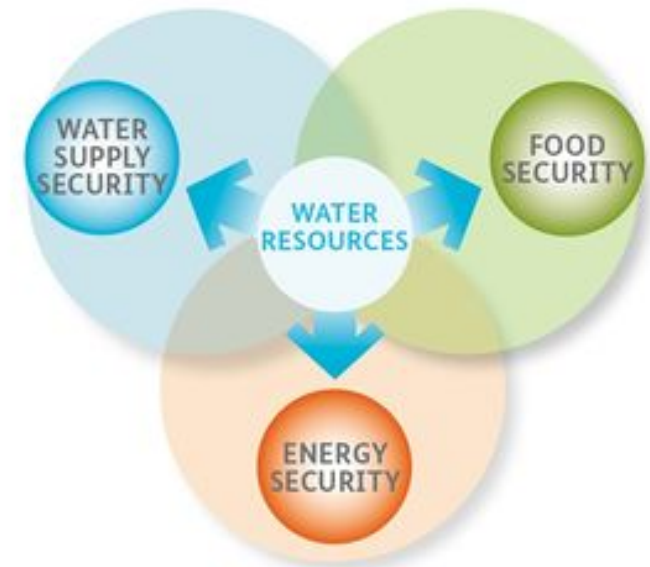


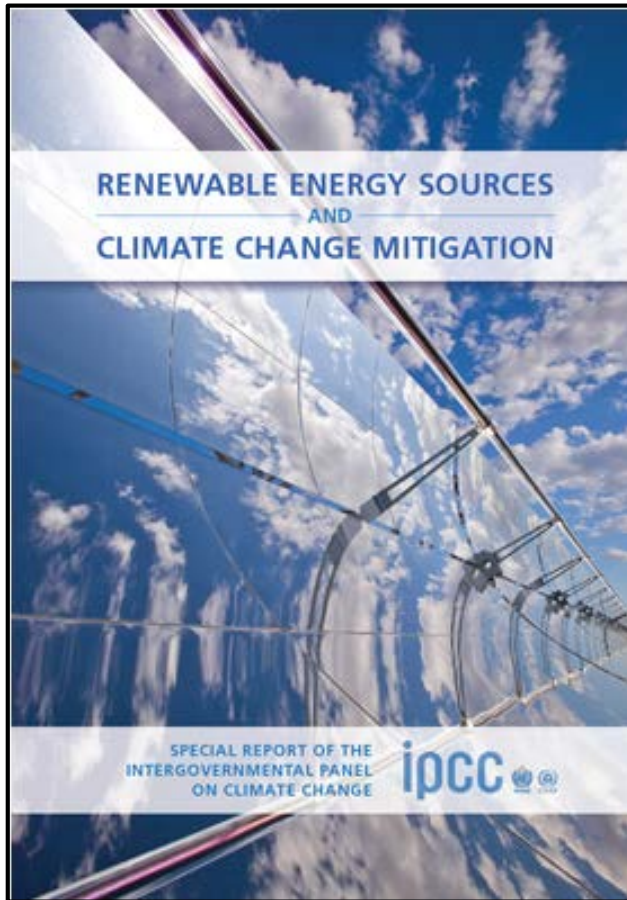
Vann og energi – konflikt eller løsninger?



Tor Haakon Bakken

NTNU / SINTEF Energi

IPCC (2011) – point of departure

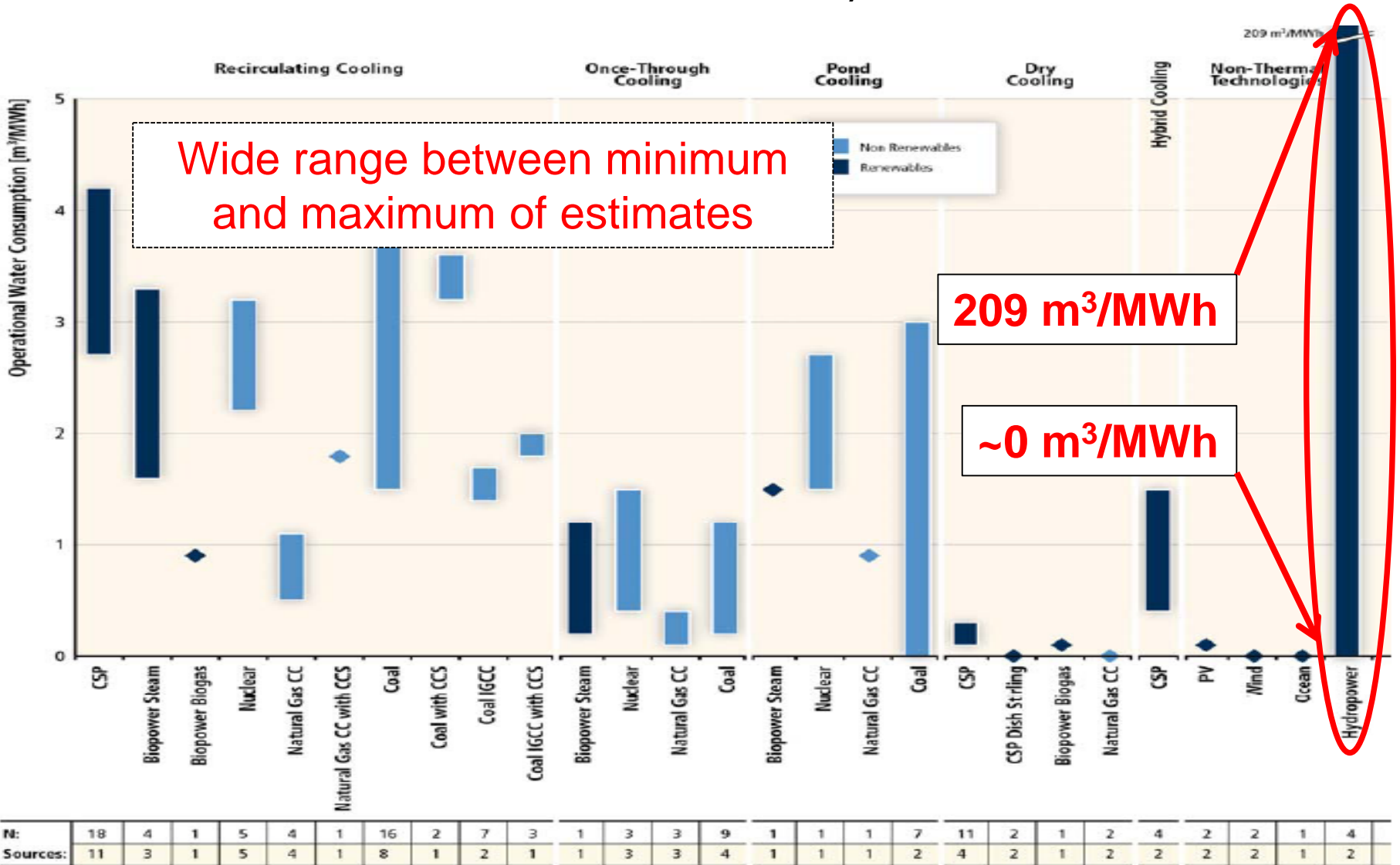


IPCC Special Report on Renewable Energy (2011):

- What is the potential for renewable sources to replace fossil-based fuels?
- The various technologies benchmarked with respect to various criteria, including 'water needed to produced 1 MWh electricity (*water consumption*)'

Water consumption from electricity generation:

Source: IPCC SRREN, 2011



Main concerns in the HP sector

Risk related to the view that 'hydropower is a large water consumer'

→ **reputational risk**

Water is in many cases 'lost', and reservoirs affect the availability of water for hydropower production as well as other use

→ **risk of investments/financial risks**

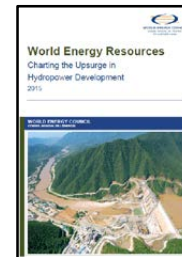
Status on water consumption assessments

- Methodology evaluated and improvements proposed
- Improved methodology seems to be gradually adopted
- Numbers still show a wide range of variation
- Norwegian hydropower (in Norway) consumes very little water

Science

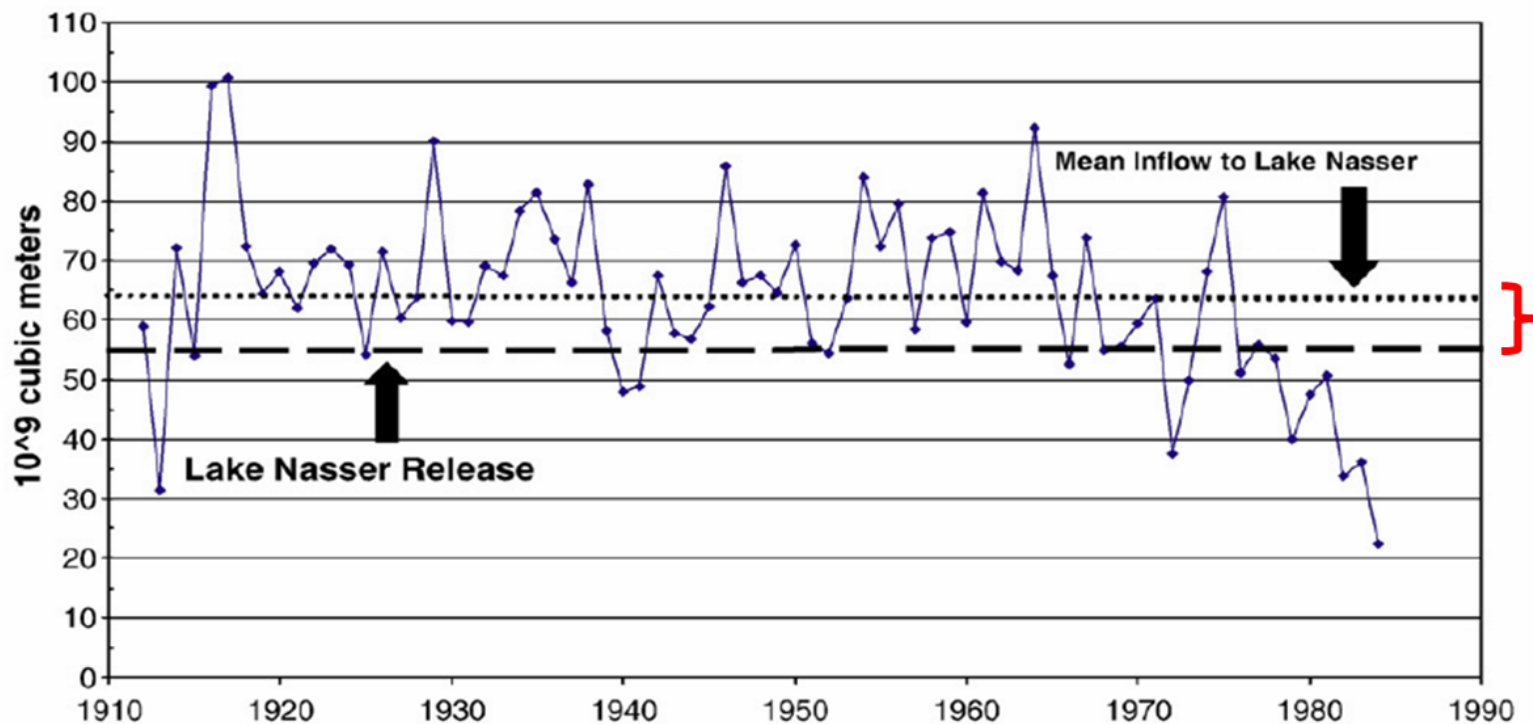


Policy



The trade-offs – Case Lake Nasser, Egypt

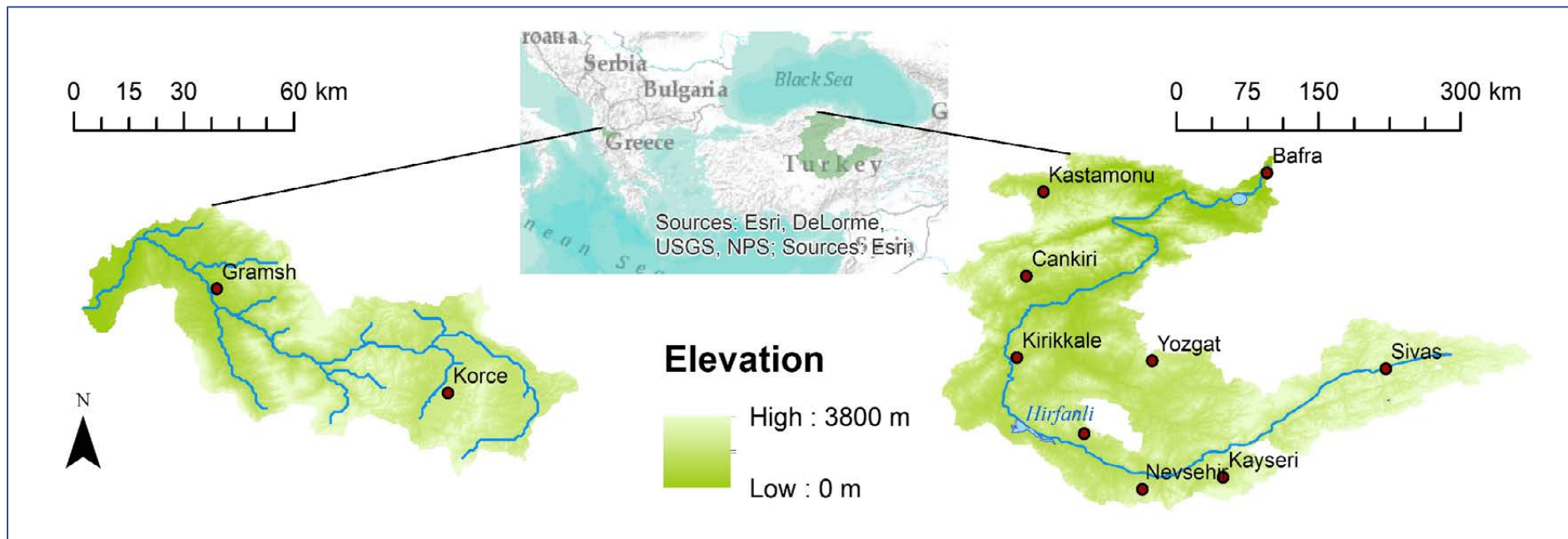
Trade-off: Increased availability versus reduced annual volumes



Evaporation

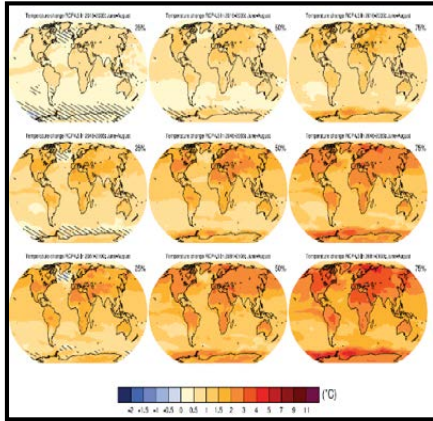
Source: Strzepek et al., 2008

Available water resources in semi-arid regions & the role of reservoirs

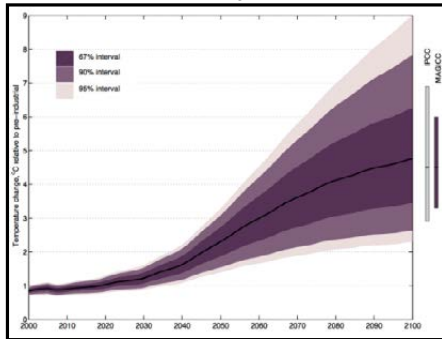


What is left for hydropower production?

Climate change



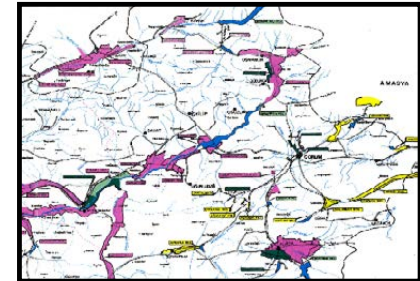
Uncertainty



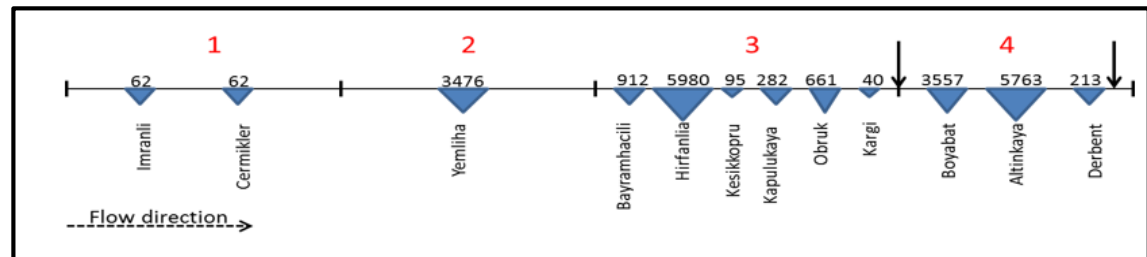
Policy



Plans for irrigation



Data on reservoirs



Findings from studies

- The availability of water resources can be very sensitive to climate change and irrigation withdrawals
- Upstream regulations might represent a risk to downstream power production, due to
 - Withdrawals enabled by regulated flow
 - Evaporative losses from reservoir surfaces
- The river basin are highly complex, and close inter-dependencies exist
- Reservoirs can create mutual benefits for several water users

Reflections on future hydropower development & planning



Hydrological risk must be assessed:

- climate change
- other water users
- changes in water use/priorities
- environmental flow/policies
- reservoir establishment upstream



Planning the water resources:

**A challenge with many and big
uncertainties**

**Robust Methodologies & Tools
needed**

Owens Lake,
California