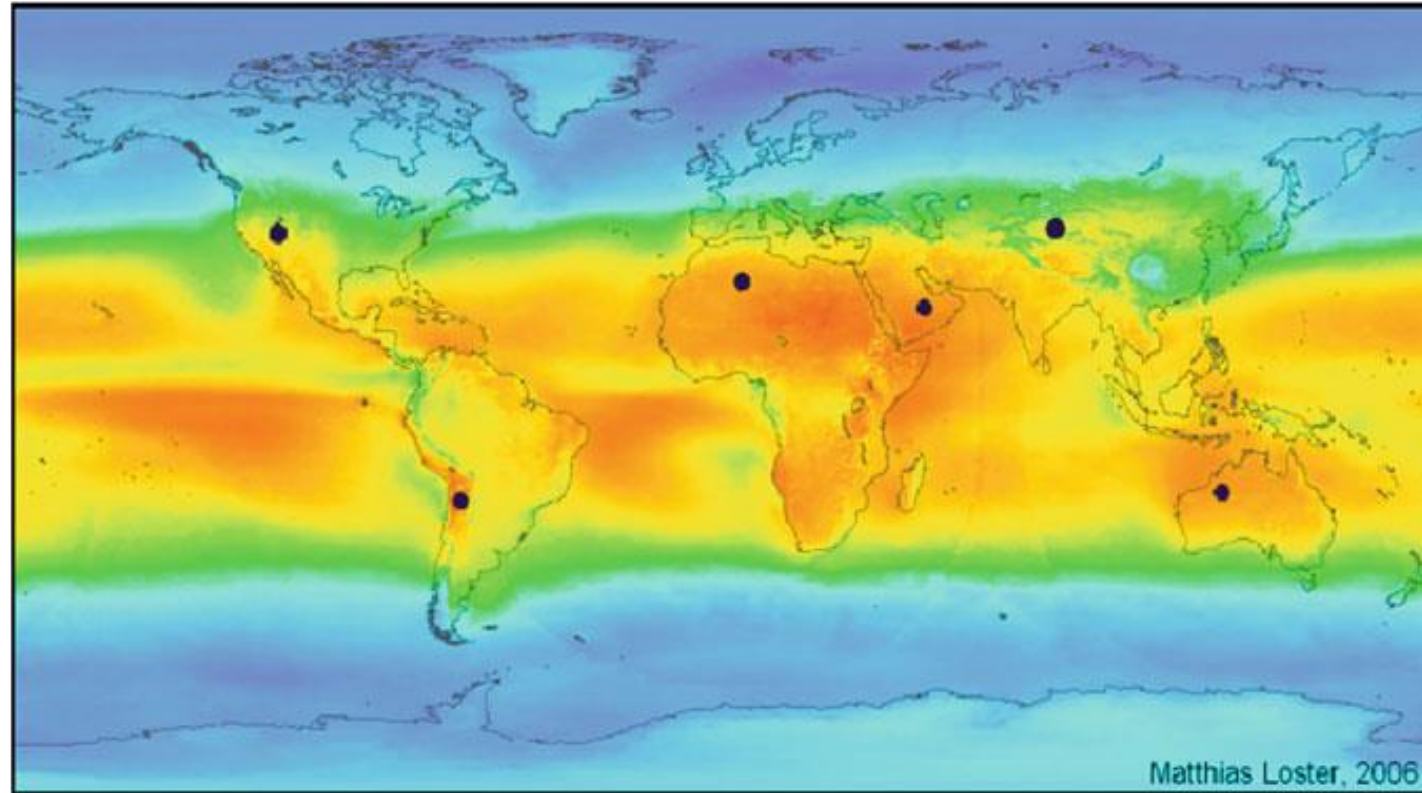
«Energy Technologies and Economics», 2014, by:

Dr. P.A. Narbel (energy economy)

Prof. J.P. Hansen (energy physics, UiB)

Prof. (emeritus) J.R. Lien (nuclear and petroleum technology)

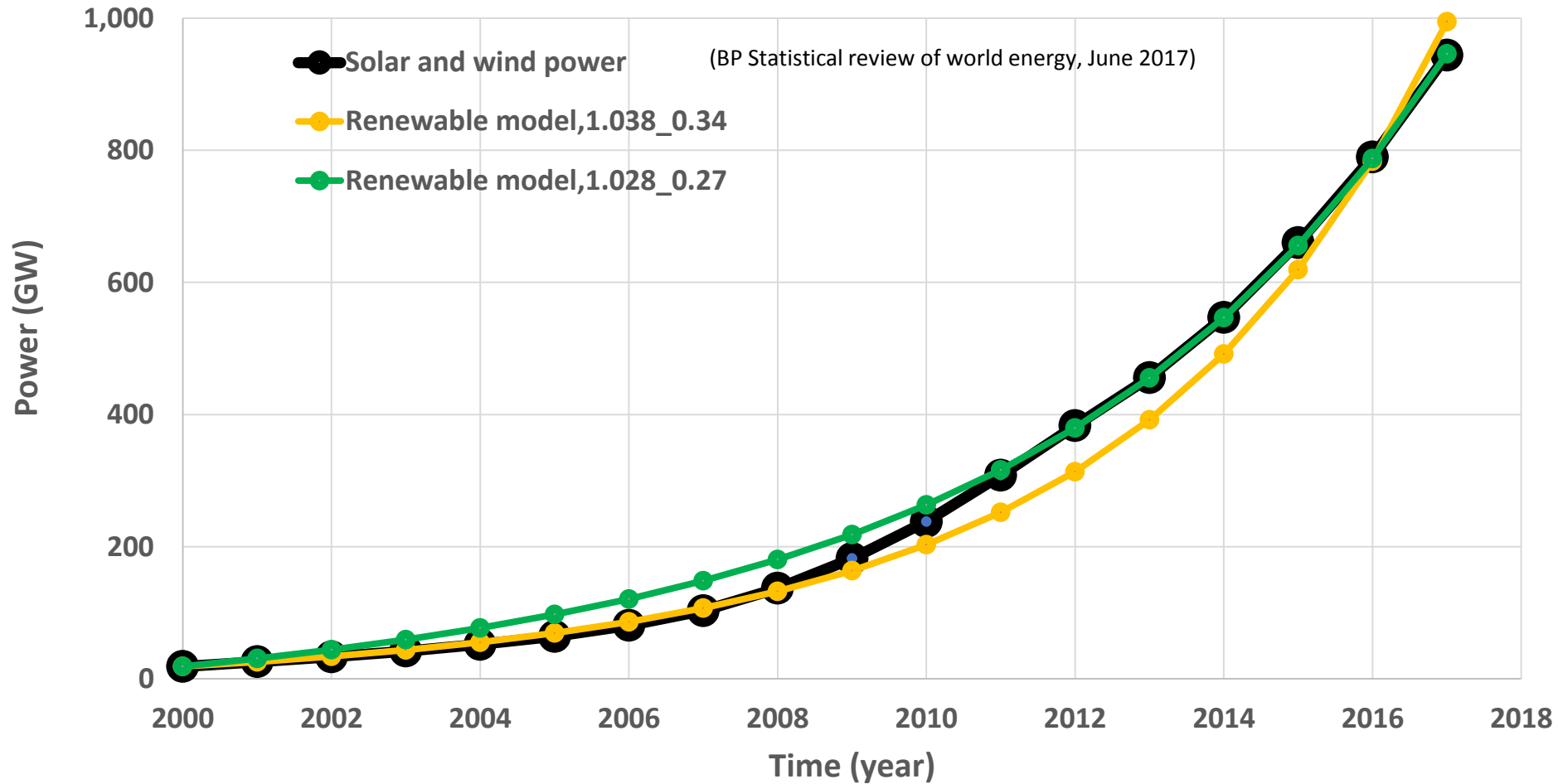
Dark dotted areas enough to produce 18 TW



$\Sigma \bullet = 18 \text{ TWe}$

Can we really get rid of «all» fossil fuel within 2050?

Global Solar and Wind Power



$$P_{(n+1)} = \left((a + P^z_{(n)}) * Tot_{(n+1)} / (b * (a + P^z_{(n)})) + Tot_{(n+1)} \right)$$

where:

P is modeled global solar- and wind power production (GW)

n is year

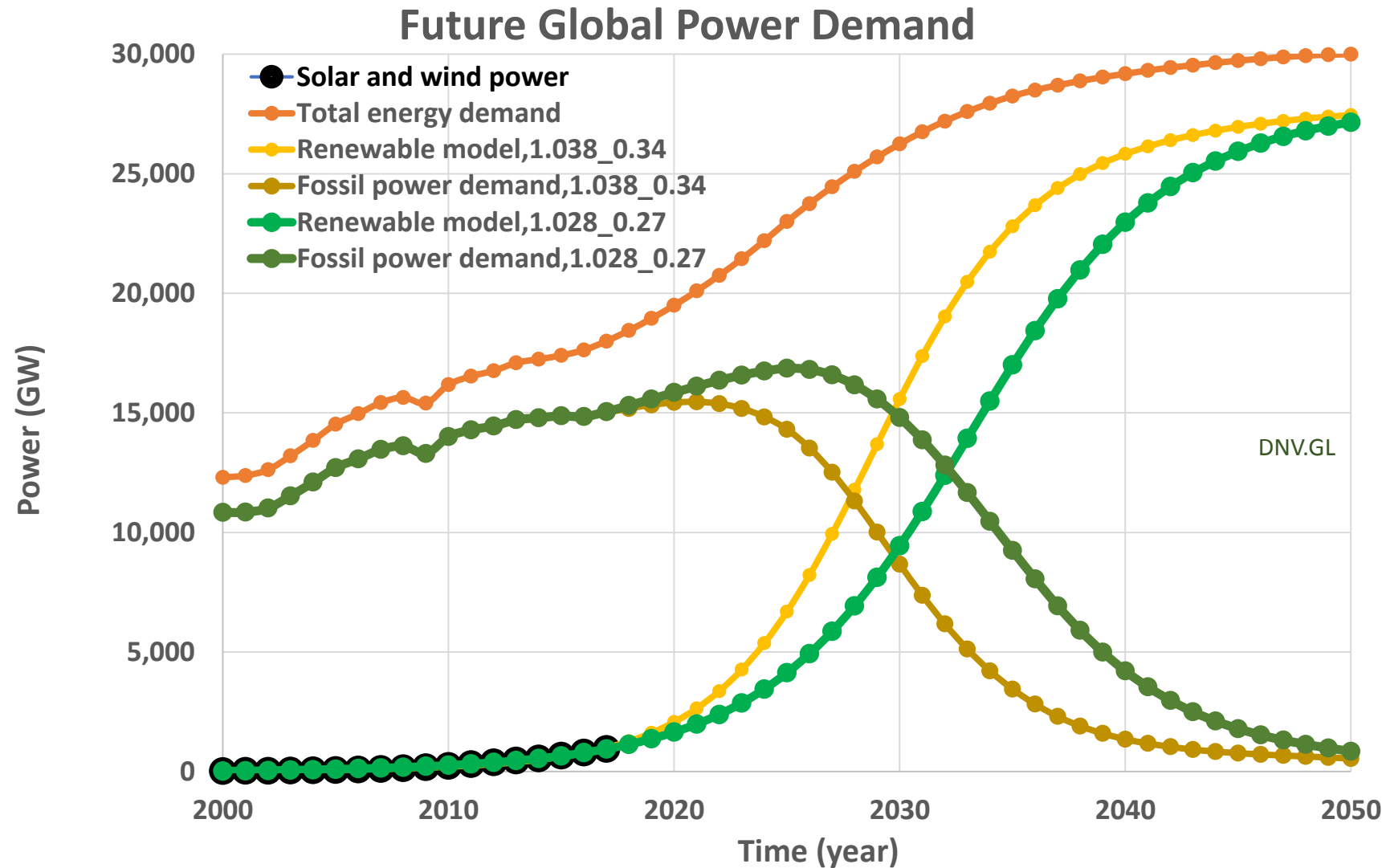
a is a fitting constant

z is the constant for the exponential growth

Tot is the total demand for global power (energy pr. time unit (GW))

b is a constant related to the resistance against green energy transfer

Predicted development of global solar and wind power supply and «death» of fossil fuel (compared to total power requirements)



Norway is searching for new fossil fuel reserves, while global demand will probably:

- Reach its maximum in 2025
 - Fall drastically over 10 years (2030-2040)
 - Be close to zero in 2050 (but the outlook from DNV.GL says near 50% still fossil)
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- In this perspective, is it wise for Norway to spend enormous amounts of governmental (our) money searching for new fossil fuel resources, oil and gas which probably no one will buy in 10-20 years?

What are the resistances/breaks/inertia?

- Price of solar and wind technology? No
- Politics (traditional industry, present economy)
- Human tradition/indoctrination (Statoil is the God of Norway)
- Presence of technology (based on fossil fuels)
- Renewable energy storage
 - Hydrogen (still expensive and lack of infrastructure)
 - Batteries (weight is a problem for aircrafts and boats (or infrastructure))
 - Pumping water up high (many countries don't have high mountains)
- New ecosystem impacts
- Pressure on traditional human cultures, and political risk

The DESERTEC plan for HVDC connections of renewable power plants

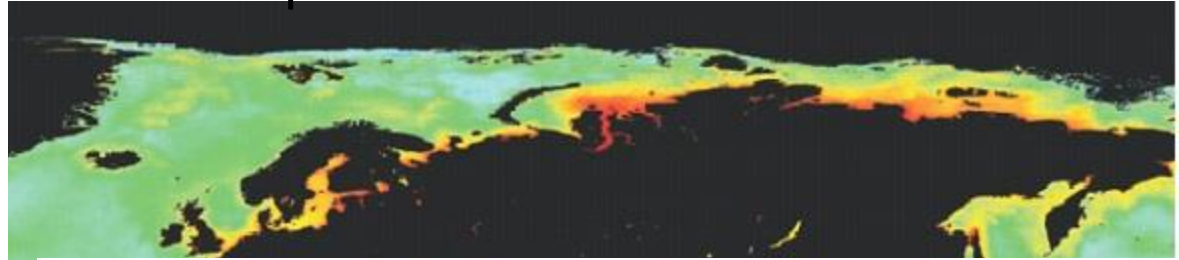
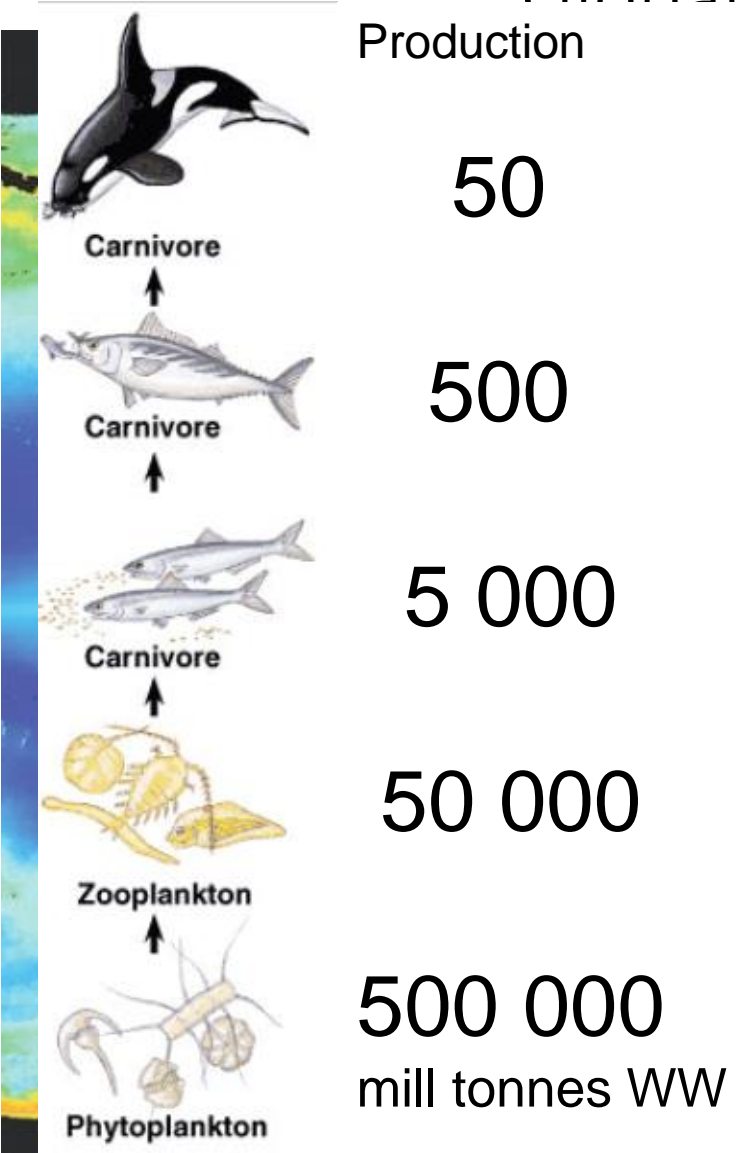


Norway should be up front in the green energy shift also due to

Ocean acidification and CC

- OA is a sneaking threat to marine ecosystem functioning, **directly linked to the use of fossil fuel**
 - Norway is the world's second largest exporter of fish and fish products
 - This is Norway's second largest export product (after fossil fuel) and by far the largest export product based on renewable resources
 - The risk of OA is uncertain due to the uncertainty of
 - the ecosystem's ability to adapt to OA and
 - the human's ability to adapt to changes in marine life
- Precautionary approach

Global marine production



Human population today

weight: 290 mill. tonnes

annual food consumption: 1800

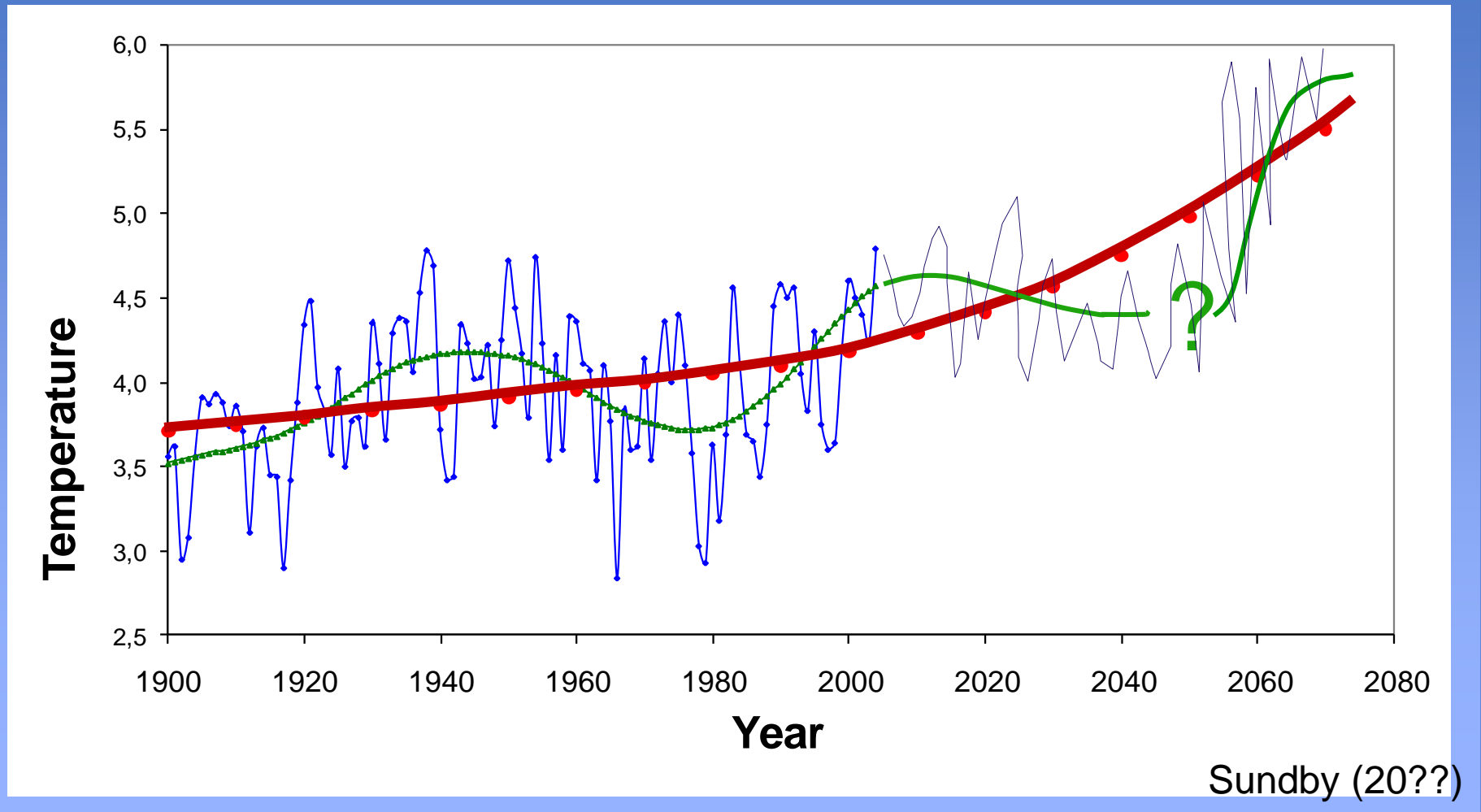
fisheries: 80



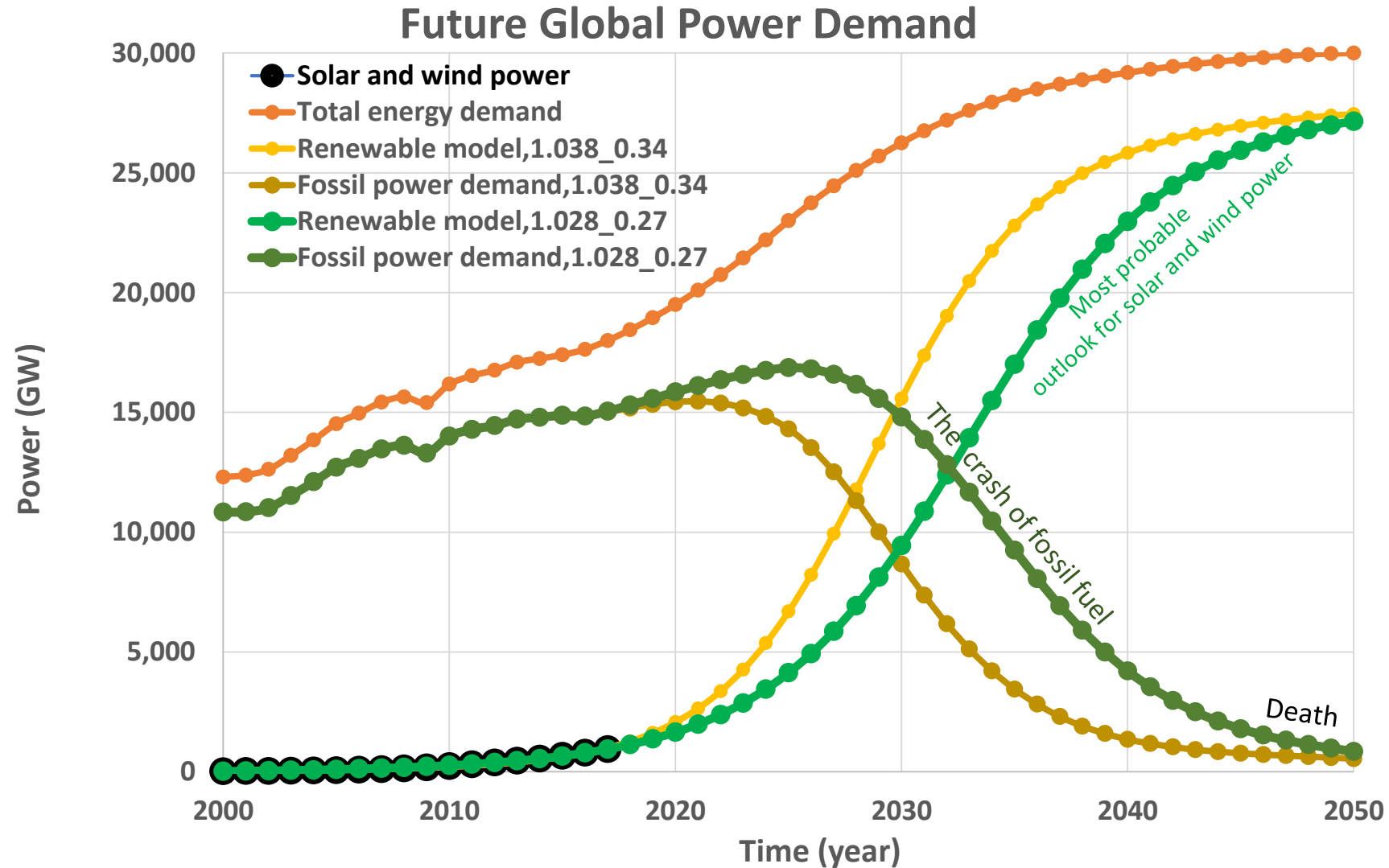
Dag Aksnes,



Observed ocean temperature for Atlantic water in the Barents Sea (PINRO and IMR) and prognoses for the 21. century (Furevik *et al.* 2003)



Conclusion: Predicted development of global solar and wind power supply and «death» of fossil fuel



*The most beautiful thing we
can experience
is the mysterious.
It is the source of all true art
and all science*

Albert Einstein