CCS

- a new solution
or
- a new problem?

NOAH
Friends of the Earth Denmark

Klimaforum09
Copenhagen
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CCS

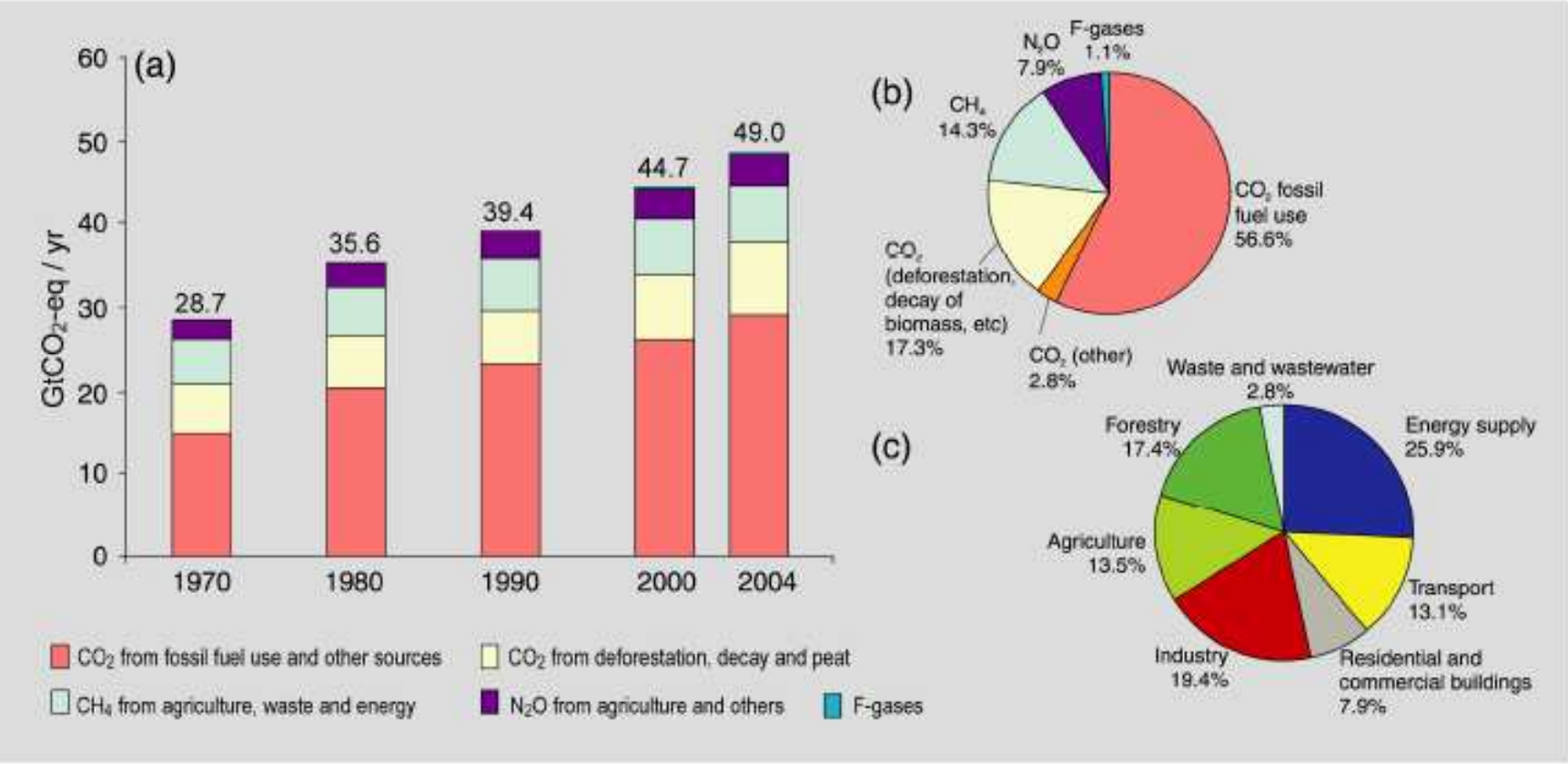
- Timing
- Climate
  - Energy efficiency
  - Mitigation potential
- Environmental effects
- Energy future
- Climate Justice

- Financing
- Economics
- CCS in CDM
- CCS in ETS
- Security
- Liability
- Public debate?

Conclusion

Timing

Global emissions



Meinshausen, 2009: Emission pathways to achieve a 2°C target

Bringing economics and energy-system analysis into the picture (IPCC WG3): "For the lowest mitigation scenario category assessed, emissions would need to peak by 2015".

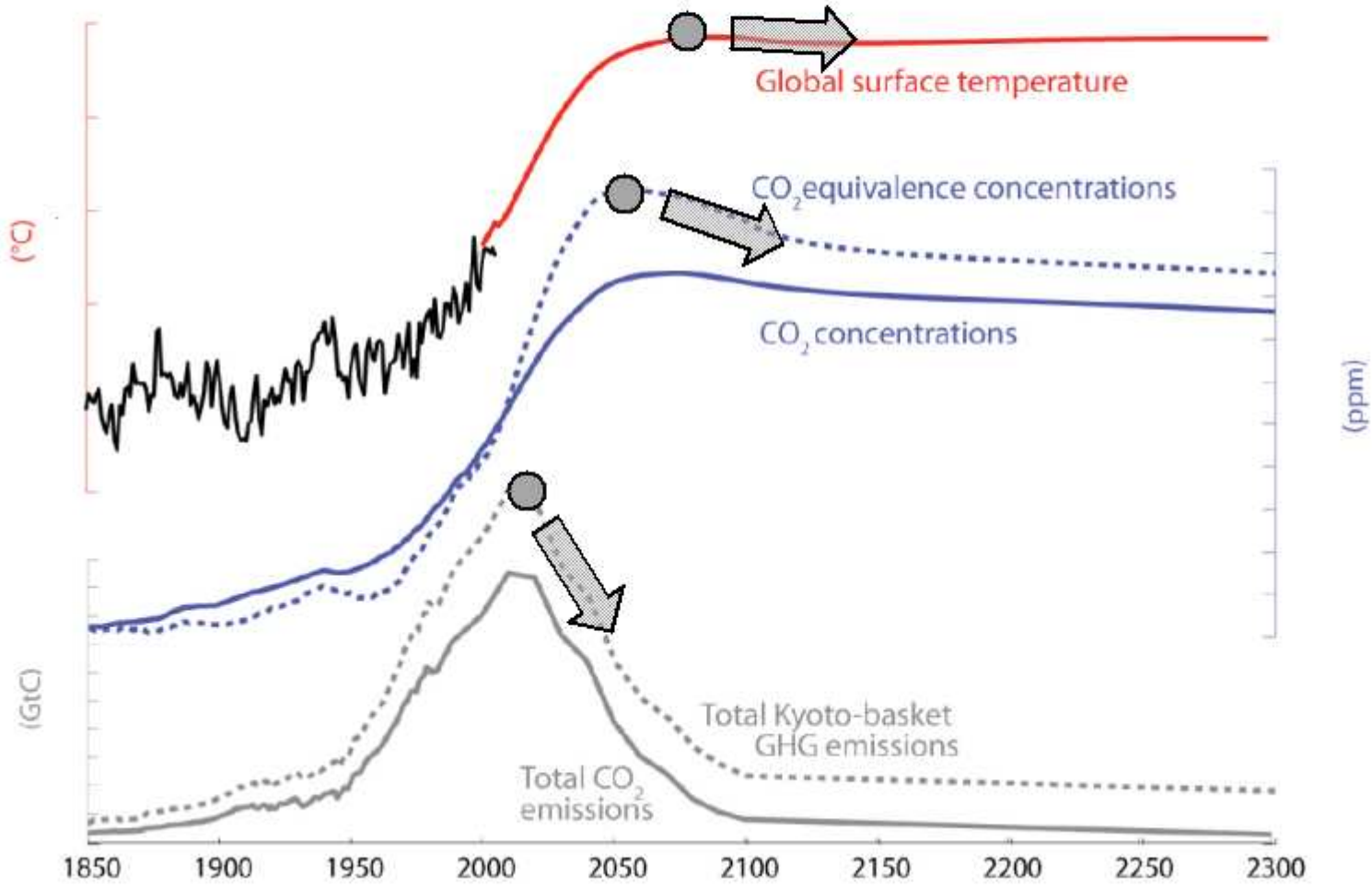
Table 3.1 – Stabilisation scenario classes and their 21st century characteristics adapted from IPCC AR4 WGIII SPM 5 and Fig.3.18. Emission scenarios within category I and the lower end of II are consistent with a 2°C target, if the probabilities of staying below 2°C shall be 50% or higher [9].

IPCC Category	CO_2 conc.	CO_2-eq conc.	Peaking year for CO_2 emissions	Year in which emissions decrease below 2000 levels	Cumulative CO_2 emissions 2000-2100	Change in global emissions in 2050 (% of 1990 emissions)[10]
WGIII Source	SPM.5	SPM.5	SPM.5	Fig. 3.19	Fig.3.18	SPM.5
	ppm	ppm	Year	Year	$GtCO_2$	%
I	350-400	445-490	2000-2015	2000-2030	800-1500	-83.5 to -40
II	400-440	490-535	2000-2020	2000-2040	1000-1800	-56 to -23

2°C paper, Tab 3.1, IPCC SYR SPM, Footnote 20

Meinshausen, 2009: Emission pathways to achieve a 2°C target

The problem of climate system inertia: If temperatures shall reach their maximum in 50 years, emissions need to peak "today".



2°C paper, Fig 3.3

Questions regarding timing

Emissions must peak no later than 2015

Will CCS be able to deliver in time?

What about the non-captured part?

Environment

Effects pertaining to increase in mining of coal and operation of CCS-plant

- Emissions of NOx, SOx, HC, VOC, particulates, heavy metals
- Increased use of energy and raw materials
- Impact on surface and groundwater

- **Destruction of villages, nature, habitats, landscapes,**
- Noise and aesthetic effects
- **Increased use of water**

Czech Republic:

81 villages and towns have disappeared since 1945

due to coal mining

Coal mining – open pit

Czech Republic

Coal mining – open pit

India

Coal mining –
MTR:
Mountain Top
Removal,

Appalaches and
Kentucky, US

"No vegetation survives MTR, so the land is deforested prior to mining operations and the resultant lumber is either sold or burned"

Environment - water

Figure A-1 - Percent of freshwater withdrawal by use category

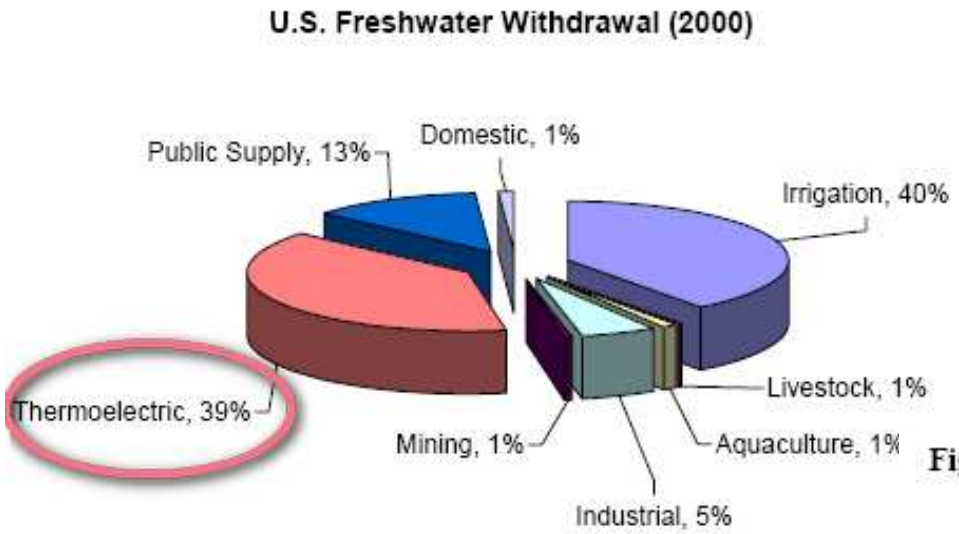
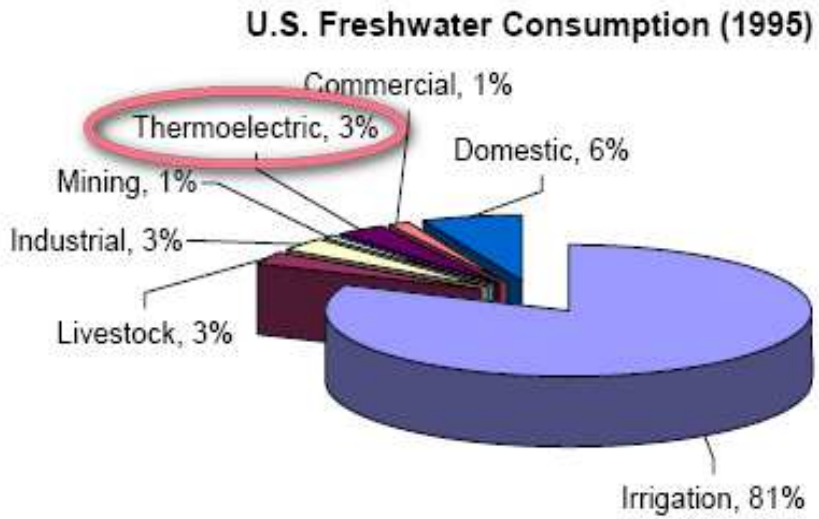


Figure A-2 - Percent of freshwater consumption by use category



Estimating Freshwater Needs to Meet Future Thermoelectric Generation Requirements, DOE/NETL

Increased use of water due to CCS

Table ES-1. Water consumption and cooling duty factors for thermoelectric power plants[i]

	Without CO_2 Capture	With CO_2 Capture	% Change With CO_2 Capture
*Water Consumption Factors (gallons per MWh net power)**			
Nuclear	720	--	
Subcritical PC	520	990	+90%
Supercritical PC	450	840	+90%
IGCC, slurry-fed	310	450	+50%
NGCC	190	340	+80%
Cooling Duty Factors (MMBtu per MWh net power)			
Subcritical PC	4.7	11	+130%
Supercritical PC	4.1	9.3	+130%
IGCC, slurry-fed	3.0	3.7	+20%
NGCC	2.0	4.2	+110%

** Based on a cooling water system utilizing wet recirculating cooling towers*

Source: Water Requirements for Existing and Emerging Thermoelectric Plant Technologies DOE/NETL-402/080108

Environment

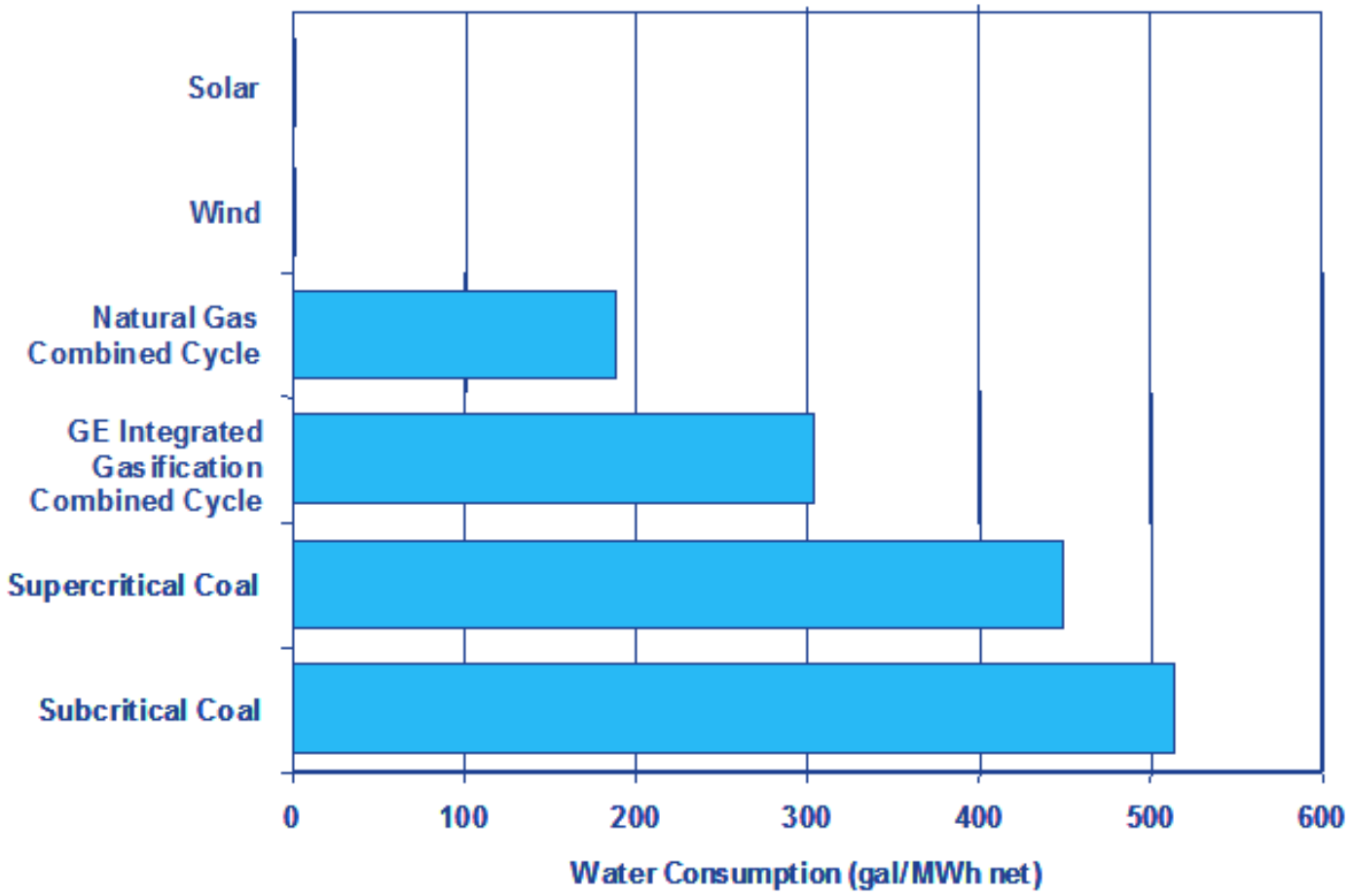
Increased use of water

Growing concerns about freshwater availability must be reconciled with growing demand for power if the United States is to maintain economic growth and current standards of living.

Source: Water Requirements for Existing and Emerging Thermoelectric Plant Technologies DOE/NETL-402/080108

Increased use of water due to CCS

Power plant water consumption



Sources: USGS, Estimated Use of Water in the United States in 2000, USGS Circular 1268, March 2004
USGS, Estimated Use of Water in the United States in 1995, USGS Circular 1200, 1998

Vestas expects that the installed wind power capacity on average will experience an annual growth rate of about 20 per cent in the coming ten years mainly due to the fact that wind power neither uses water nor emit CO2 when generating electricity. At the same time, modern energy creates local jobs and reduces the dependence on fossil fuels which is often imported. Vestas expects that wind power will account for at least 10 per cent of the world's electricity consumption by 2020.

http://www.vestas.com/files//Filer/EN/Investor/Company_announcements/2009/090211-CA_UK-04.pdf

Equity and sustainability

Environmental space – dematerialization Factor 10

Demand side

- Energy savings
- Energy efficiency
- Recycling cradle-to-cradle
- Less meat
- Stop deforestation

Supply side

- Renewables
  - Wind
  - Solar PV
  - Solar heat
  - Solar CSP
  - Wave
  - Hydro (existing)

Equity and sustainability

Environmental space

Sequestration in soil

Reform of land-use

Reform of agriculture

Afforestation

1. Avoid runaway climate change
   - max. 2°C increase in global av. temp.
   - apply the cautionary principle

2. "Common but differentiated responsibilities and respective capabilities" (UNFCCC)
   → climate justice

CCS

– a technical fix for a flawed development

- **Timing** ... too late
- **Climate**
  - Energy efficiency ... too poor
  - Mitigation potential ... too small
- **Environmental effects** ... too big
- **Energy future** ... lock-in centralised system - unsustainable - coal
- **Climate Justice** ... does not deliver

CCS

– a technical fix for a flawed development

- Financing ... not without public money
- Economics... unsustainable
- CCS in CDM ... destructive, no offsetting
- CCS in ETS ...
- Security ... risks
- Liability ... hit-and-run
- Public debate?.... belated if at all

Conclusion