

# CZ-AT Winter / Summer School

Graz, 6 February 2012

## Rethinking energy

The EU energy system –  
Understanding the need and  
potential for innovation

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Economic Research  
Vienna



Our current energy system can be compared with the state of mobile phones around 1980



1980



1995

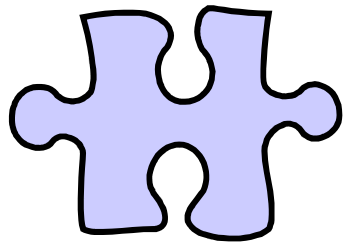


2010

# My agenda

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- Why we need to prepare for a major energy crisis
- Why we should search for a long-run shared vision
- Why most current energy strategies are inadequate



(1)

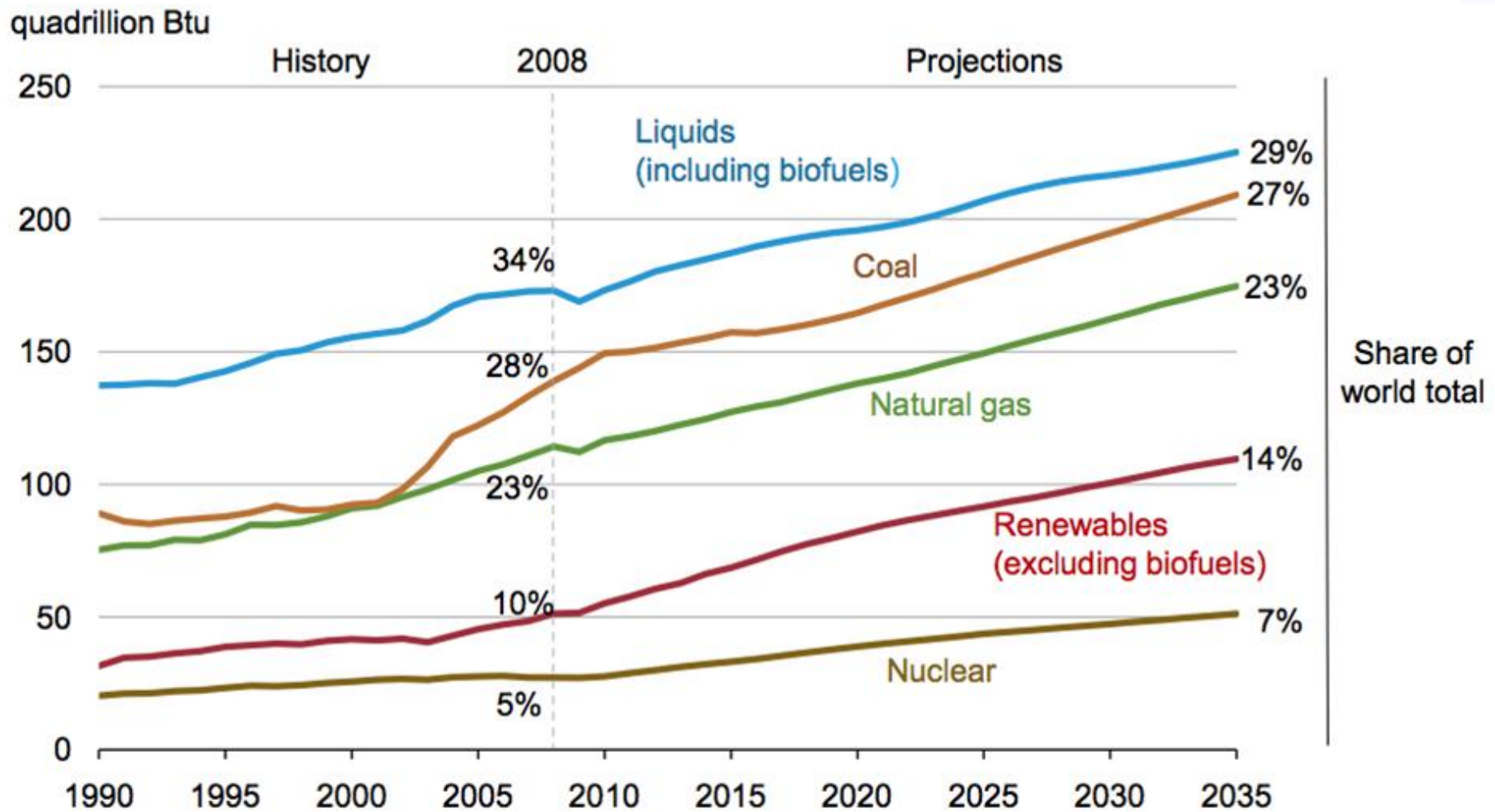
## Why the world and Europe are running into a major energy crisis

# The next oil (price) shocks

- **in 2012**  
**Iran might block the Street of Hormuz**  
↗ Supply route for 1/5 of global crude oil
- **until 2015**  
**investments needed in MENA region**  
**of \$ 100 bn per year**
- **until 2035**  
**35 % increase in global demand**  
**mainly in Asia**

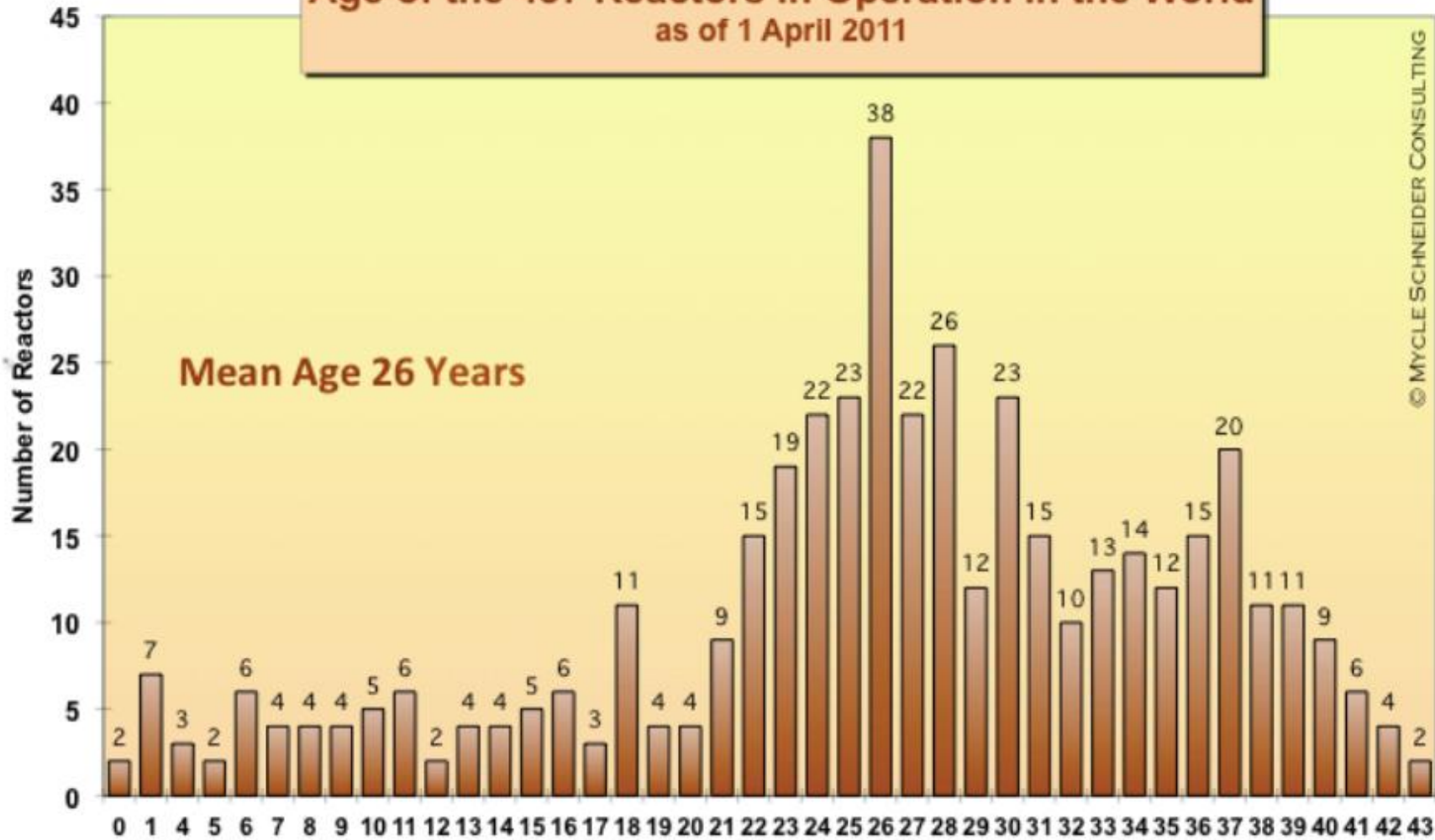


# The global energy perspective



# The aging nuclear reactors

Age of the 437 Reactors in Operation in the World  
as of 1 April 2011



# Investments needed for maintaining the current generating capacity of nuclear reactors

- **until 2015**  
every 92 days a new installation
- **afterwards until 2025**  
every 10 days a new installation



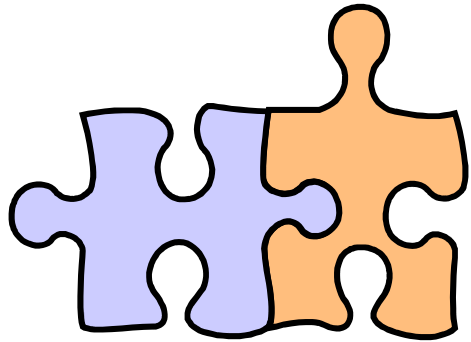


# The emerging European energy crisis

## A first summary

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- **Shortages of electricity**
  - ↗ **Policy of shut-down of reactors**
  - ↗ **Age distribution of reactors**
- **Financial constraints for renewables**
  - ↗ **Sovereign debt crisis**
- **Vulnerability with respect to oil and gas**
  - ↗ **Quantities**
  - ↗ **Prices**

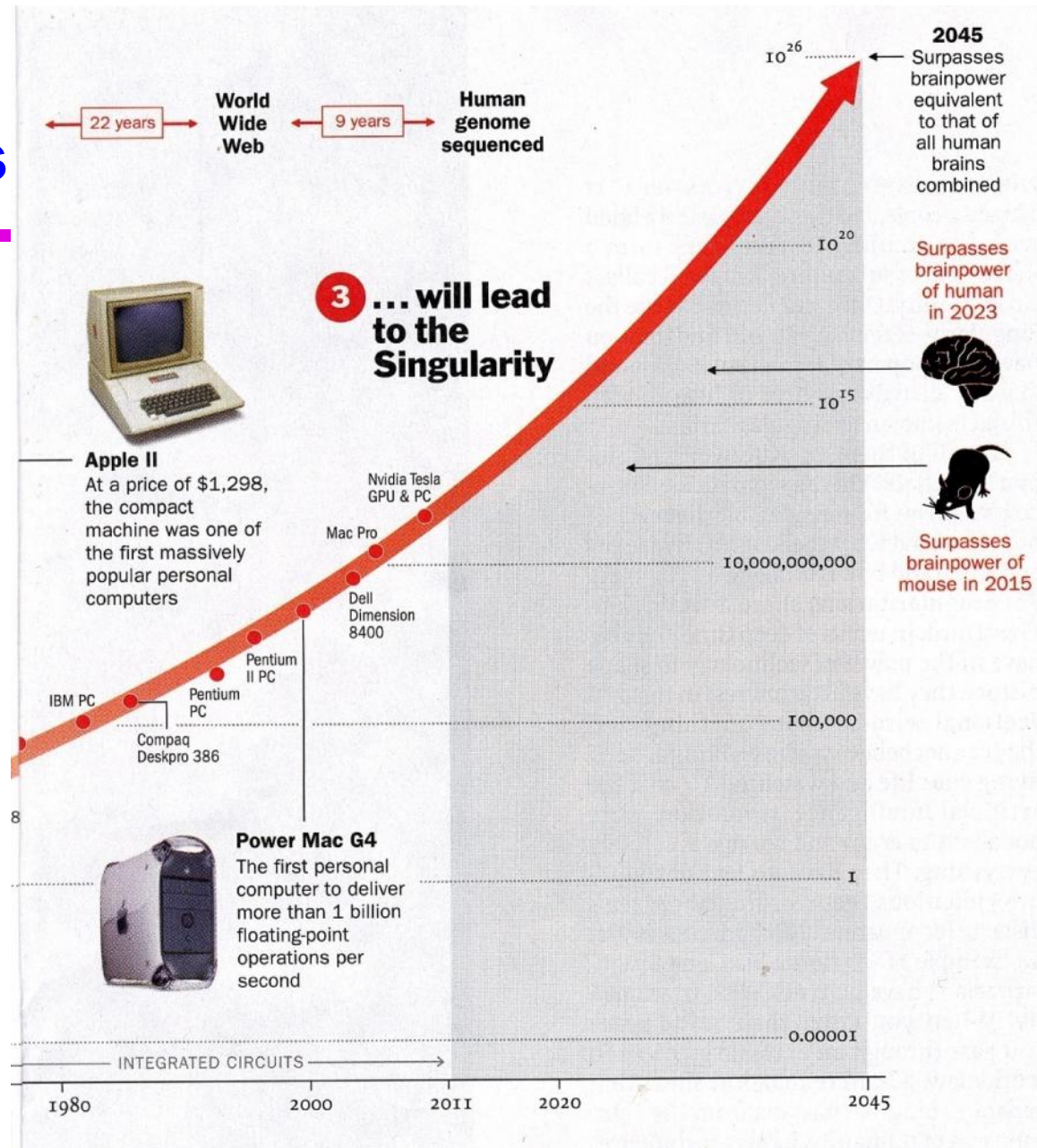


(2)

**Looking forward:  
Scanning coming technology futures**

# The future of information technologies

- Computer processing power keeps doubling every two years
  - MIPS for 1.000 USD
- By 2045 artificial intelligence might match human intelligence
- Potential impacts of this radical technological change
  - Aging society



# The future of production

- 3D printers: fabricator – “fabber”

**The Economist**

FEBRUARY 12TH-18TH 2011 Economist.com

Europe loses the mobile-phone war  
Africa's new wealth  
Japan's tea party  
How to switch off the internet  
The shoe-thrower's index

## Print me a Stradivarius

The manufacturing technology that will change the world

This violin was made using an EOS laser-sintering 3D printer (and it plays beautifully)

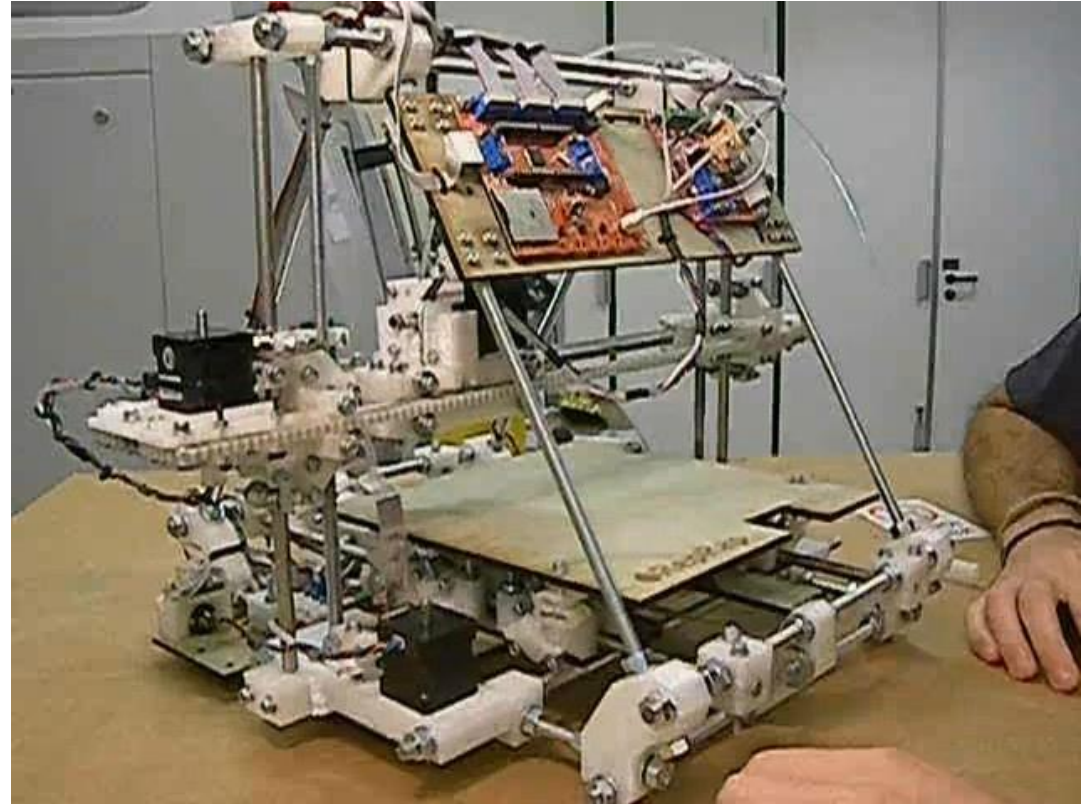
€5.50

9 770013 061190

Albania ALL700 Croatia HRK40 France €5.50 Ireland €5.50 Latvia LVL3.00 Nigeria Naira 700 Romania RON24 South Africa R45.00  
Austria €5.50 Cyprus €5.50 Gibraltar GIP4.00 Israel NIS38.00 Lebanon L£11.500 Norway NOK50 Saudi Arabia Riyal40 Sweden SEK55  
Bahrain Dinar4.00 Czech Rep CZK150 Greece €5.50 Italy €5.50 Lithuania LTL20 Poland PLN26.8 Serbia RSD600 Switzerland Sfr10  
Belgium €5.50 Denmark Dkr43 Hungary HUF1,850 Kenya KSh540 Luxembourg €5.50 Portugal (cont) €5.50 Slovakia €5.50 Turkey TRY12  
Bulgaria BGN13 Estonia €5.60 EUR69 Iceland ISK750 Kuwait Dinar3.00 Malta €5.50 Qatar Rial50 Slovenia €5.50 UAE Dirhams40

# Products from nano structures

- Universal machines for production of (almost any) product
- Macroscopic products are generated from nano structures



# Fabber products

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- **Waste free**

- “Additive” instead of “subtractive”

- **Decentralized**

- “Downloading” of the file with instructions of the fabber



# The future of mobility

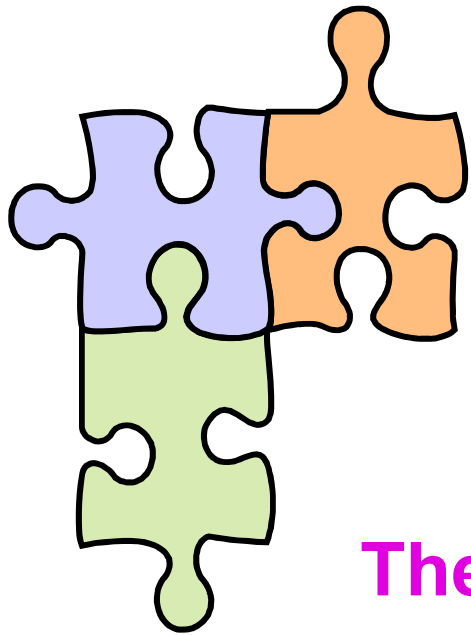
- **Automover or “mover”**

- Automatic Transport Module
- Self-steering modular platforms

- **Merging of road and train transport**

- Road traffic converges to train structures





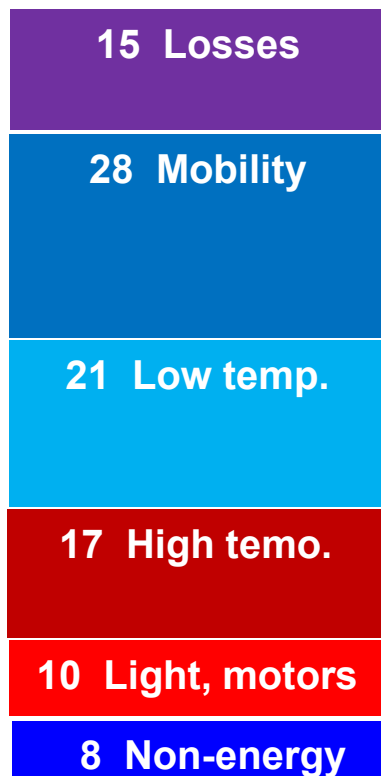
(3)

## Looking forward: The emerging energy technologies



# What for do we **currently** need energy?

2010



Surprisingly we don't know much

- We hardly know about the **energy services**

# What for will we need energy in the future?

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2050



Surprisingly we know a lot

- We just need to check the available and unfolding technologies

# The new buildings

## Energy-autonomous and plus-energy standards



2010

21 Low temp.

2050

5 Low temp.



# The new mobility

## Electric-powered cars



Nissan Leaf



Mitsubishi MiEV

2010

2050

28 Mobility

5 Mobility

- ❑ Plug-in vehicles serve as storage for the electricity grid
- ❑ The mobility services are sold not the vehicle

# The new transformation technologies

## Efficient transformation and distribution



GE Jenbacher

2010

15 Losses

2050

5



Volkswagen

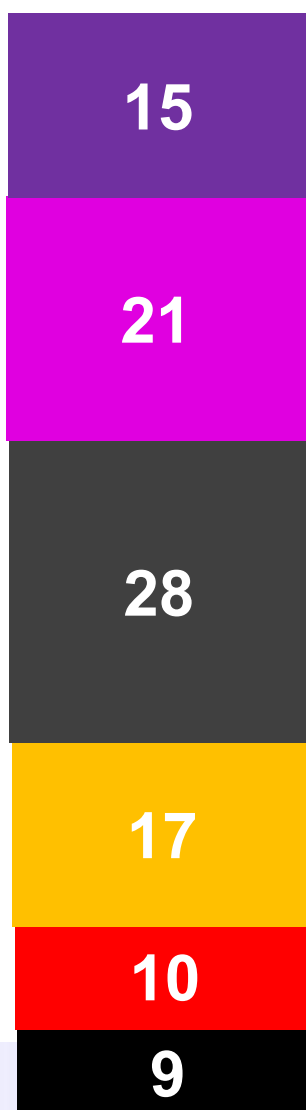
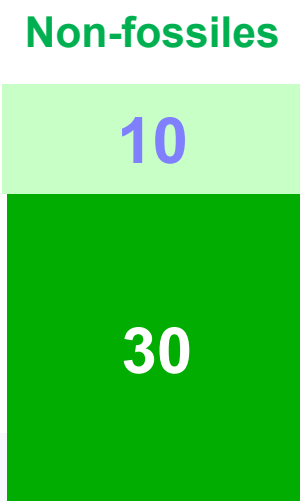
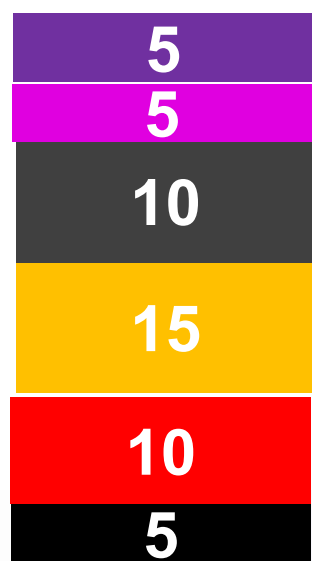
- ❑ Co-generation of heat and electricity
- ❑ Distributed Generation
- ❑ Smart Grids

# Envisioning the big transformation

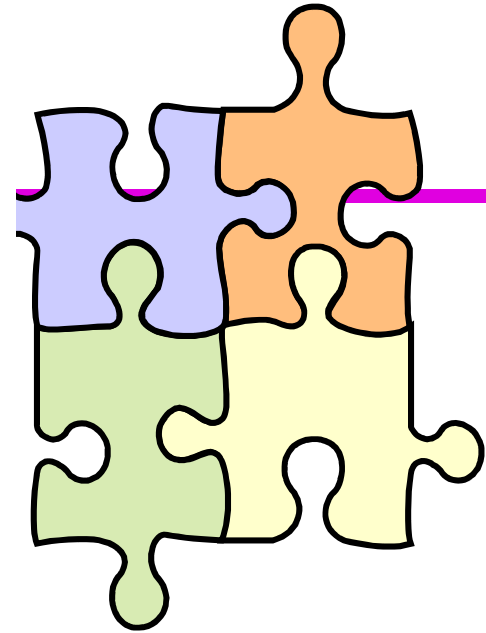
2010

- 50% less energy
- 80% from non-fossiles

2050



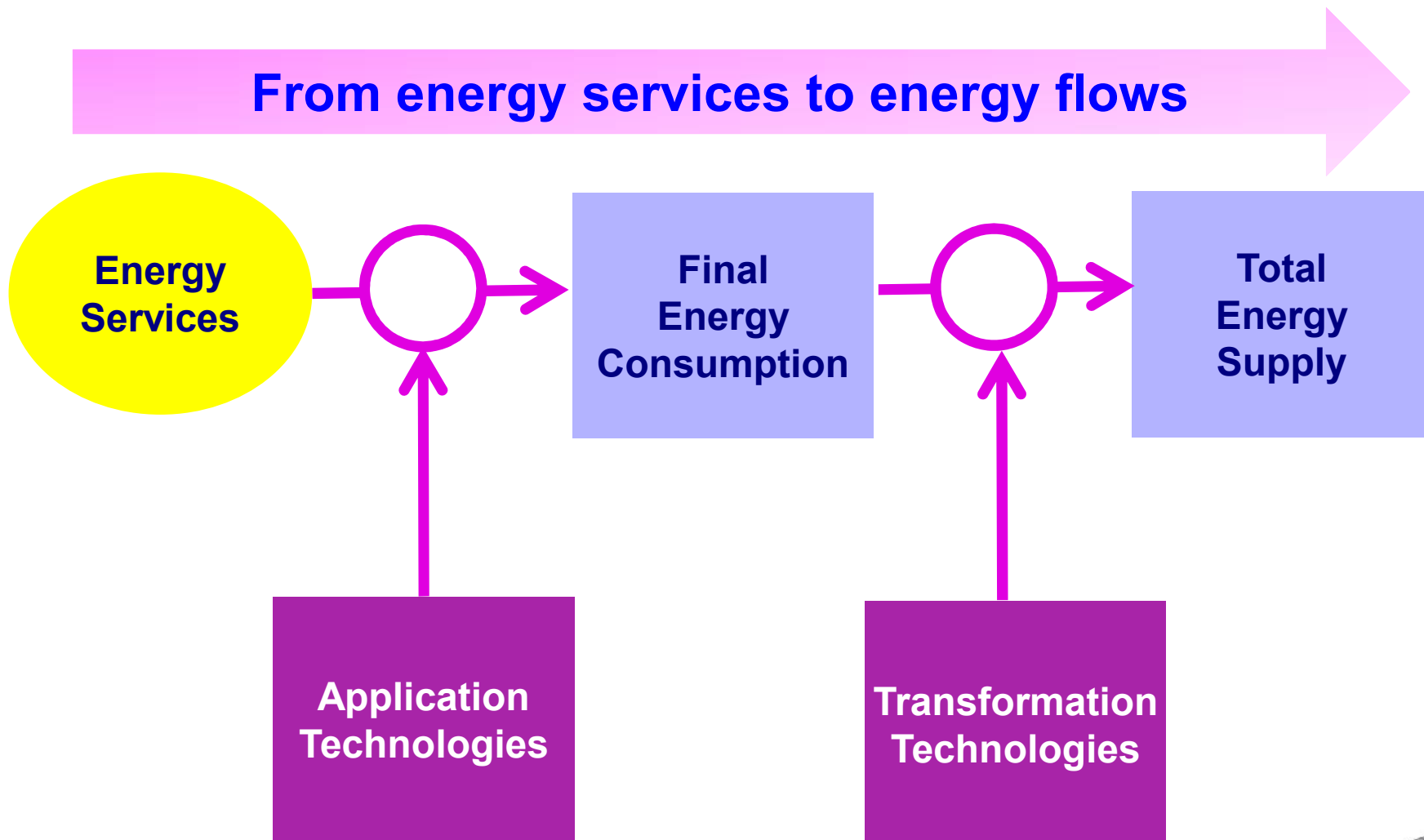
- Losses in transformation and distribution
- Low temperature
- Mobility
- High temperature
- Lighting, electronics, electric motors
- Non-energetic use



(4)

**Why most current energy strategies  
are no adequate answers  
to the coming energy crisis**

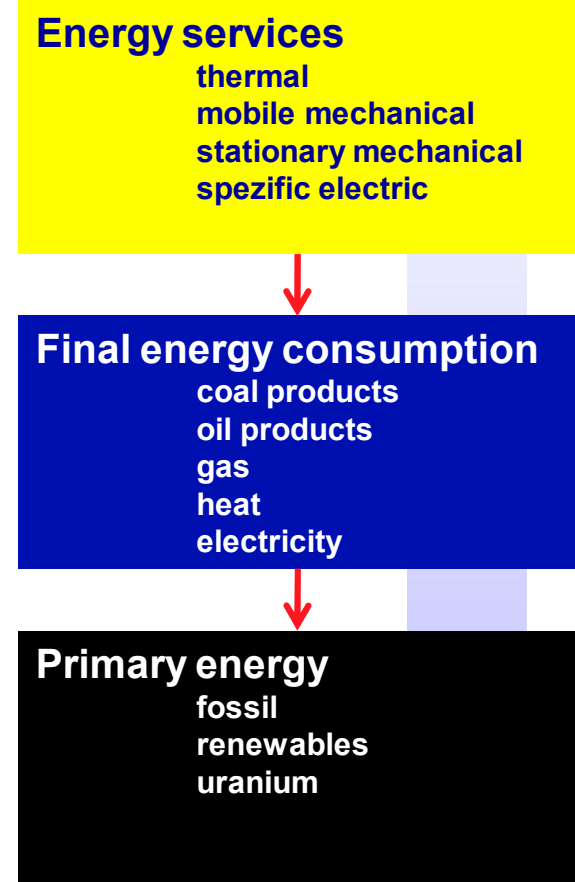
# A Copernican turn of our understanding of energy systems





# Changing the mind set

- Focusing on energy services
- Considering the cascade structure of energy systems

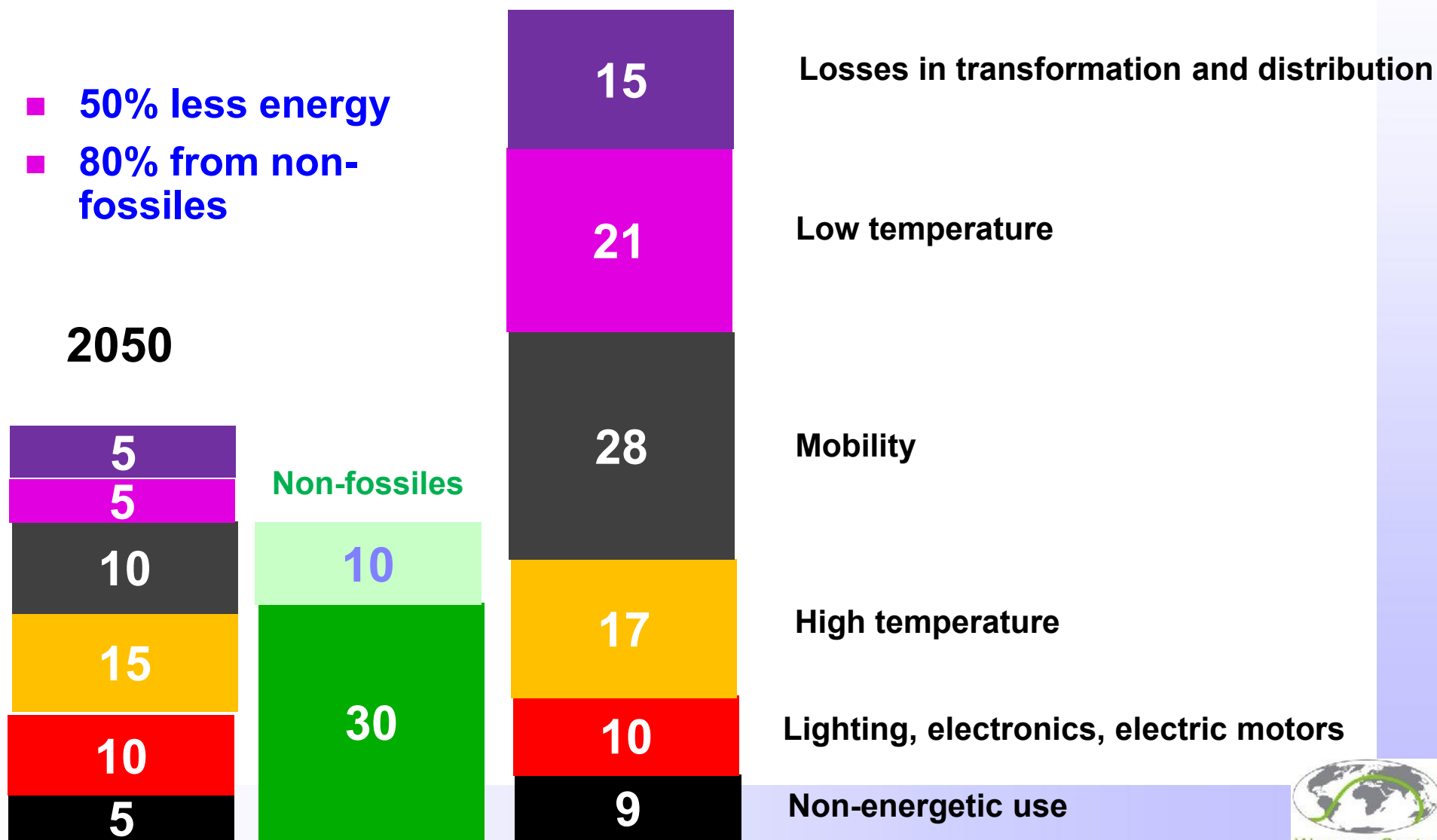


# Envisioning the big transformation

2010

- 50% less energy
- 80% from non-fossiles

2050



# Preparing policy makers

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- In a global but also European perspective the transformation to low-energy structures is inevitable
- Major additional investments will be required amounting to between 2 and 4 percent of GDP
- This will not necessarily increase the user costs of energy services

# Changing the rhetoric of energy policy

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**Alternatives**  
**Anti-nuclear**  
**Autarky**



**Innovative**  
**Intelligent**  
**Integrated**

**Thank You.**

**Stefan P. Schleicher**

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<http://Stefan.Schleicher.wifo.at>

[@SPSchleicher](#)



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# Modeling energy systems

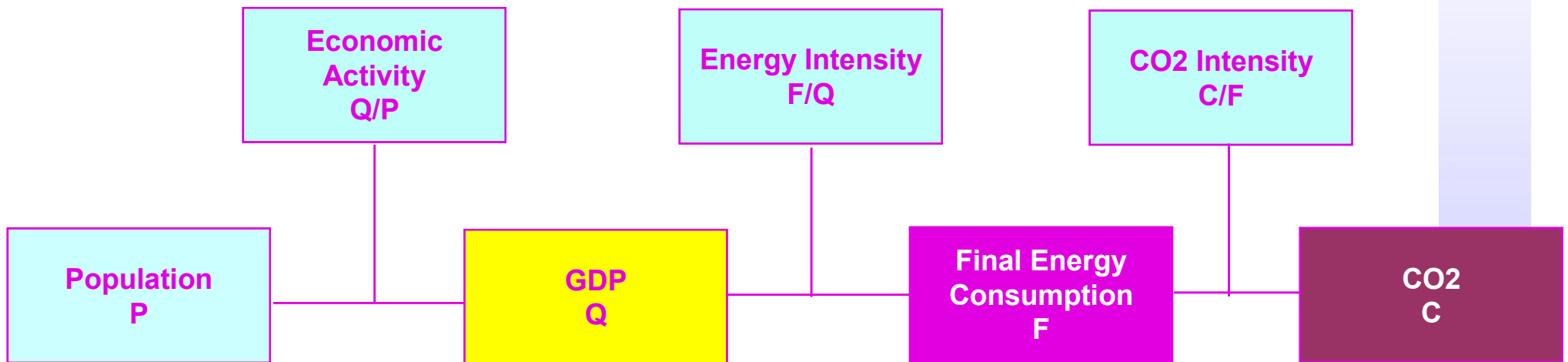


Wegener Center  
[www.wegcenter.at](http://www.wegcenter.at)

**UNI  
CRAZ**

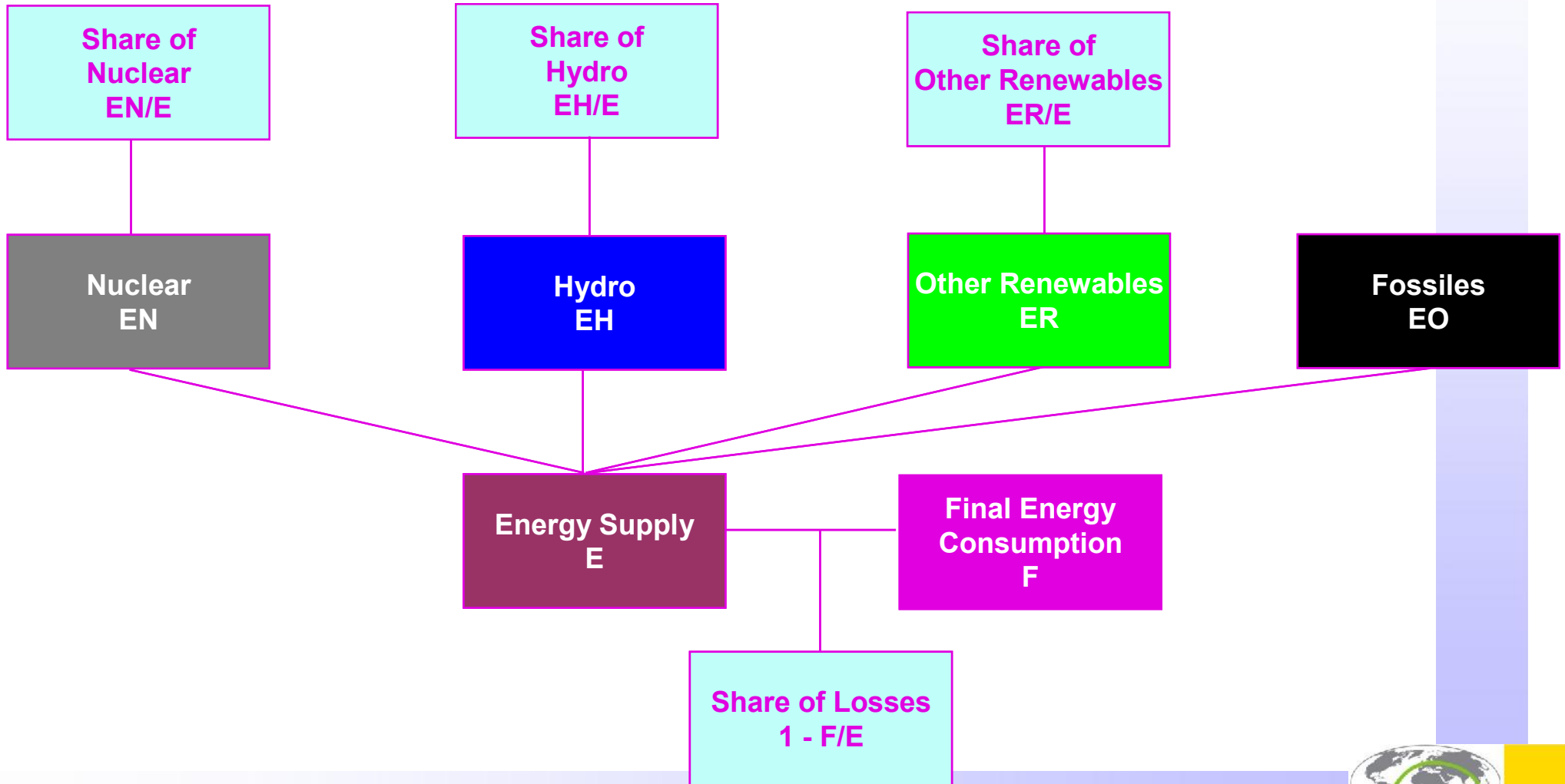
# Modeling energy systems

## Demand module



# Modeling energy systems

## Supply module





# The global energy system



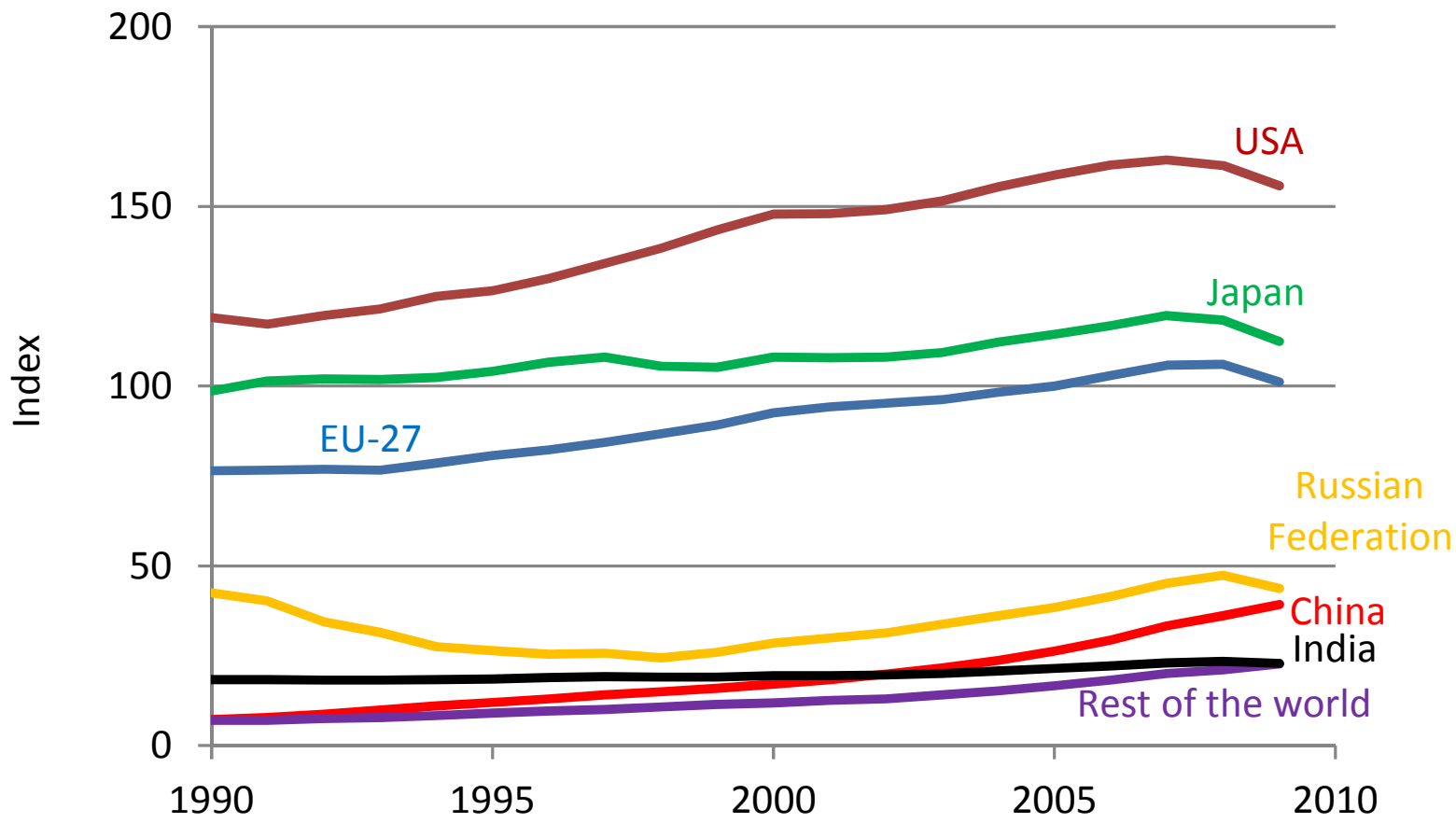
Wegener Center  
[www.wegcenter.at](http://www.wegcenter.at)

**UNI  
CRAZ**

# Economic activity

## GDP / Population

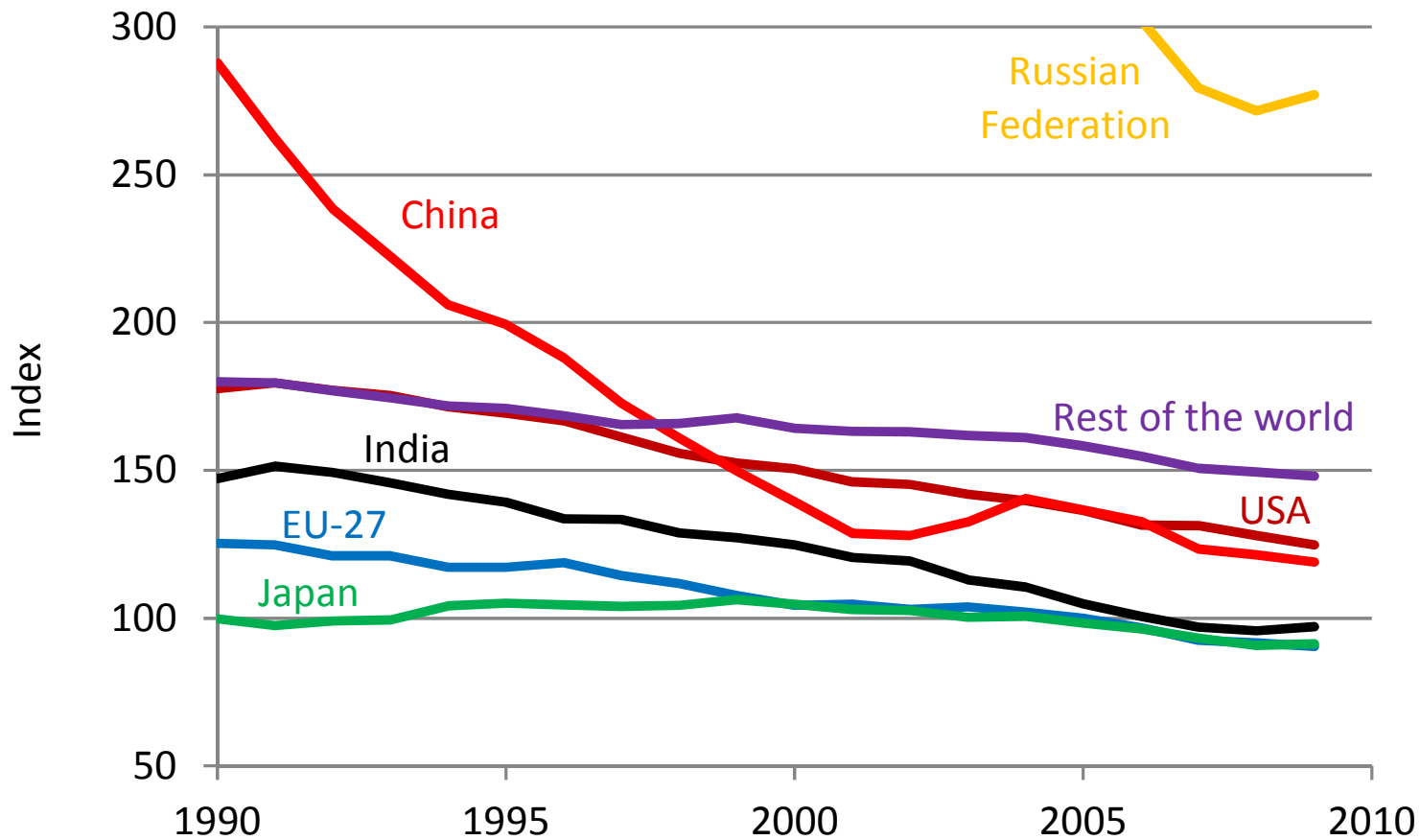
Economic activity



# Energy intensity

## Total Energy Supply / GDP

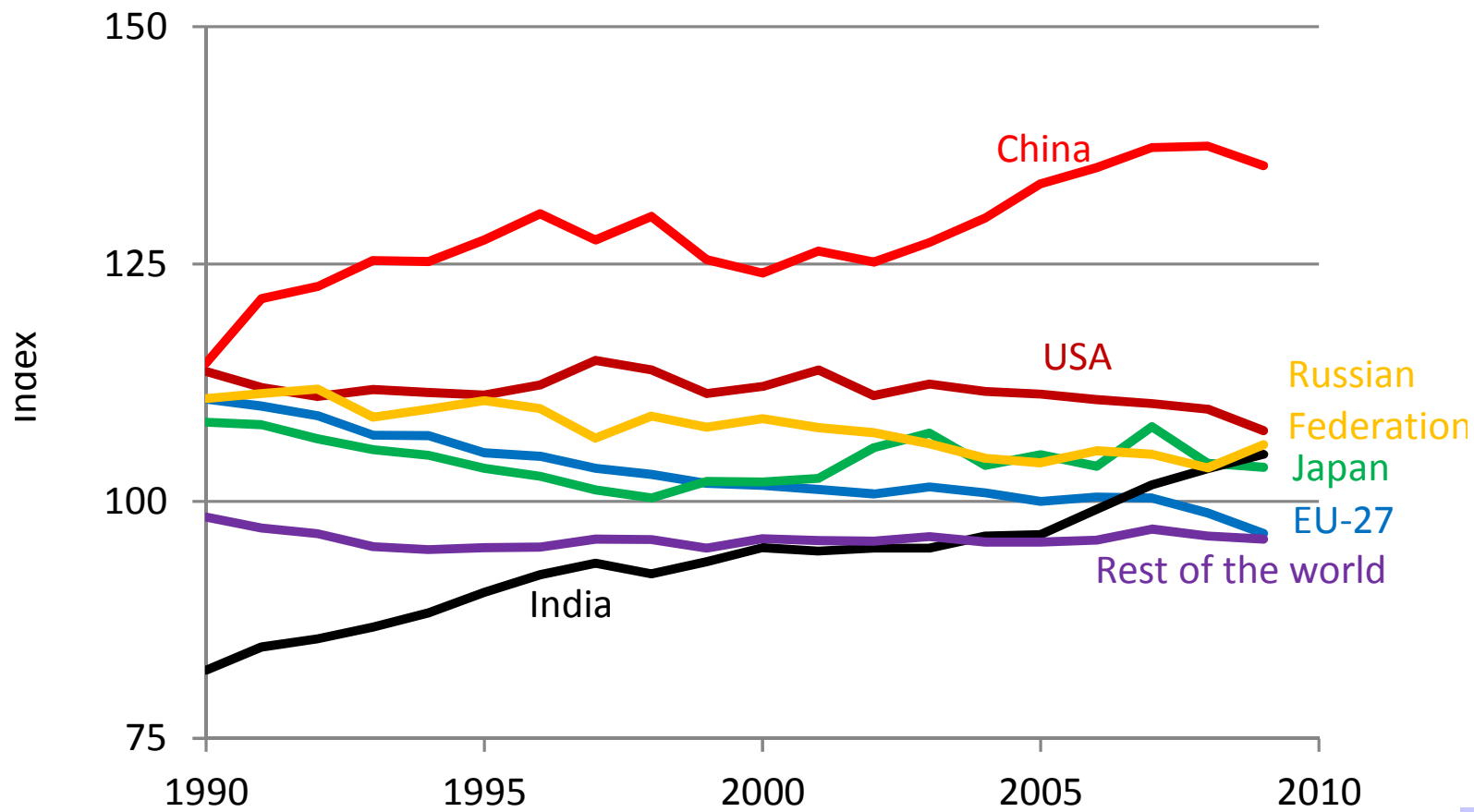
Energy intensity



# Carbon intensity

## CO<sub>2</sub> / Total Energy Supply

Carbon intensity



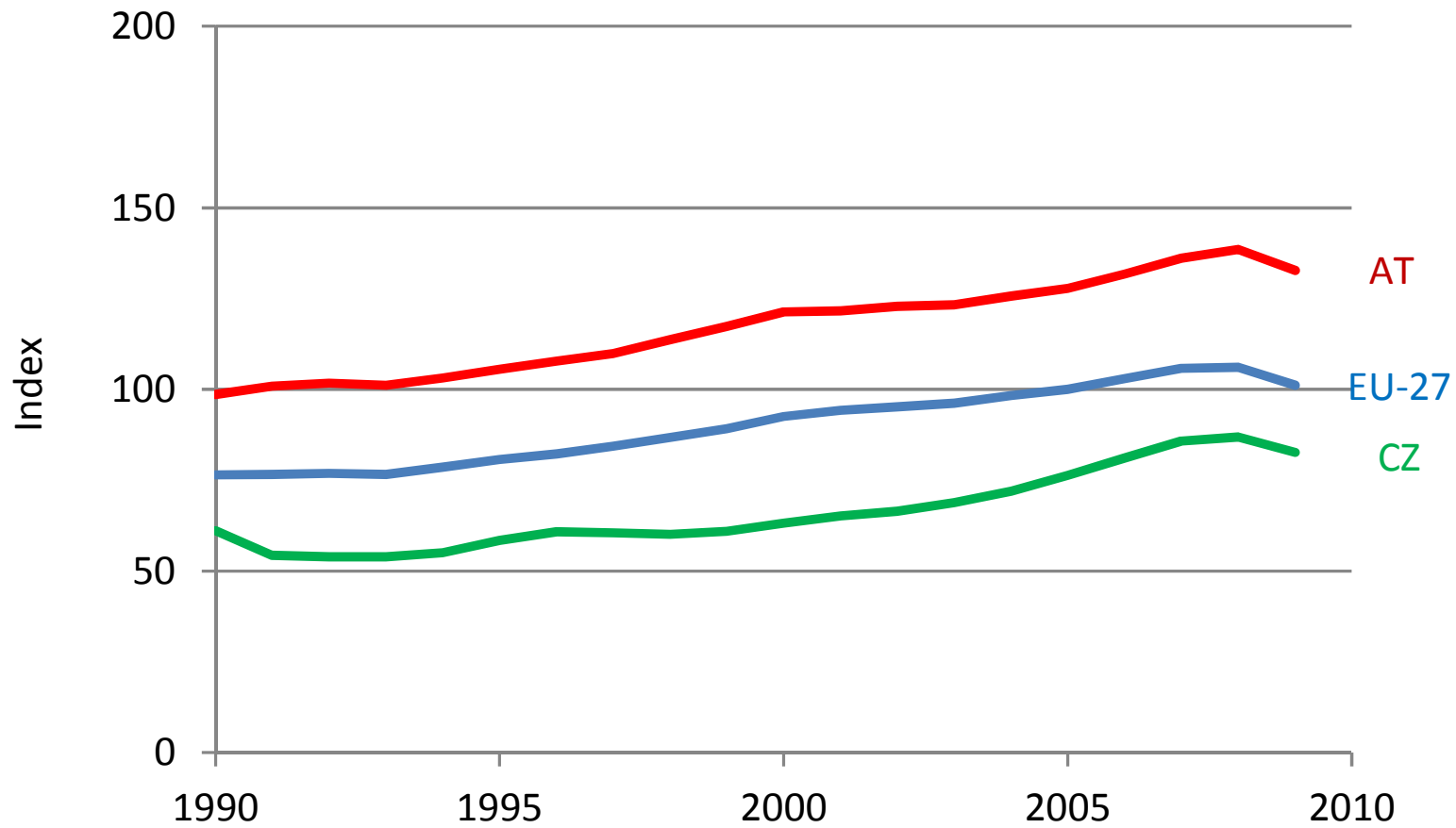
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# Comparing the energy systems of Austria and the Czech Republic

# Economic activity

## GDP / Population

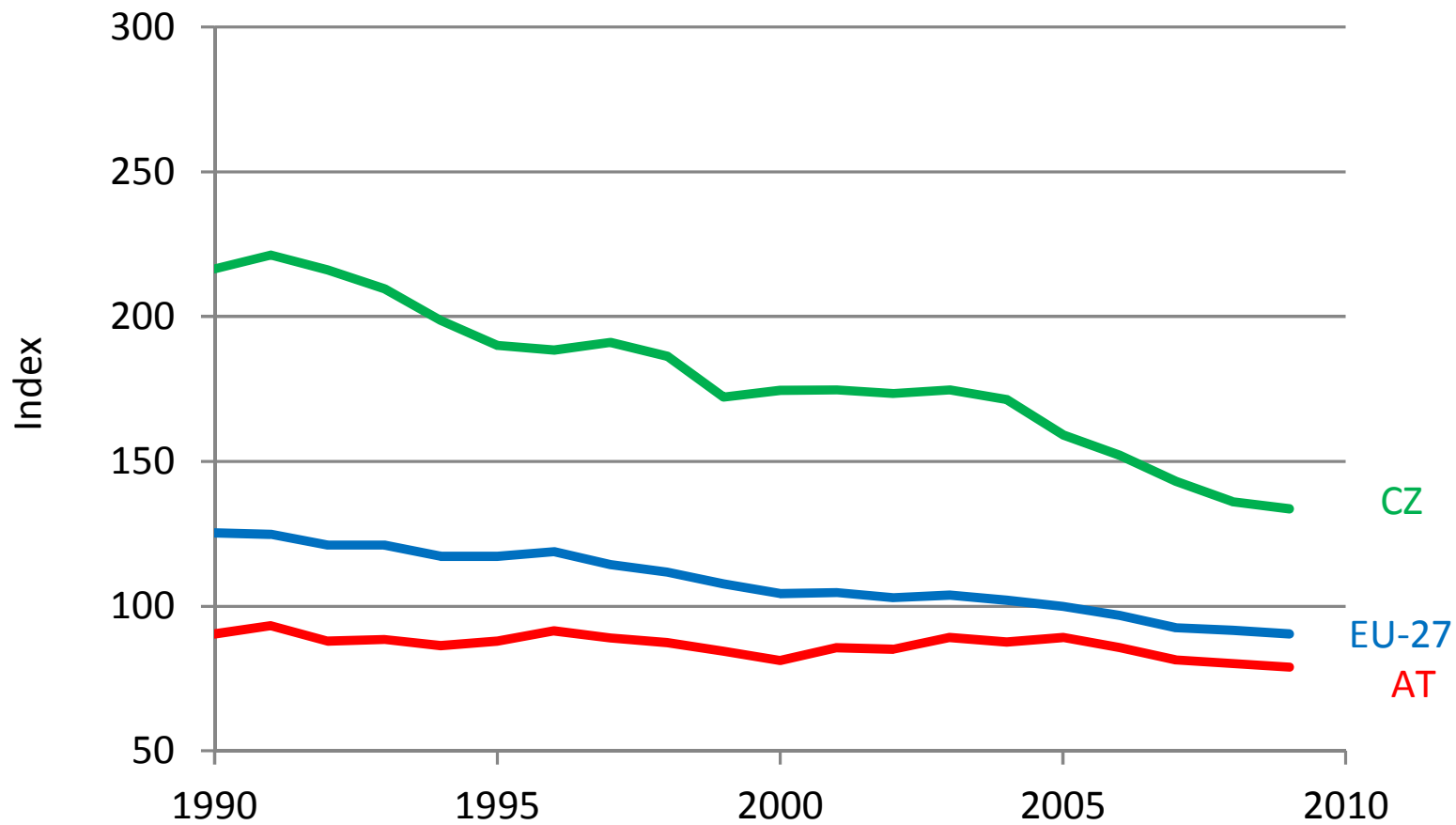
Economic activity



# Energy intensity

## Total Energy Supply / GDP

Energy intensity



# Carbon intensity

## CO<sub>2</sub> / Total Energy Supply

Carbon intensity

