

From Desertec to the Present Stage of the Energy Transition

- **Desertec 2008**
- **Dii Desert Energy GmbH**
- **Desertec today**
- **HECAP paper**
- **Climate emergency**

DESERTEC: „Apollo-Project of the 21st century“

DLR/TREC 2003 (Franz Trieb)

Power production @ most viable places:

Solar power in DESERTS

Wind power at coast lines and offshore

Power storage:

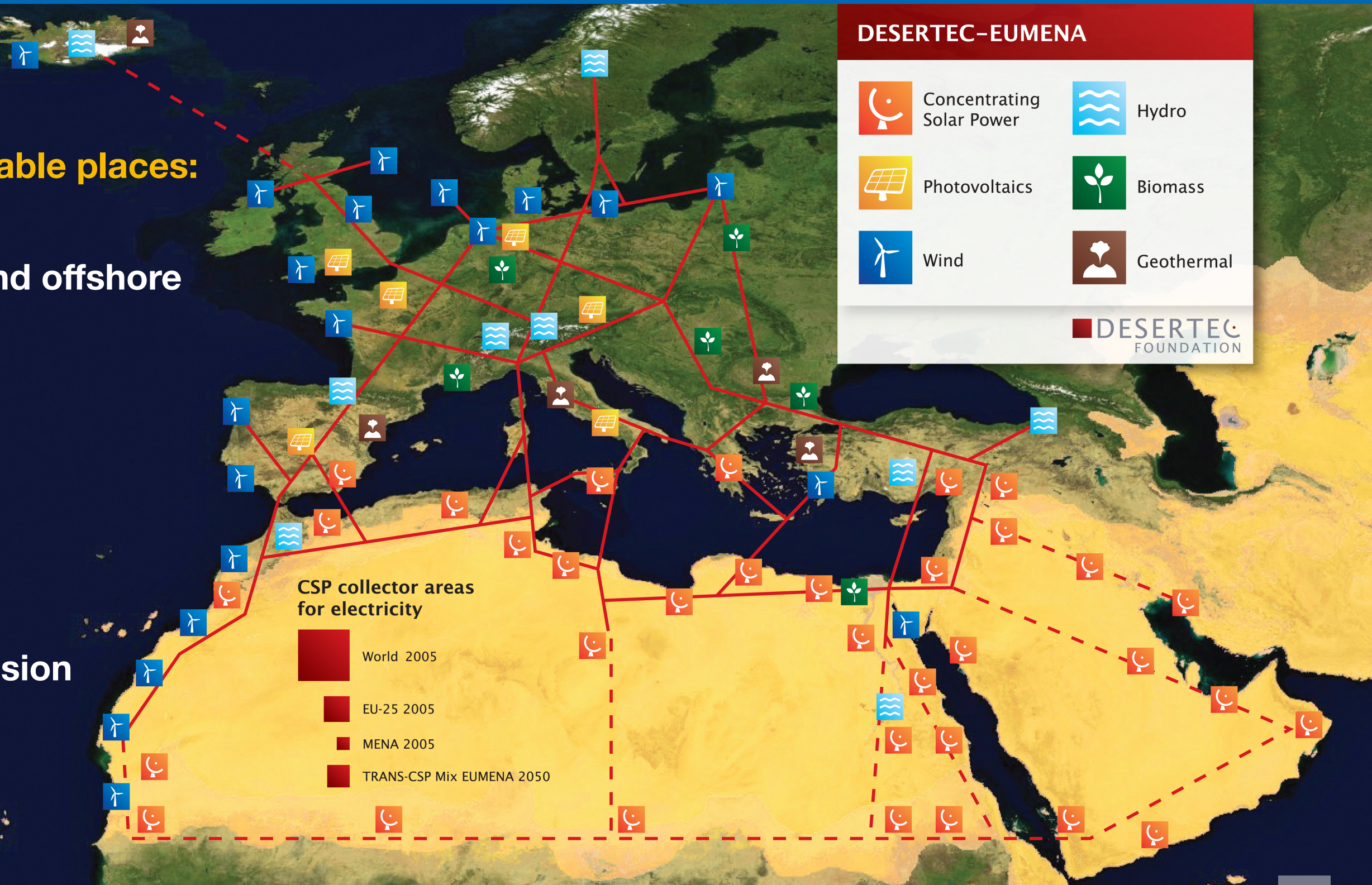
**Use CSP + heat storage
for solar power at night**

Power transport:

Use HVDC lines for transmission

Win-win cooperation

between Europe and Africa



DESERTEC idea

© DIE ZEIT, 08.03.2007 Nr. 11 „Die Welt ist noch zu retten“

... Durch Nutzung von nur 0,3 Prozent der dort vorhandenen Wüstengebiete könnte genug CO₂-freier Strom für den steigenden Bedarf der Region und für Europa erzeugt werden, belegen Studien.

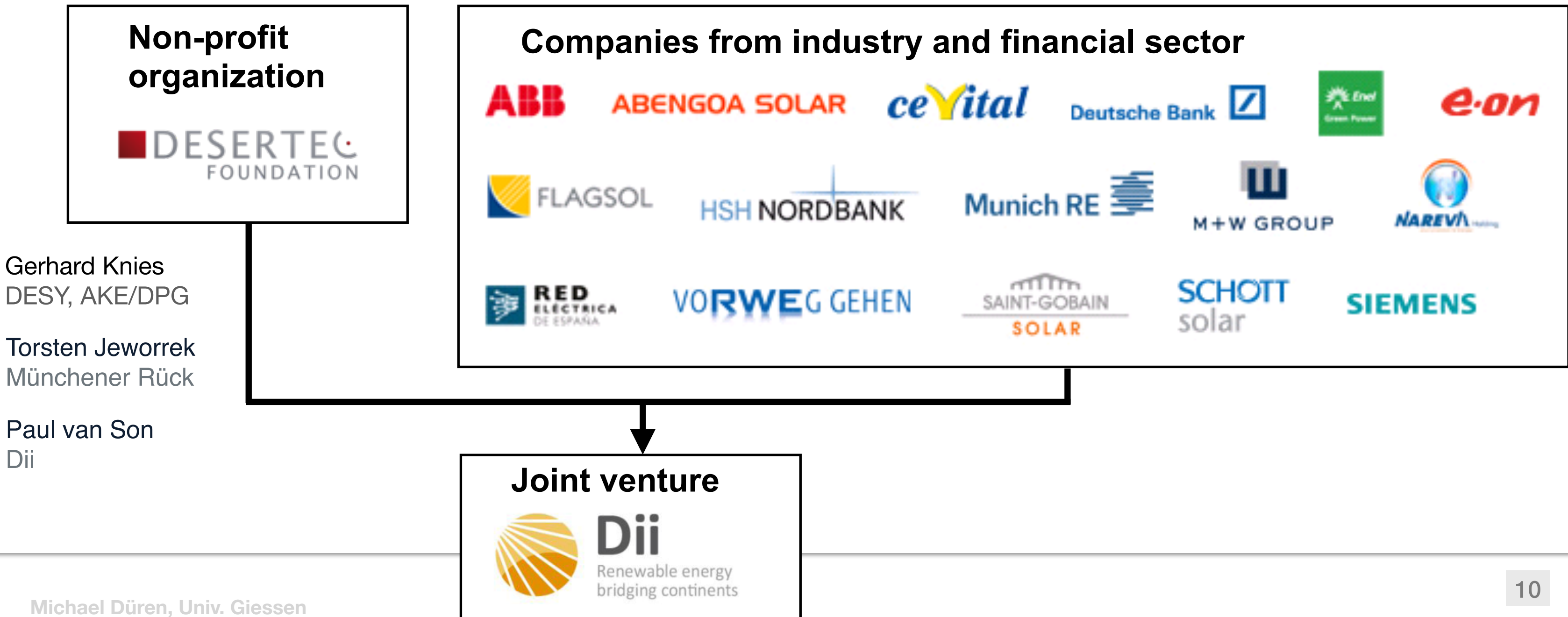
„Ein Mix aus Ignoranz und Böswilligkeit« verhindere bisher, dass Politik und Wirtschaft sich mit der Idee ernsthaft beschäftigten“

klagt Uwe Möller, **Generalsekretär des Club of Rome.** ...

- **Germany and other western countries were leading in solar, wind and HVDC technology**
- **Investors were looking for long-term investments**
- **North Africa needed foreign currency and jobs for the young generation**

DESERTEC idea: 2009

Desertec Industrial Initiative Dii GmbH 1+16 voting shareholders



DESERTEC idea: 2009

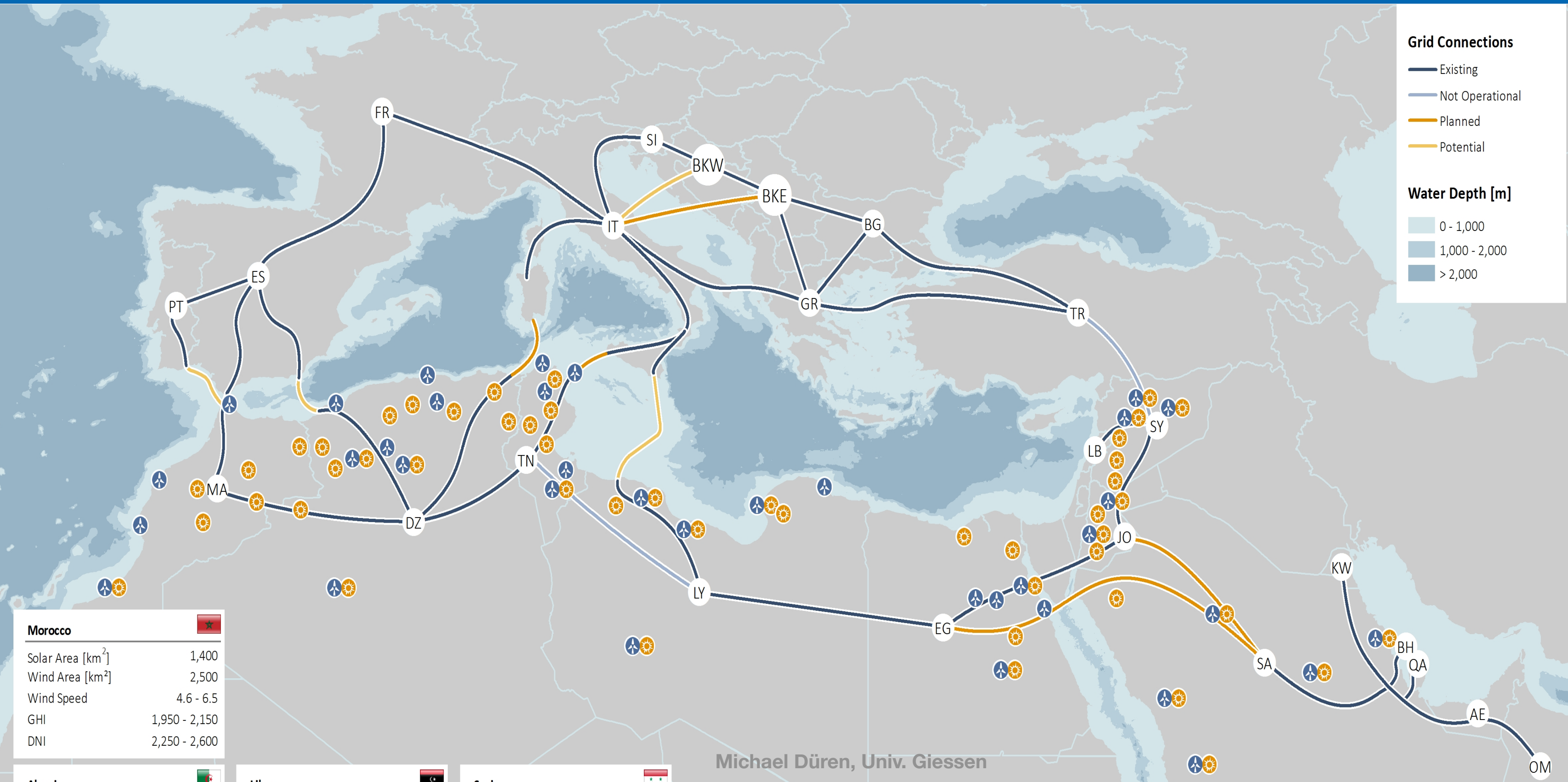
„Das Desertec-Konzept ist eine faszinierende Vision. Wir werden die RWE-Energie-Kompetenz einbringen und gemeinsam mit unseren Partnern untersuchen, wie und wann das Konzept Realität werden kann.“

Frank-Detlef Drake, RWE AG Leiter Forschung und Entwicklung

RWE / EON / Innogy / ...

- **Fascinating vision**
- **Check when it can be realized**

Dii getting started 2009: „Option for 2020“



DESERTEC idea: 2011 - China understood!

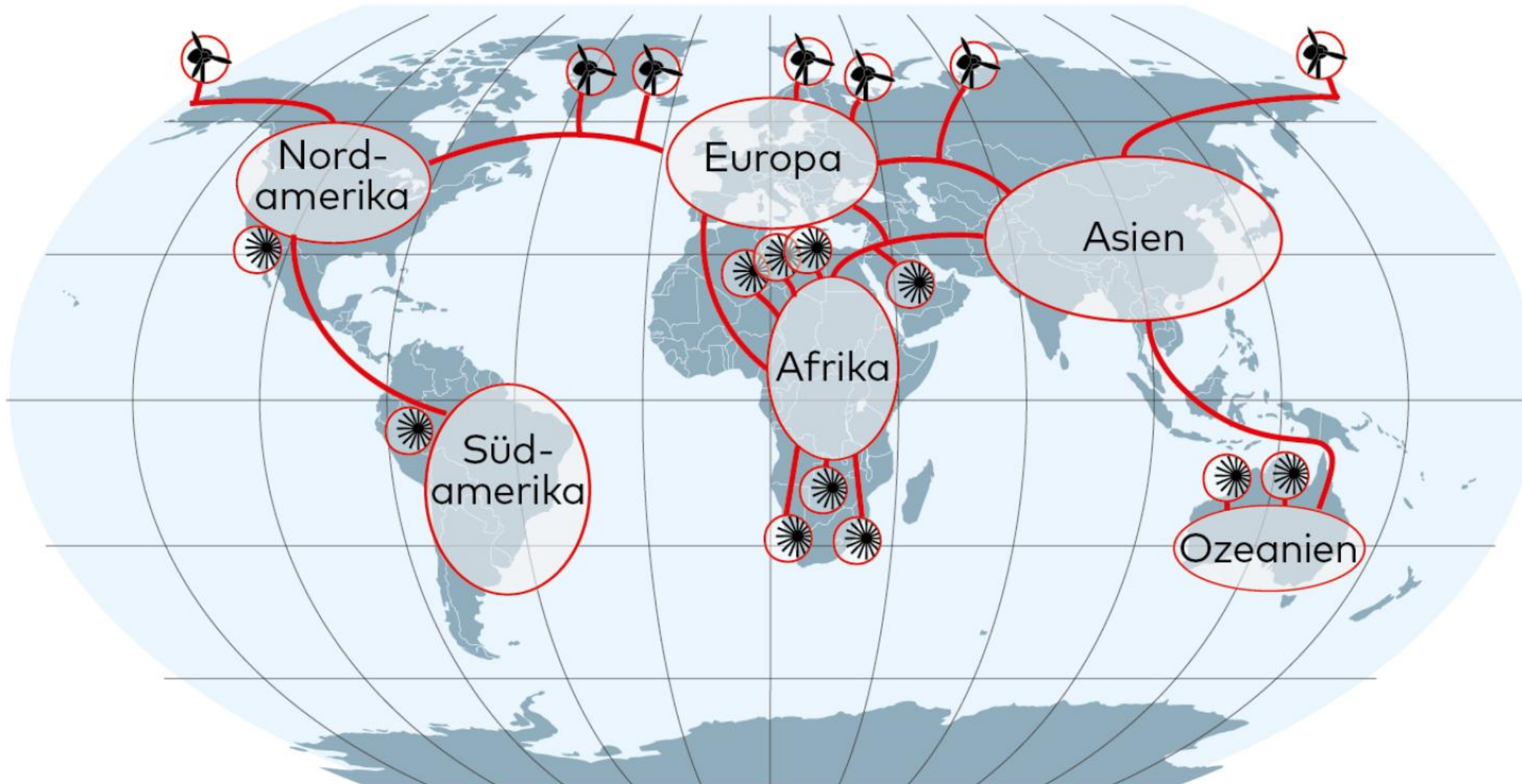


2011/09/26

State Development and Investment Corporation (SDIC) pilot company in state-owned assets management



DESERTEC idea: World Wide Resonance



1. Regional grids (<2020)*
2. Renewables (<2030)
3. Intercontinental grids (<2050)

Compare Sputnik crisis 1957

Quelle: Global Energy Interconnection

WELT

DESERTEC idea: World Wide Resonance

2012

Desertec Ambitions Turn to Asia, Australia

The ambitious Desertec project—a \$9 billion initiative to develop, harness, and transmit 2,000 MW of renewable power from North Africa and the Middle East to Europe by 2050—has been trumped by a vaster concept that spans Asia and Australia (Figure 8).



- Grid (new)
- Grid (existing)
- Natural gas (existing)
- Natural gas (new)
- Fiber optic (existing)
- Fiber optic (new)
- High solar radiation

DESERTEC idea: 9 years later

© SPIEGEL Wissenschaft 25.03.2018 „Was wurde aus Desertec?“

"Die Konzerne wollten in Europa keine Konkurrenz für den Atom- und Kohlestrom. Deshalb haben sie das Konzept von Desertec infrage gestellt",

erklärt Frithjof Finkbeiner, Aufsichtsratsvorsitzender der Desertec-Stiftung

European companies did not want to question their traditional business model (coal + nuclear)

Geopolitics:

- **European debt crisis 2009**
- **Arab spring 2011**

DESERTEC and Dii: the end?

2012 most companies left Dii

2013 DESERTEC foundation split-up with Dii

Remaining:

Dii: RWE (Paul van Son), China, Saudi Arabia



2015 DESERTEC foundation: Chairman of the Board of Trustees: Roland Berger



DESERTEC idea: PV in deserts



Benban, Ägypten Leistung: 1650 MW

Benban, Egypt 1650 MW

DESERTEC idea: power tower in deserts



Atacama desert/Chile 210 MW, 16 h heat storage, power day and night

DESERTEC idea: CSP+PV combination in deserts



Dubai, UAE: 700 MW (solar thermal) + 200 MW (PV)

DESERTEC idea: wind in deserts

Gobi desert, China: Wind power
Plan: additional 450 GW renewables mainly in deserts



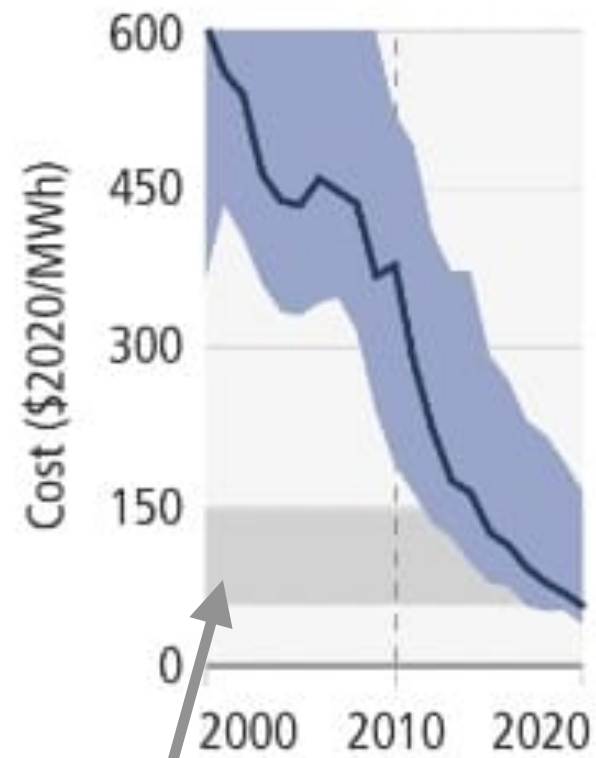
DESERTEC idea: HVDC connections

HVDC power line, 3300 km, 12 GW



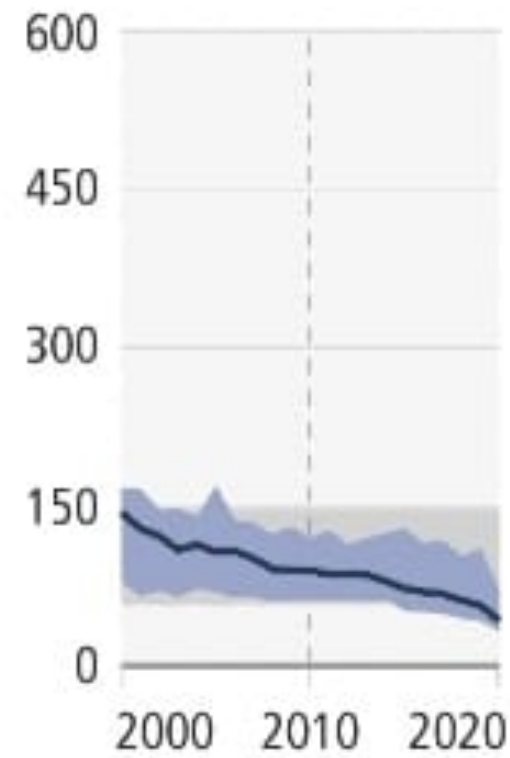
Cost reduction

PV

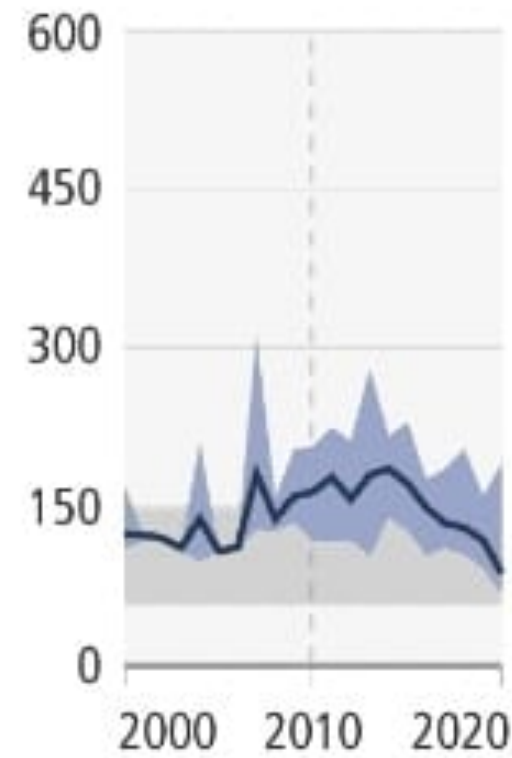


Fossil power

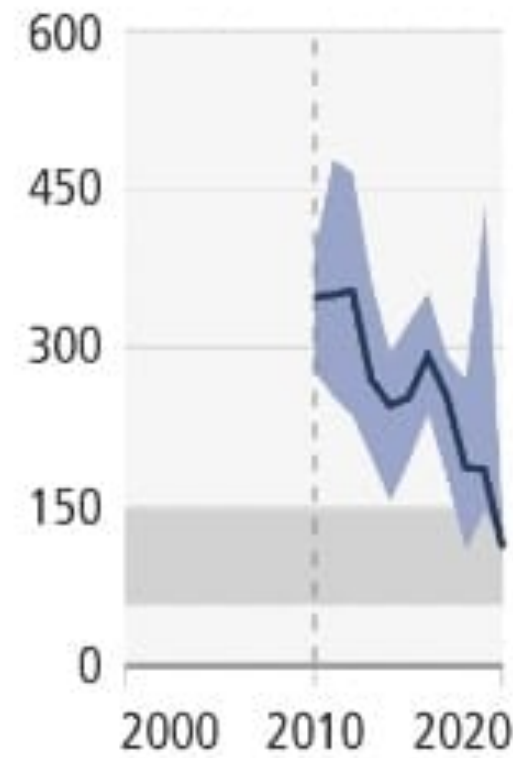
Wind/onshore



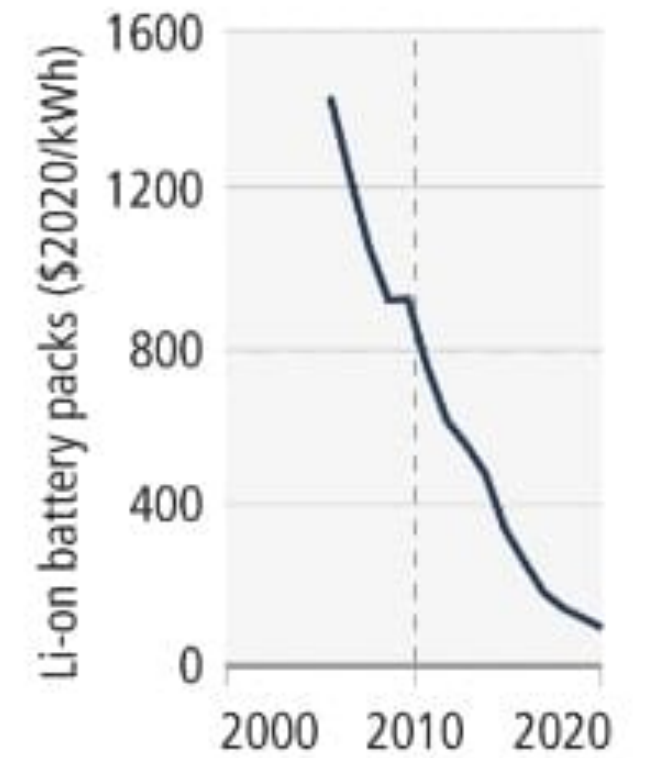
Wind/offshore



CSP (solar thermal)

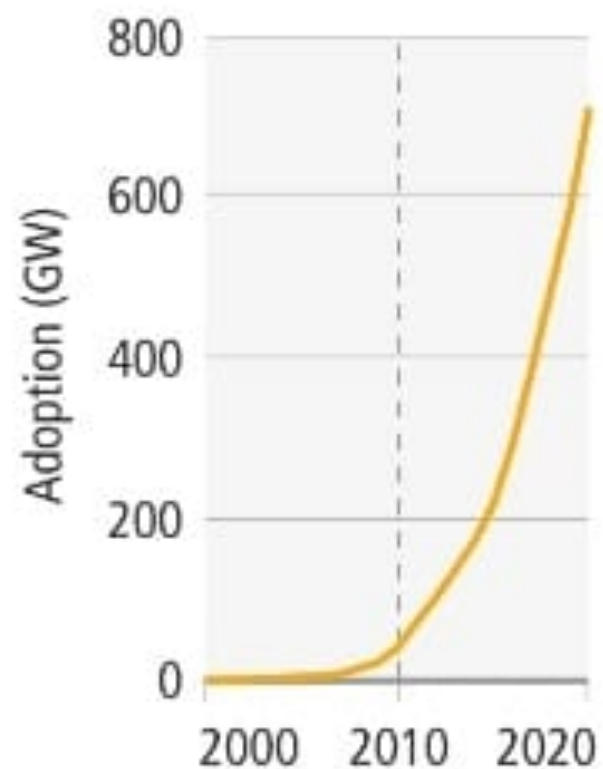


EV (batteries)



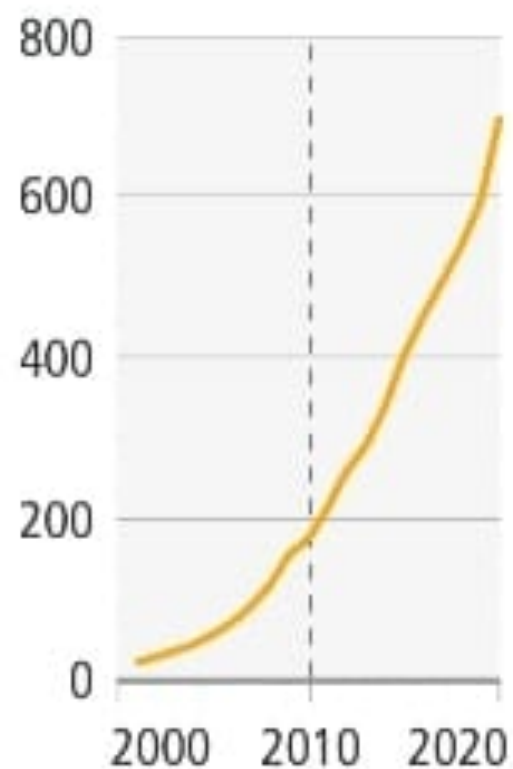
Renewables: exponential growth

PV



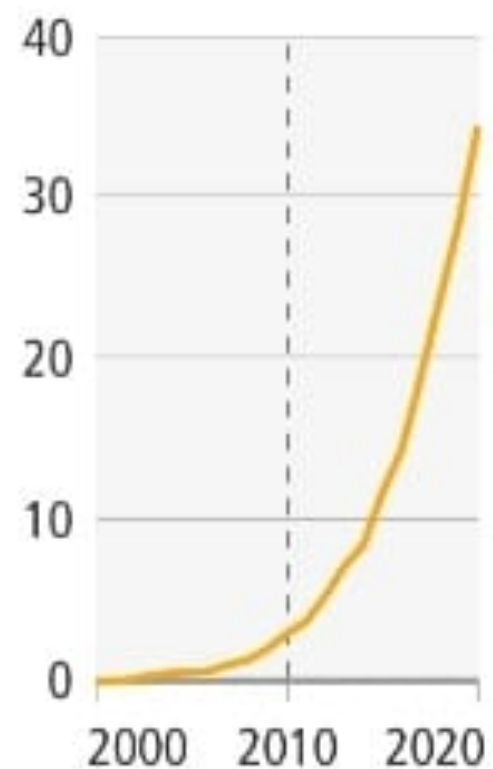
Share of electricity produced in 2020: 3%

Wind/onshore



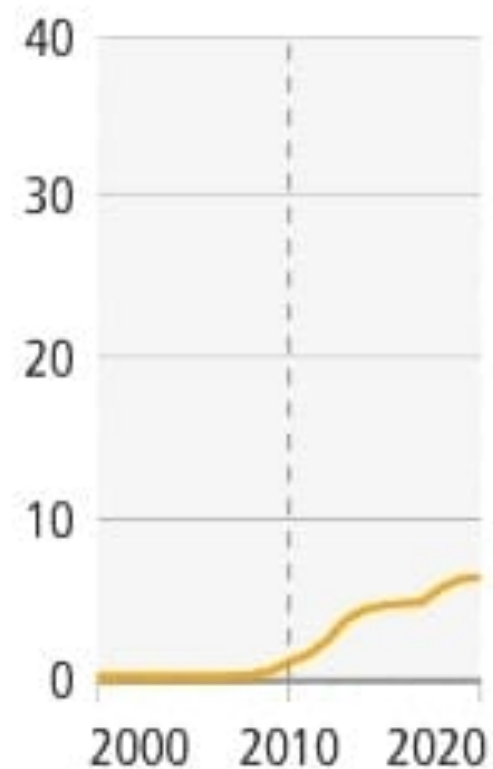
Share of electricity produced in 2020: 6%

Wind/offshore



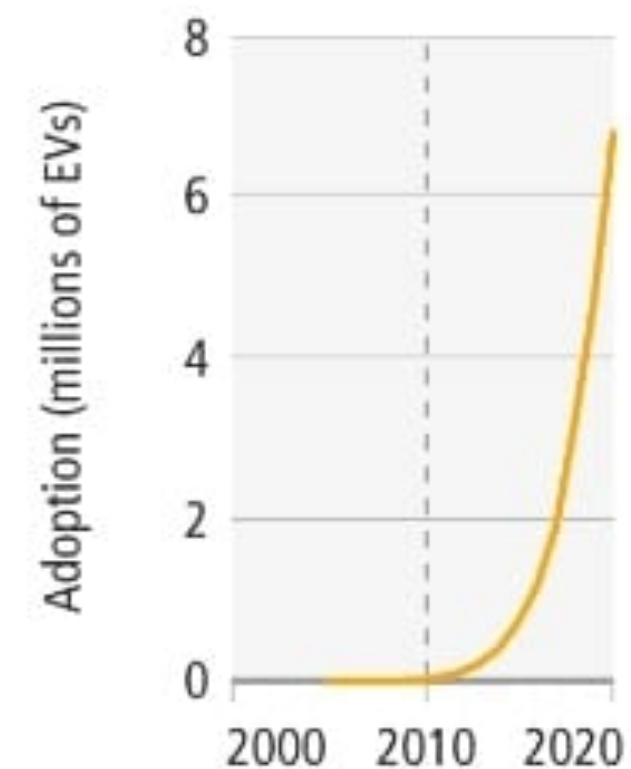
Share of electricity produced in 2020: <1%

CSP (solar thermal)



Share of electricity produced in 2020: <1%

EV (batteries)



Share of passenger vehicle fleet in 2020: 1%



Dii Desert Energy today:

4 strategic partners +131 lead-, associated-, and cooperative Partners



thyssenkrupp

Saudi Arabia

Saudi Arabia

China

Germany?

ex Flabeg (solar)
(Germany)

NEOM
500 G\$

1.5 Mio. employees
revenue >300 G\$/y

„NEOM Green
Hydrogen Company“
Green Ammonia
for Saudi Arabia
5 G\$

Dii today: local power and green hydrogen for export



Habeck-Reise nach Abu Dhabi

Wasserstoff-Kooperation mit den Emiraten

Stand: 21.03.2022 13:51 Uhr

Wirtschaftsminister Habeck hat die Zusammenarbeit bei Forschung und Produktion von Wasserstoff mit den Vereinigten Arabischen Emiraten verkündet. Langfristig sollen fossile Energien ersetzt werden. Auch mit Katar gibt es Kooperationen.



Dii

Renewable energy
bridging continents



Paul van Son
Robert Habeck
Abu Dhabi 2022

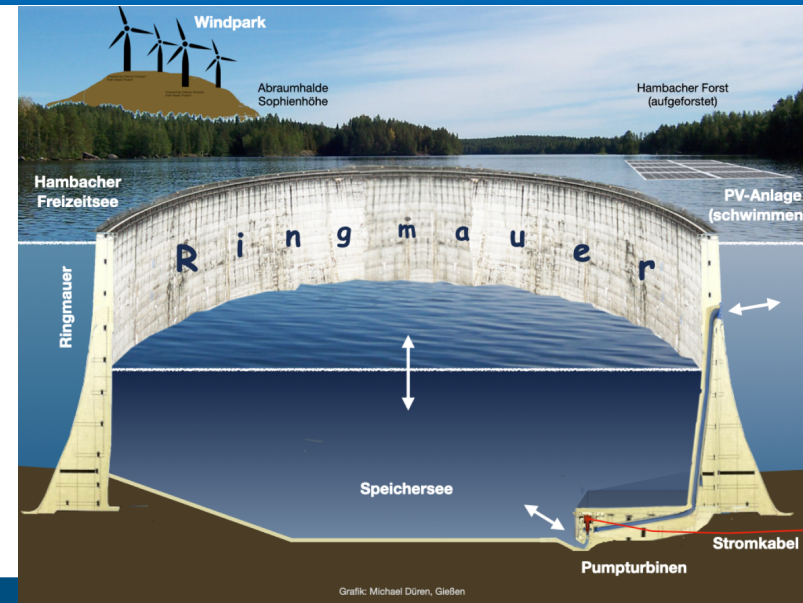
Comparison: Electricity vs. Hydrogen

Case study: Renewables for basic research (Thesis Johannes Hampp, Giessen)
Base load power North Africa to Geneva (CERN)

	Cable	Hydrogen
Idea	Desertec power from deserts	Dii green molecules
Energy source	PV, wind, CSP in North Africa	
Conversion	inverter	electrolyser, gas turbines
Transport	HVDC	pipeline
Storage	thermal, liquid salt	H ₂ tank
Costs	7 ct/kWh	17.5 ct/kWh
Advantage	lower cost for consumers	higher profit for producers
Market	competition with local production	empty global market

Comparison: with / without storage

(for Gerhard L.
& Horst S.-B.)



With storage

Without storage

Fluctuation

Small

Large

Electricity Costs

Low + stable

High spikes

Advantage

lower cost for consumers

higher profit for producers

Market

**No business case for storage
due to tariffs**

**Coal and nuclear have
advantages**

HVDC Connector Tunesien - Italy (Sicilia)

entsoe European Network of Transmission System Operators for Electricity

EU Project history:

TYNDP
2012

TYNDP
2014

TYNDP
2016

TYNDP
2018

TYNDP
2020

TYNDP
2022

200 km 400 kV 600 MW

600 M€

Funding EBRD, EU Grant, KfW

Application deadline: June 30, 2023

Commissioning 2028



Paper: Environmental sustainability in basic research

Environmental sustainability in basic research

A perspective from HECAP+

Abstract

The climate crisis and the degradation of the world's ecosystems require humanity to take immediate action. The international scientific community has a responsibility to limit the negative environmental impacts of basic research. The **HECAP+ communities (High Energy Physics, Cosmology, Astroparticle Physics, and Hadron and Nuclear Physics)** make use of common and similar experimental infrastructure, such as accelerators and observatories, and rely similarly on the processing of big data. Our communities therefore face similar challenges to improving the sustainability of our research. This document aims to reflect on the environmental impacts of our work practices and research infrastructure, to highlight best practice, to make recommendations for positive changes, and to identify the opportunities and challenges that such changes present for wider aspects of social responsibility.

Version 1.0, 5 June 2023

Please read this document in electronic format where possible and refrain from printing it unless absolutely necessary. Thank you.

arXiv:2306.02837v1 [physics.soc-ph] 5 Jun 2023

A perspective from HECAP+

(High Energy Physics, Cosmology, Astroparticle Physics, plus Hadron and Nuclear Physics)



Figure 3.4: Potential CERN-LINK cable (in blue) connecting North African solar power plants with the European electricity grid. Also shown are existing power lines (purple, red, dashed blue), gas and oil pipelines (green/yellow) and PV plants (yellow/red dots). Base map taken from Ref. [104], reused and annotated under the terms of the [Creative Commons Attribution 4.0 International \(CC BY 4.0\) license](#).

Paper: Environmental sustainability in basic research

155 pages

June 5, 2023

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Chapters

- Computing
- Energy
- Food
- Mobility
- Research Infrastructure and Technology
- Resources and Waste

<https://sustainable-hecap.github.io>

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Examples:



Individual actions:

- Consider the environmental impact of work practices.



Further group actions:

- Include critical assessment of the environmental impact of all activities during planning stages.

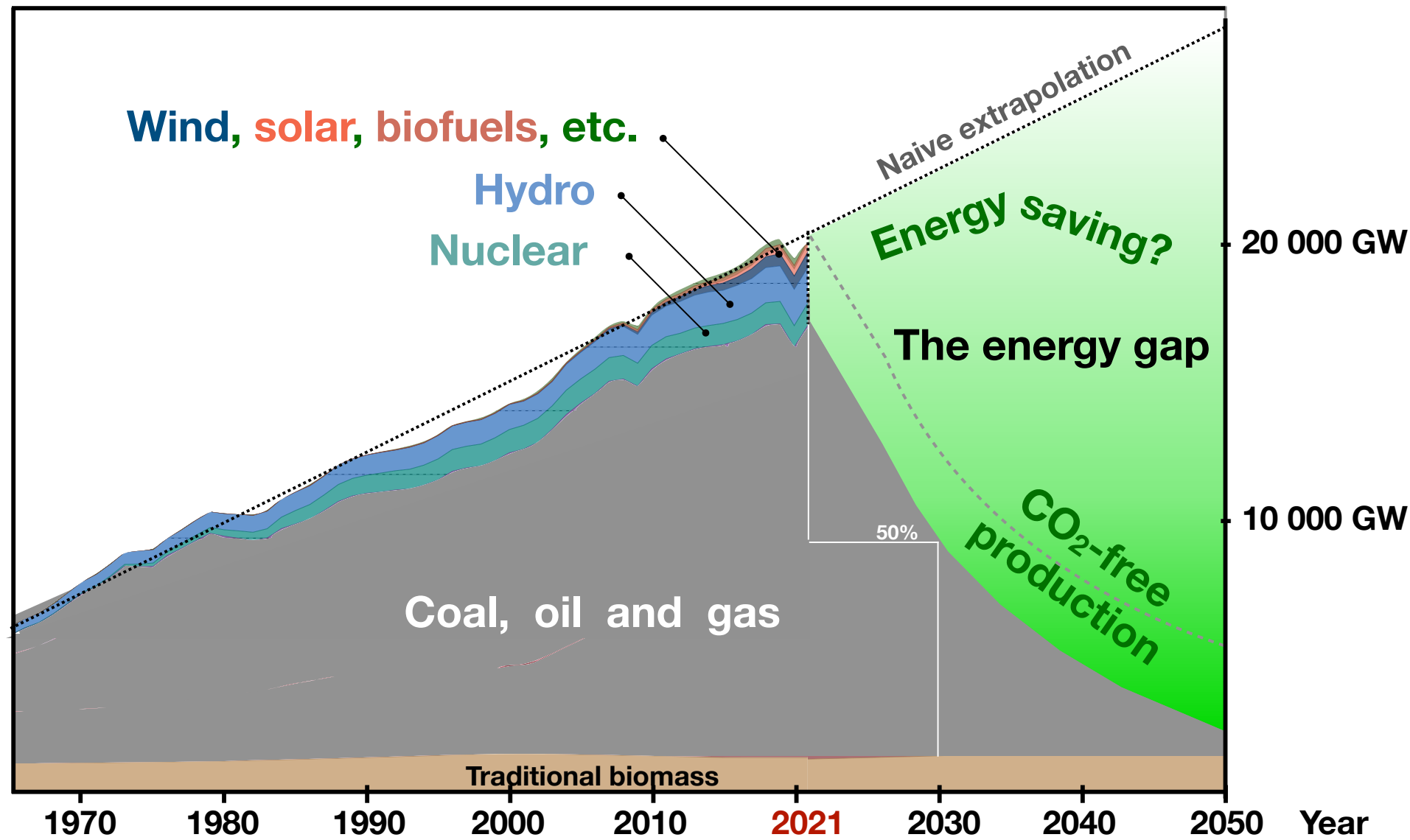


Further institutional actions:

- Require funding applications to outline plans for monitoring, reporting and minimising adverse environmental impacts, and for ensuring that research is undertaken in line with principles of social justice.

CO₂ emissions trigger tipping points (irreversible)

Global primary energy consumption per second



Sources: energy demand: Our World in Data based on Vaclav Emil (2017) and BP Statistical Review of World Energy / CO₂-saving requirement from IPCC; Graphics: M. Düren

Scenario:

50% CO₂ reduction will not be done in 7 y
(strict energy saving would be required)

- ↪ Tipping points will enforce climate change
- ↪ Agriculture will fail to feed the world
- ↪ Hunger, migration, wars of >10% of population (Billions)
- ↪ Escalation of wars and pandemics
- ↪ Cascades of tipping points
- ↪ Our children will have a life in despair

Required reduction: 50% in ~7 years

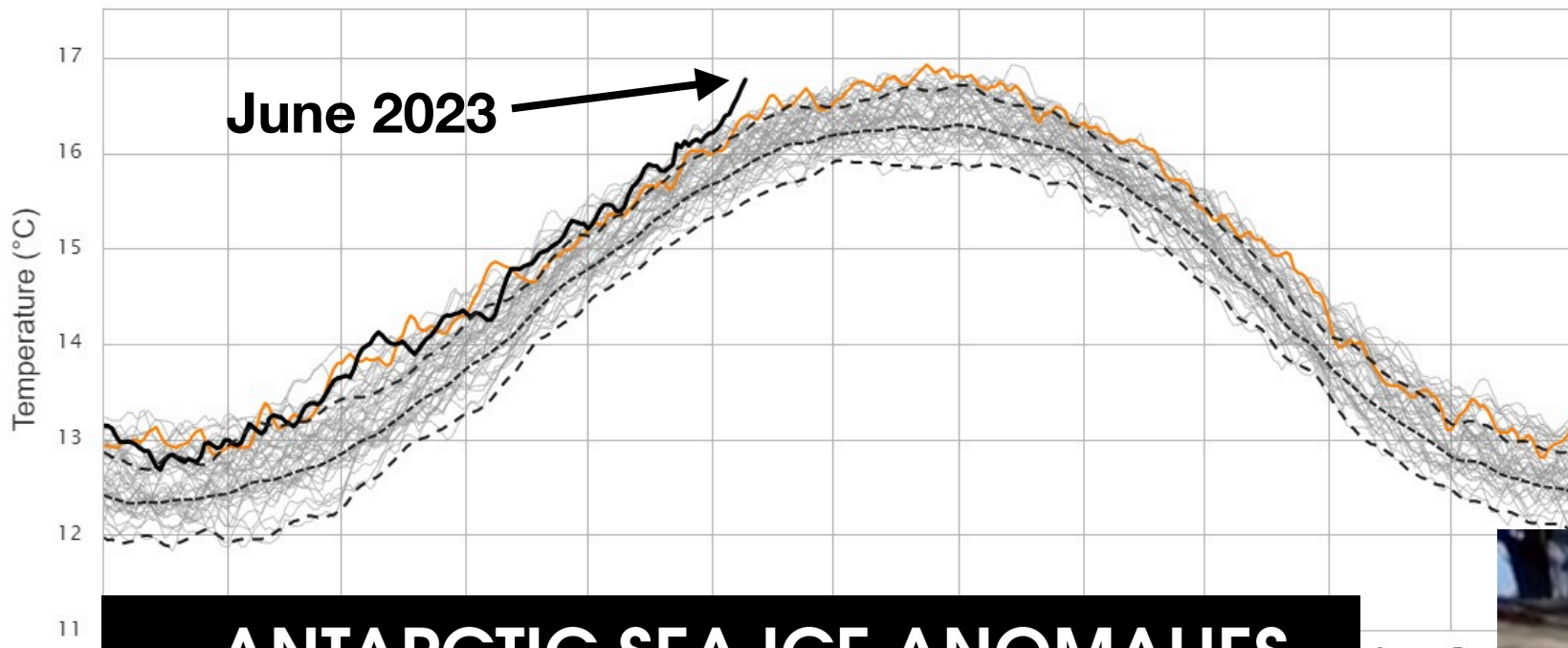
Prediction with confidence level = x

A few degrees make the difference

Michael Düren, Univ. Giessen

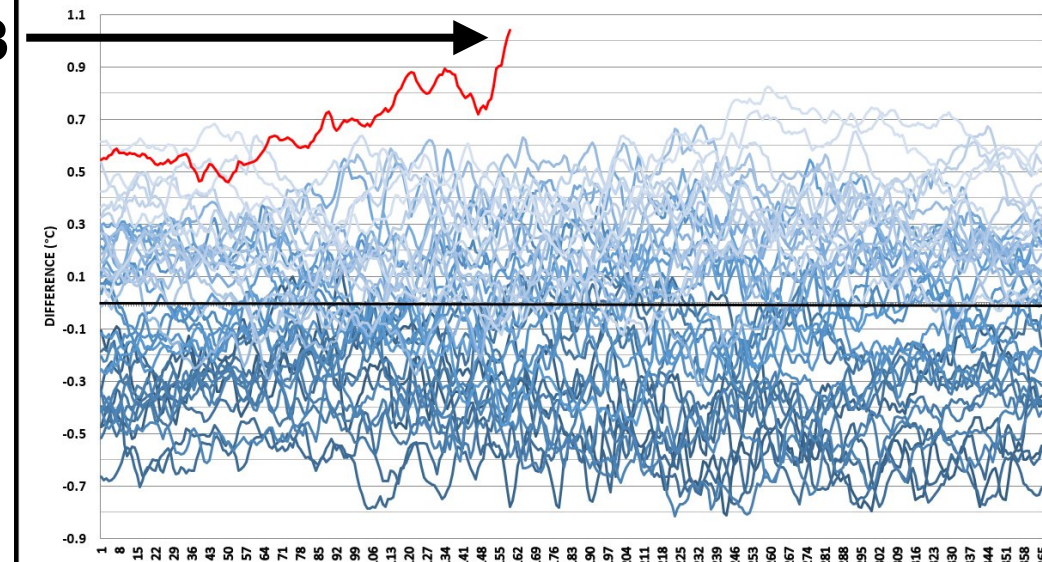
2m T **Air temperature** N, 0–360°E)

NCEP CFSV2/CFSR | ClimateReanalyzer.org, Climate Change Institute, University of Maine

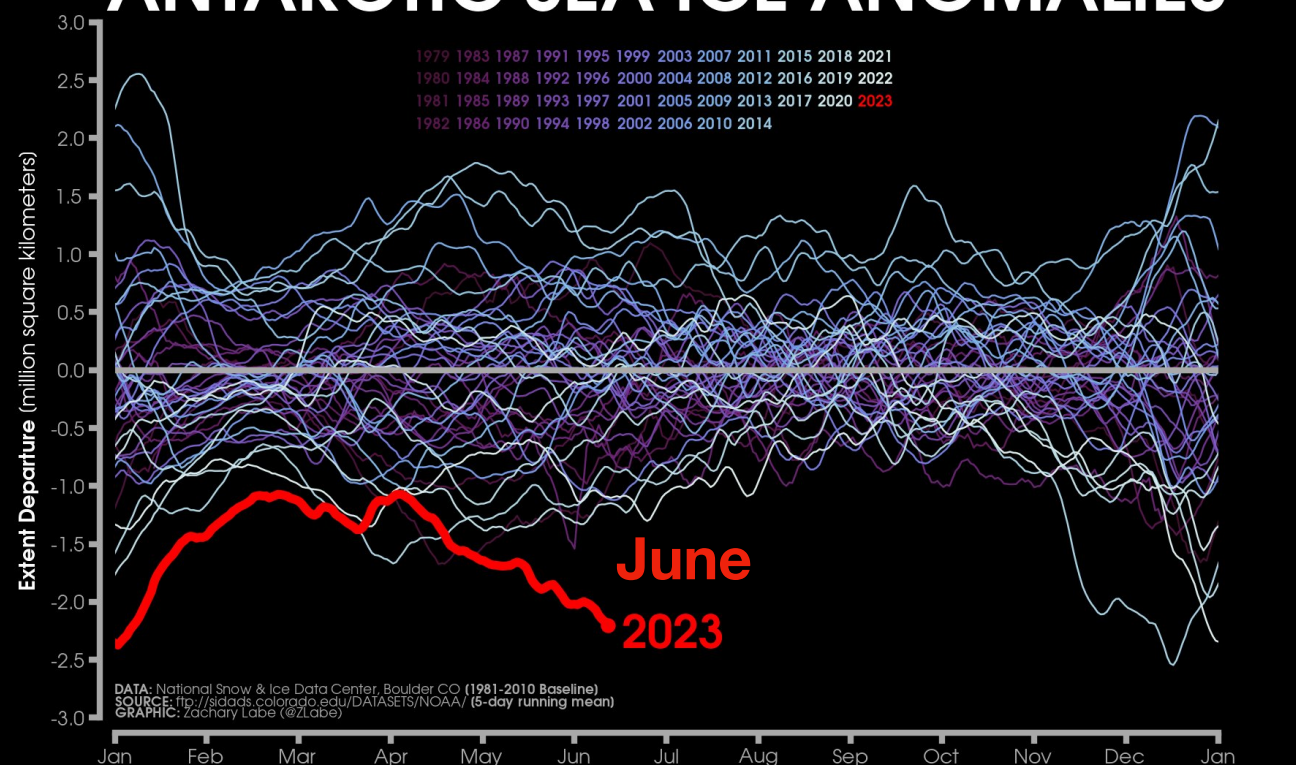


June 2023

Sea surface temperature



ANTARCTIC SEA ICE ANOMALIES



Dead fish in Australia

Life → death



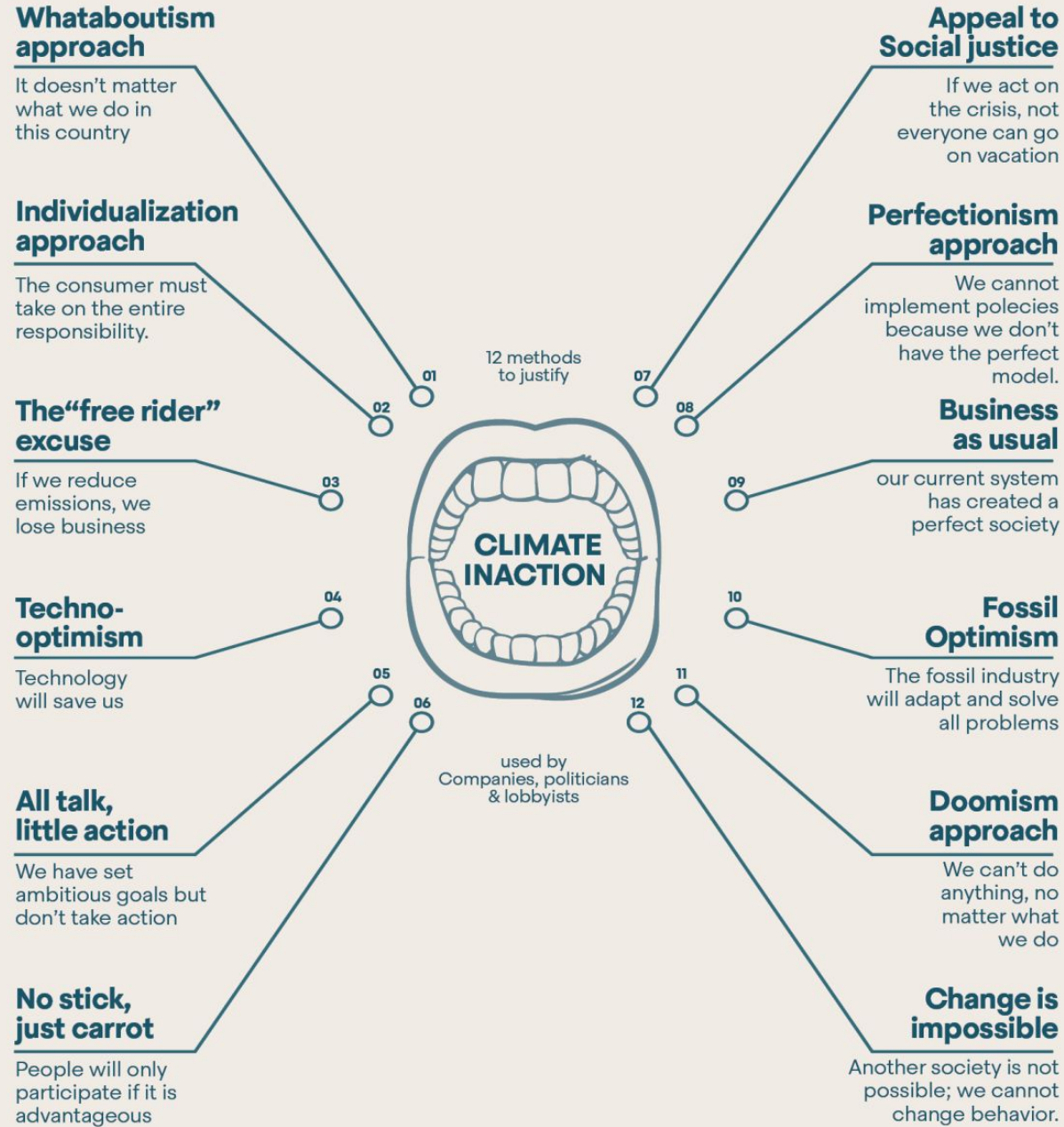
Massenhaftes Fischsterben
Hunderttausende tote Tiere im Westen Australiens

March 2023

The END

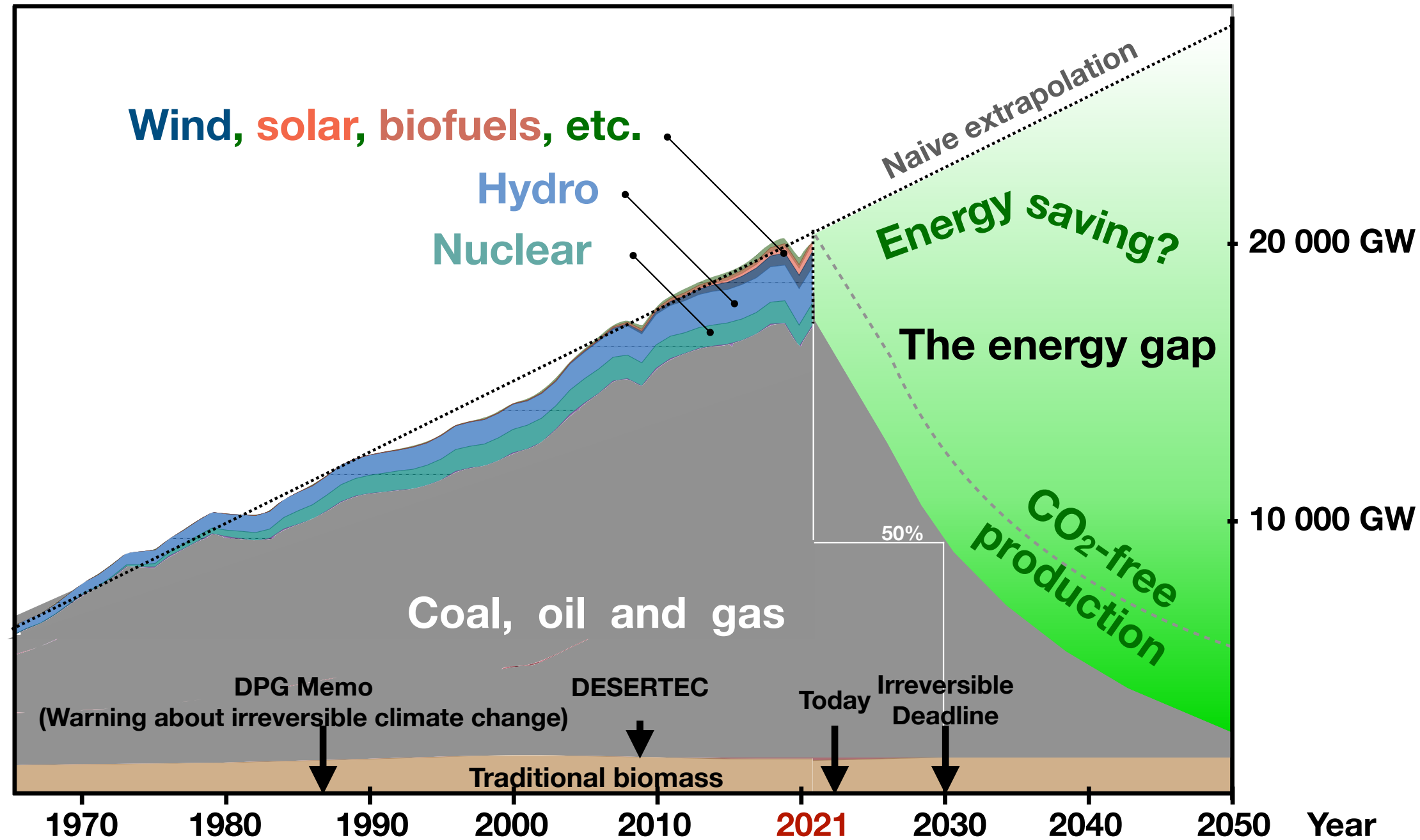
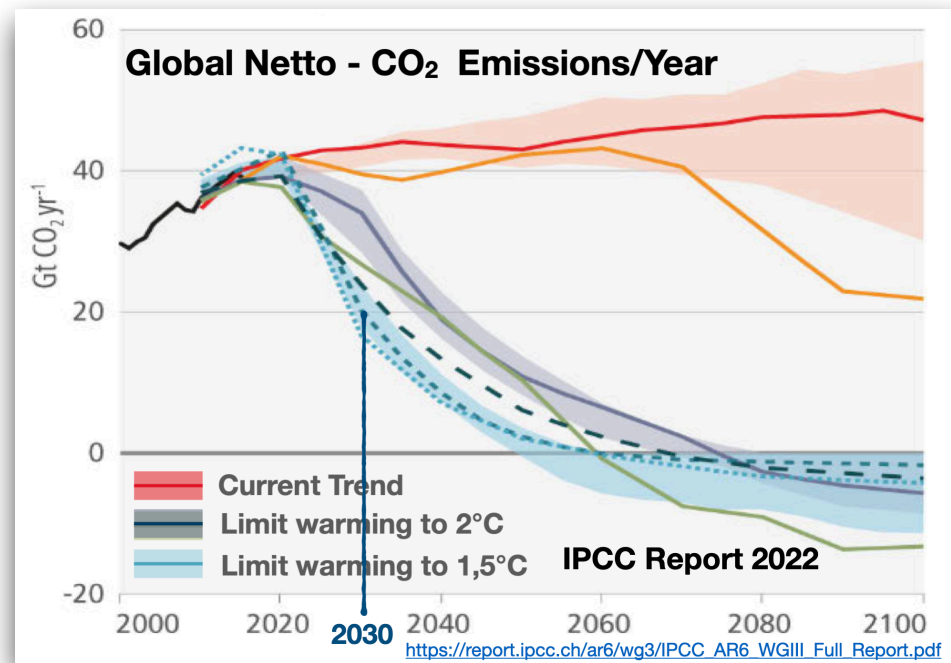
FROM CLIMATE CHANGE DENIAL TO CLIMATE CHANGE DELAY

Companies, politicians & lobbyists use these 12 methods to justify inaction, by focusing on the possible negative social effects of climate policies and raise doubt that mitigation is possible.



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