

Restructuring energy systems

The next challenge



Stefan P. Schleicher

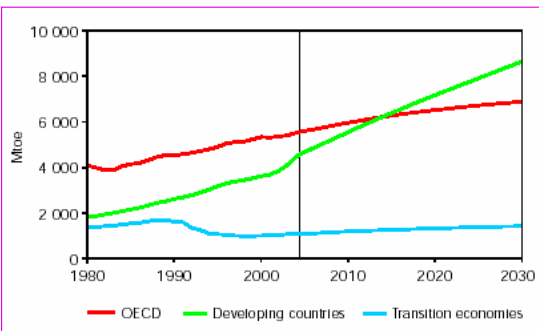
*Wegener Center
University of Graz*



Why we need a restructuring of our energy systems

Energy demand up to 2030

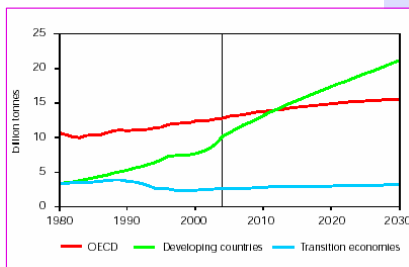
The perspective of the IEA



Primary energy demand
Baseline scenario

International Energy Agency.
2006.
World Economic Outlook.

CO₂ emissions
Baseline scenario



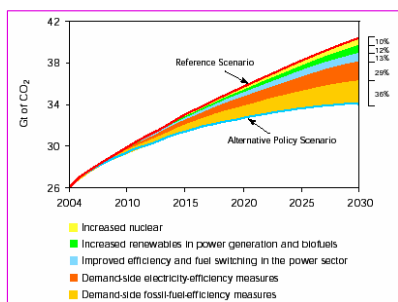
CZ-AT Energy Expert Group

www.energy-europe.net

Stefan.Schleicher@wifo.at

CO₂ emissions up to 2030

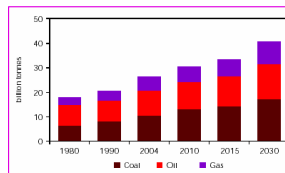
The perspective of the IEA



Primary energy demand
Baseline scenario

International Energy Agency.
2006.
World Economic Outlook.

CO₂ emissions
Baseline scenario



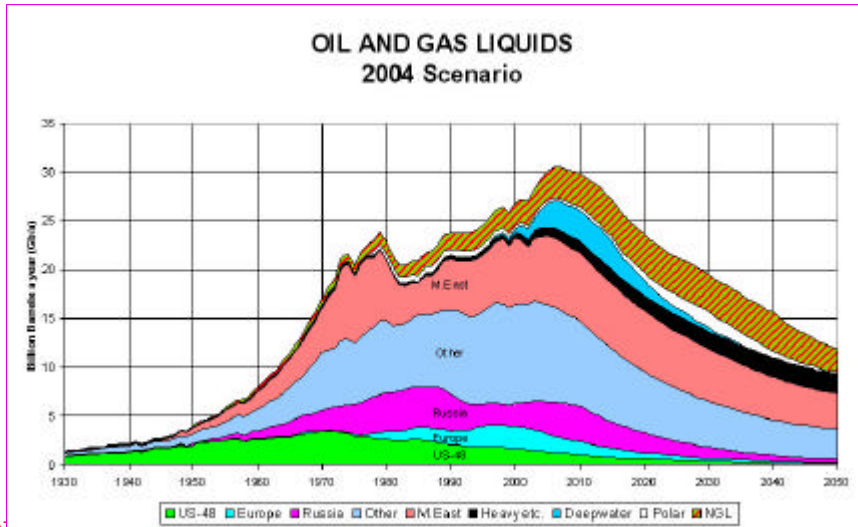
CZ-AT Energy Expert Group

www.energy-europe.net

Stefan.Schleicher@wifo.at

The challenge of oil and gas availability

Approaching global peak-oil production



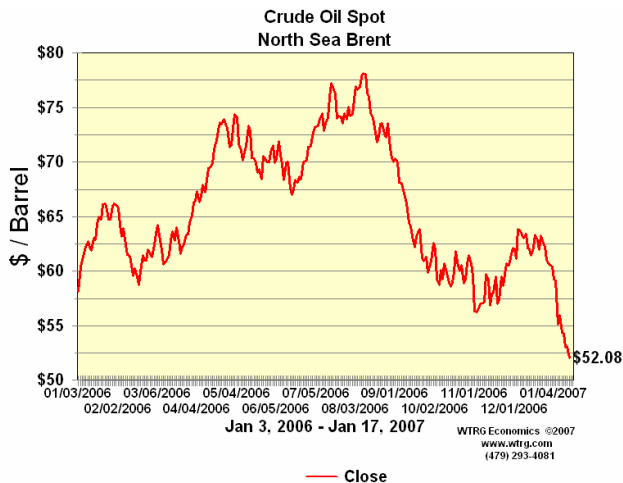
CZ-AT

www.energy-europe.net

Stefan.Schleicher@wifo.at

Price for crude oil

The past 12 months



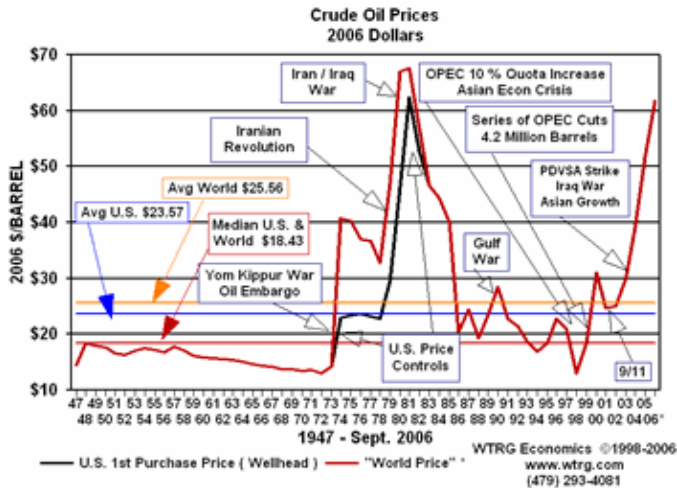
CZ-AT Energy Expert Group

www.energy-europe.net

Stefan.Schleicher@wifo.at

The price for crude oil

The past 20 years

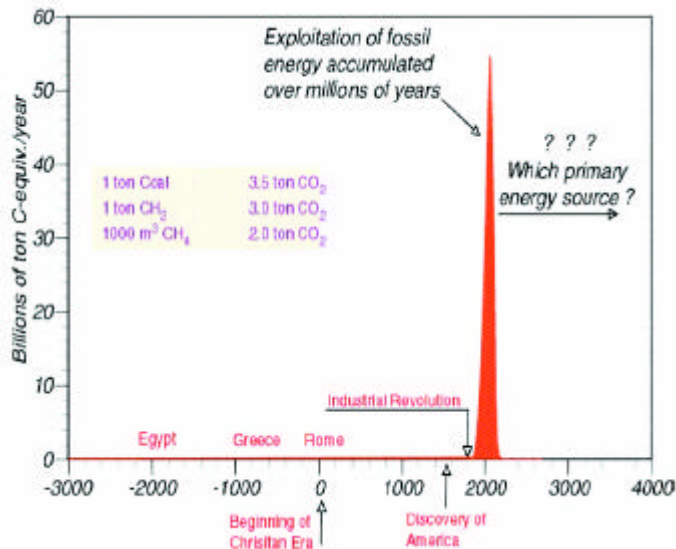


CZ-AT Energy Expert Group

www.energy-europe.net

Stefan.Schleicher@wifo.at

The (short) age of fossile fuels



CZ-AT Energy E

her@wifo.at

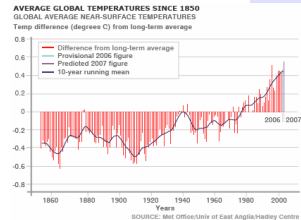
The challenge of climate change

Global warming – out of control?



■ The warmest years since 1890

■ 2005
1998
2002
2003
2004
2006



How future energy systems could look like

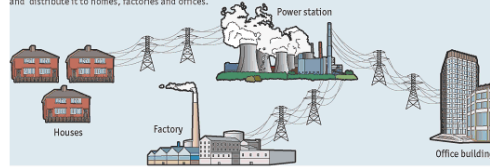
The future energy systems

Internet structures for heat and electricity

The shape of grids to come?

Conventional electrical grid

Centralised power stations generate electricity and distribute it to homes, factories and offices.

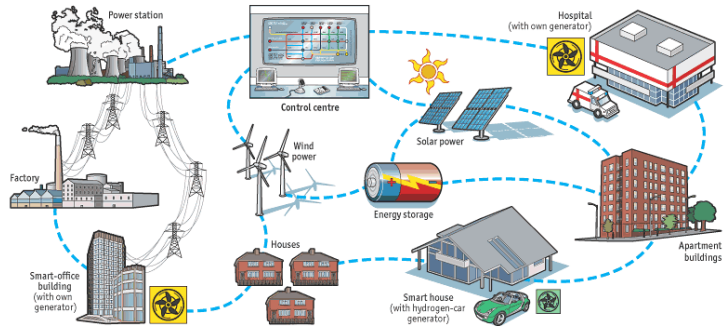


Energy internet

Many small generating facilities, including those based on alternative energy sources such as wind and solar power, are orchestrated using real-time monitoring and control systems.

Offices or hospitals generate their own power and sell the excess back to the grid. Hydrogen-powered cars can act as generators when not in use. Energy-storage technologies smooth out fluctuations in supply from wind and solar power.

Distributing power generation in this way reduces transmission losses, operating costs and the environmental impact of overhead power lines.



CZ-AT Energy Expert Group

Sources: The Economist; ABB

The transformation of mobility

From transport to mobility

Mobility modules
Instead of vehicles



Mobile and stationary use
Modular structures



CZ-AT Energy Expert Group

www.energy-euro.com

The transformation of buildings

Passive-house and plus-energy standards



- Transparent insulation materials
- Thermal and photovoltaic solar

CZ-AT Energy Expert Group

www.energy-europe.net

Stefan.Schleicher@wifo.at

The transformation of electricity and heat technologies

Remaining energy needs

Decentralized local renewable

Micro technologies



CZ-AT Energy Expert Group

www.energy-europe.net

How to understand energy systems

The incentive

Trying to understand our energy systems

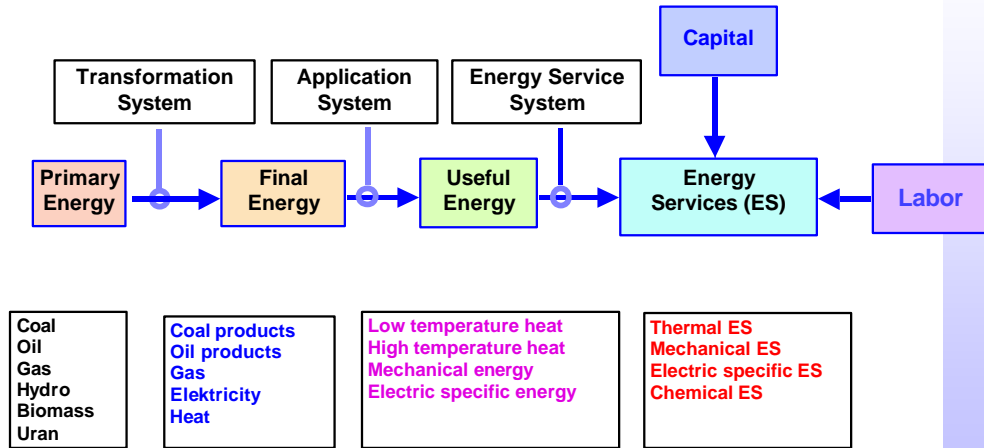
■ Comparative analysis of energy systems

- **Structure**
 - Composition of demand and supply
- **Drivers**
 - Relation to economic activity
- **Key parameters**
 - Elasticities and intensities

■ Preparation for structural modeling analysis

- **Energy services**
- **Final energy consumption**
- **Primary energy supply**

Modeling the structure of energy systems



CZ-AT Energy Expert Group

www.energy-europe.net

Stefan.Schleicher@wifo.at

The challenges for energy policy

CZ-AT Energy Expert Group

www.energy-europe.net

Stefan.Schleicher@wifo.at

The fundamental controversies

■ The wrong questions

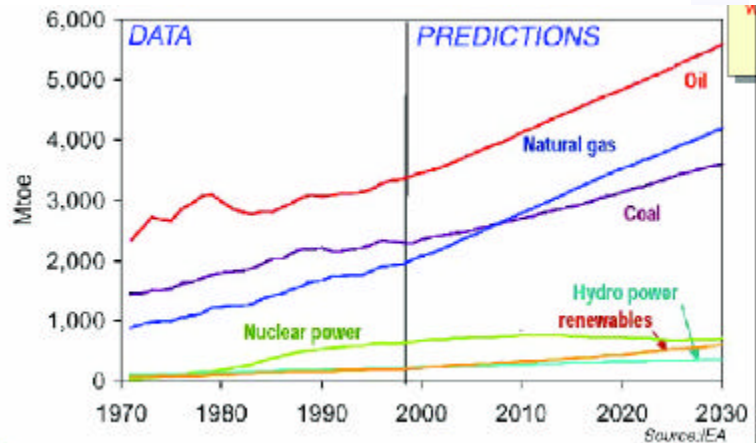
- How can we substitute the current requirements for energy flows?

■ The right directions

- Check your energy services
 - What will be the future requirements
 - How many are redundant?
- Check the potentials for raising efficiencies
 - Application technologies
 - Transformation technologies
- Develop policy guidelines
 - Low carbon
 - Low energy
 - Low distance

IEA: The main stream Business as Usual

- +2% CO₂ pro Jahr

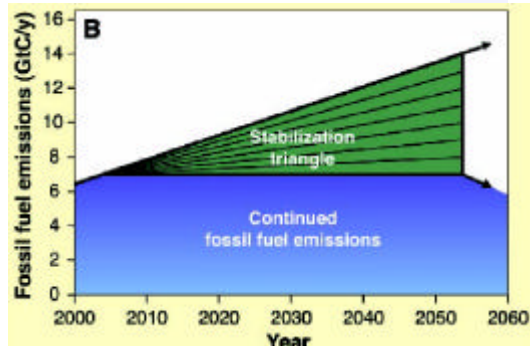
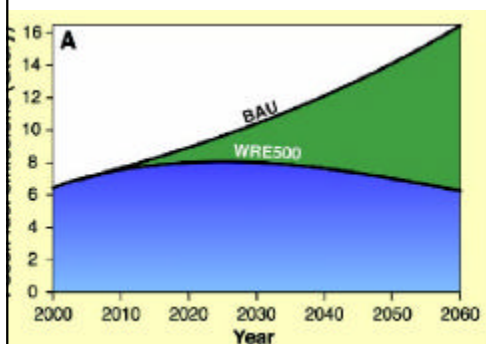


The anti-thesis to the IEA The Pacala-Socolow proposal

“Humanity already possesses the fundamental scientific, technical, and industrial know-how to solve the carbon and climate problem for the next half-century and climate problem over the next half-century.”

S. Pacala and R. Socolow
Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies
Science, Vol. 305, August 13, 2004.

Current technologies for GHG stabilization in 50 years



Current technologies for GHG stabilization in 50 years

■ Efficiency and conservation

- Cars (4x → 2 billion cars)
60 instead 30 miles/gallon
5000 instead 10000 miles per year
- Buildings
-25% energy
- Power plants
from 40 to 60% efficiency



CZ-AT Energy Expert Group

www

Current technologies for GHG stabilization in 50 years

■ Decarbonization

- Electric power plants
gas substitutes coal
- New renewables
wind, thermal and photovoltaic solar

■ Carbon capture and hydrogen storage

- Post-combustion carbon capture and storage in electricity generation
- Pre-combustion carbon separation and hydrogen storage as substitute for fossil fuels

■ Carbon sinks



CZ-AT Energy Expert Group

www.energy-europe.net

The 3 x 50 strategy

Transition to a 2.000 Watts energy system

	2005	20??	
Energy Services	100,0	150,0	+50 %
Energy Flows	100,0	50,0	-50 %
Of which Renewables	25,0	37,5	+50 %

CZ-AT Energy Expert Group

www.energy-europe.net

Stefan.Schleicher@wifo.at

Thank you.



CZ-AT Energy Expert Group

www.energy-europe.net

Stefan.Schleicher@wifo.at