

**Wegener Center**

**T4Science**

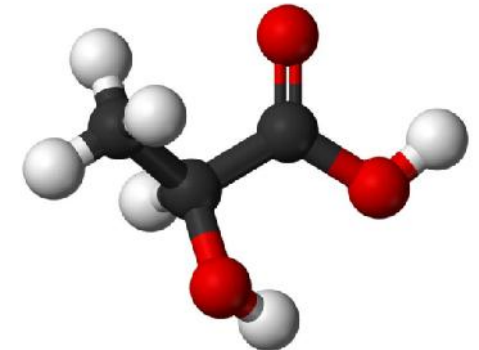
**2 July 2015**

**The end  
of climate  
policy  
(as we used  
to know it)**

**Rethinking  
and  
resetting  
energy  
and climate  
policy**

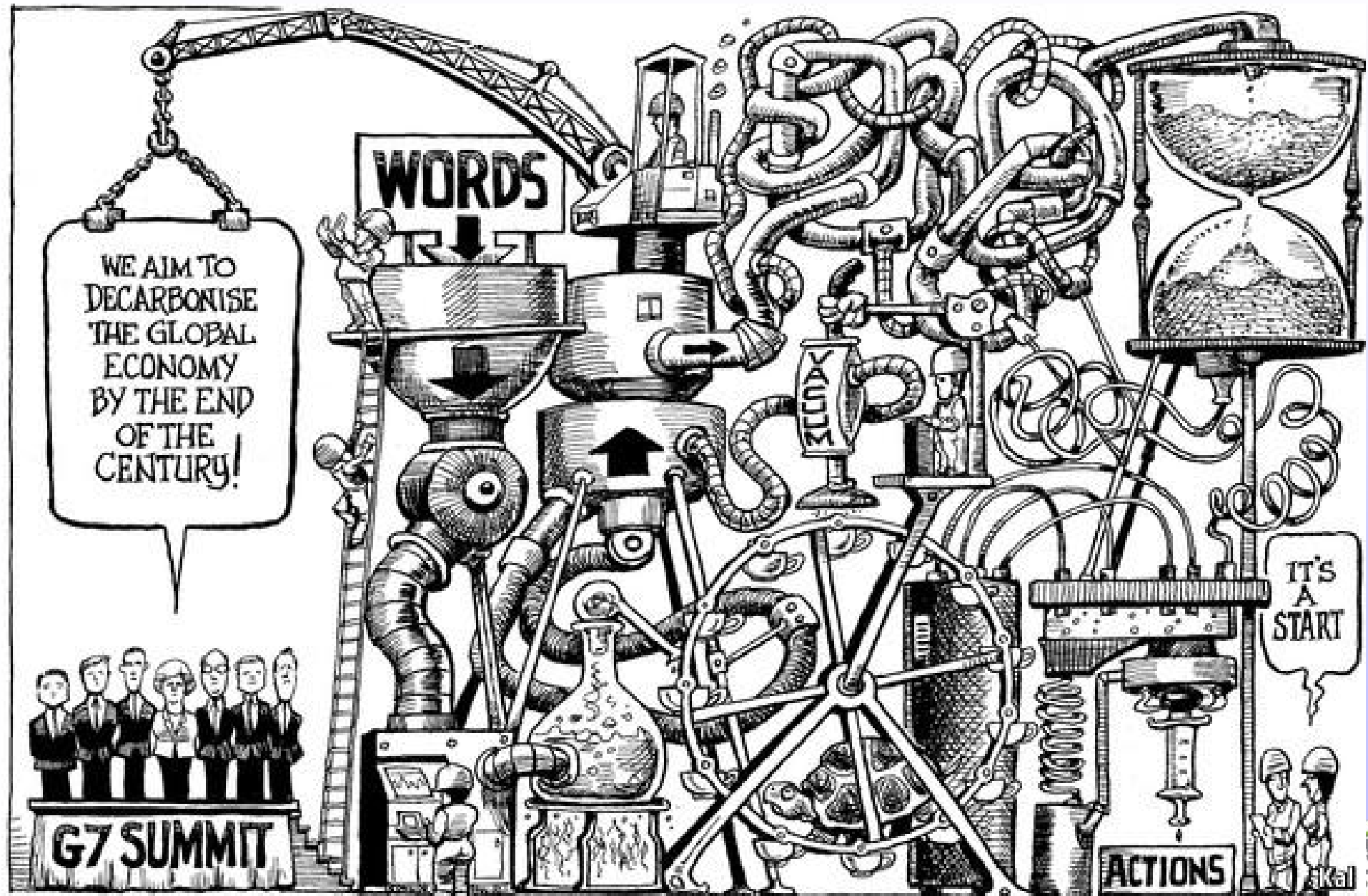
**Stefan P. Schleicher**

Wegener Center for Climate and Global Change  
at the University of Graz



# The 2015 G7 Summit

## What it revealed about decarbonizing the global economy



# Fossil fuel subsidies

## The EU takes a step backward

- **International Monetary Fund, 2015**
- **\$ 490 bill direct subsidies**
  - mainly tax reductions
  - equals 5 times the property value of Boston, MA.
  - subsidies for renewables about 1/3 of those for fossils
- **\$ 5,300 bill hidden costs**
  - to keep burning fossil fuels
  - e.g. air pollution kills 7 mill people per year
- **Meeting of EU energy ministers**
  - dropped on the same day of the G7 announcement reporting requirements on energy subsidies



# Intergovernmental Panel on Climate Change (IPCC)

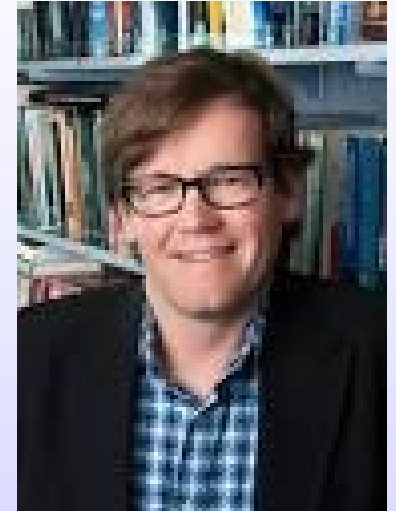
## Working Group III

- David Victor, UC San Diego, 2015

- “IPCC is becoming irrelevant to climate policy”

- A damaging statement of Working Group III is undermining the reputation of IPCC (2014)

- “Annual economic growth might decrease by just 0.06 (!) percentage points by 2050 if governments were to adopt policies that cut emissions in line with the widely discussed goal of 2°C above pre-industrial levels”.





# Who is on drugs (1)



## Who is on drugs (2)



# The use and misuse of models for climate policy

Robert S. Pindyck, MIT, 2015

**“Calling Integrated Assessment Models (IAMs) ‘Close to useless’ is generous.”**



- **The arbitrariness about crucial parameters**
  - ↗ Discounting welfare of future generations
  - ↗ Dynamics of technologies
- **Uncertainty about climate sensitivity**
  - ↗ Feedbacks between emissions, temperatures, economic impacts

# The tectonic shift in global climate policy

## From Kyoto to Copenhagen

- The COP-3 in 1997 forged the Kyoto architecture with binding commitments for GHG reductions
- The COP-15 in 2009 in Copenhagen essentially destroyed the Kyoto architecture and replaced it with a voluntary pledge design



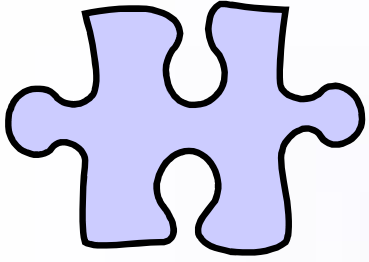


# French controversies about COP-21 in Paris

## Laurent Fabius vs. Ségolène Royal

- COP-21 in Paris with **Laurent Fabius** is expected to execute the voluntary pledges based Copenhagen architecture
  - **INDCs:**  
**Intended Nationally Determined Contributions**
- Last minute effort by **Ségolène Royal**:  
“Call for an ambitious and credible agreement in Paris”
  - **Dauphine University and Toulouse School of Economics**

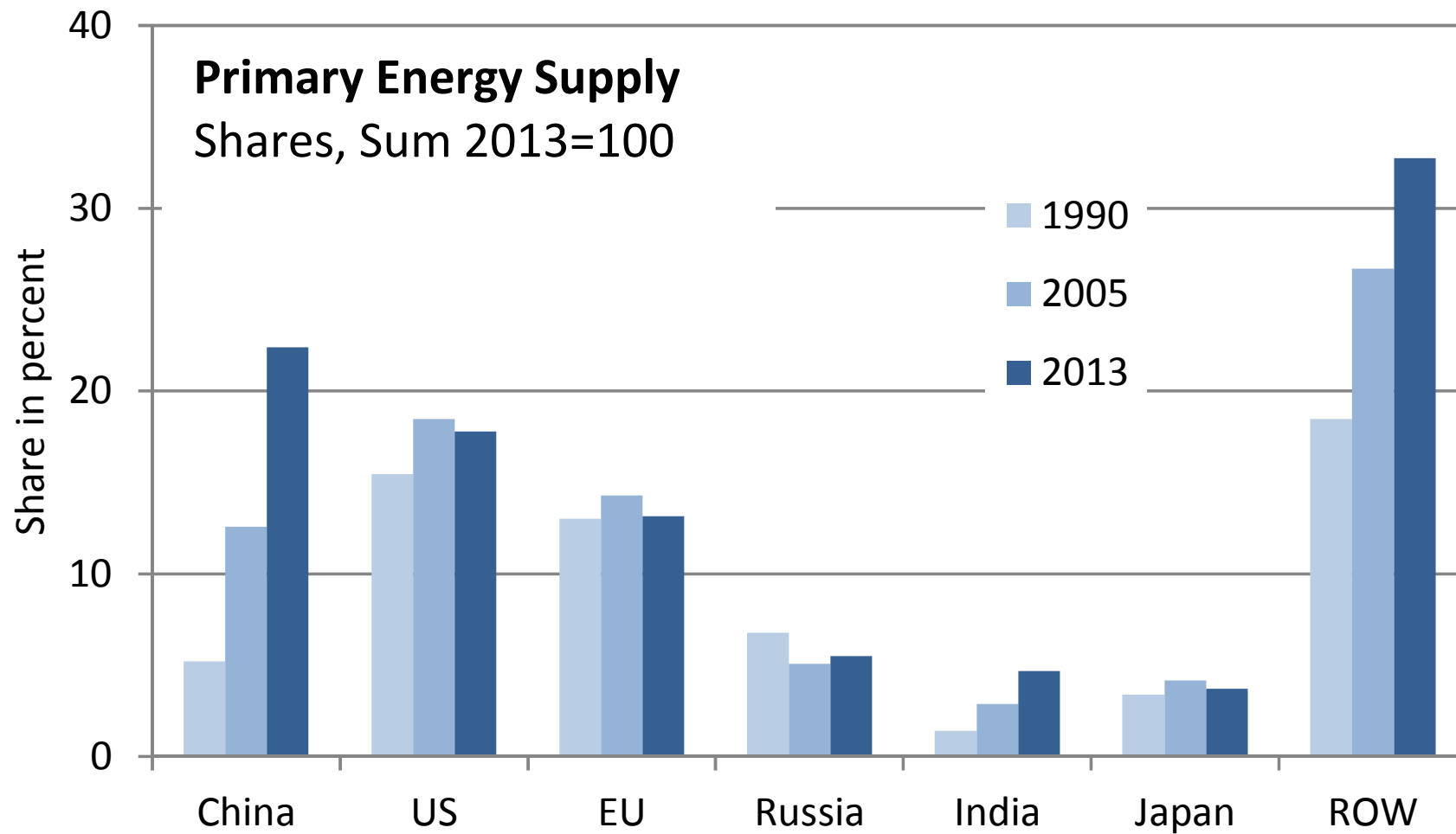




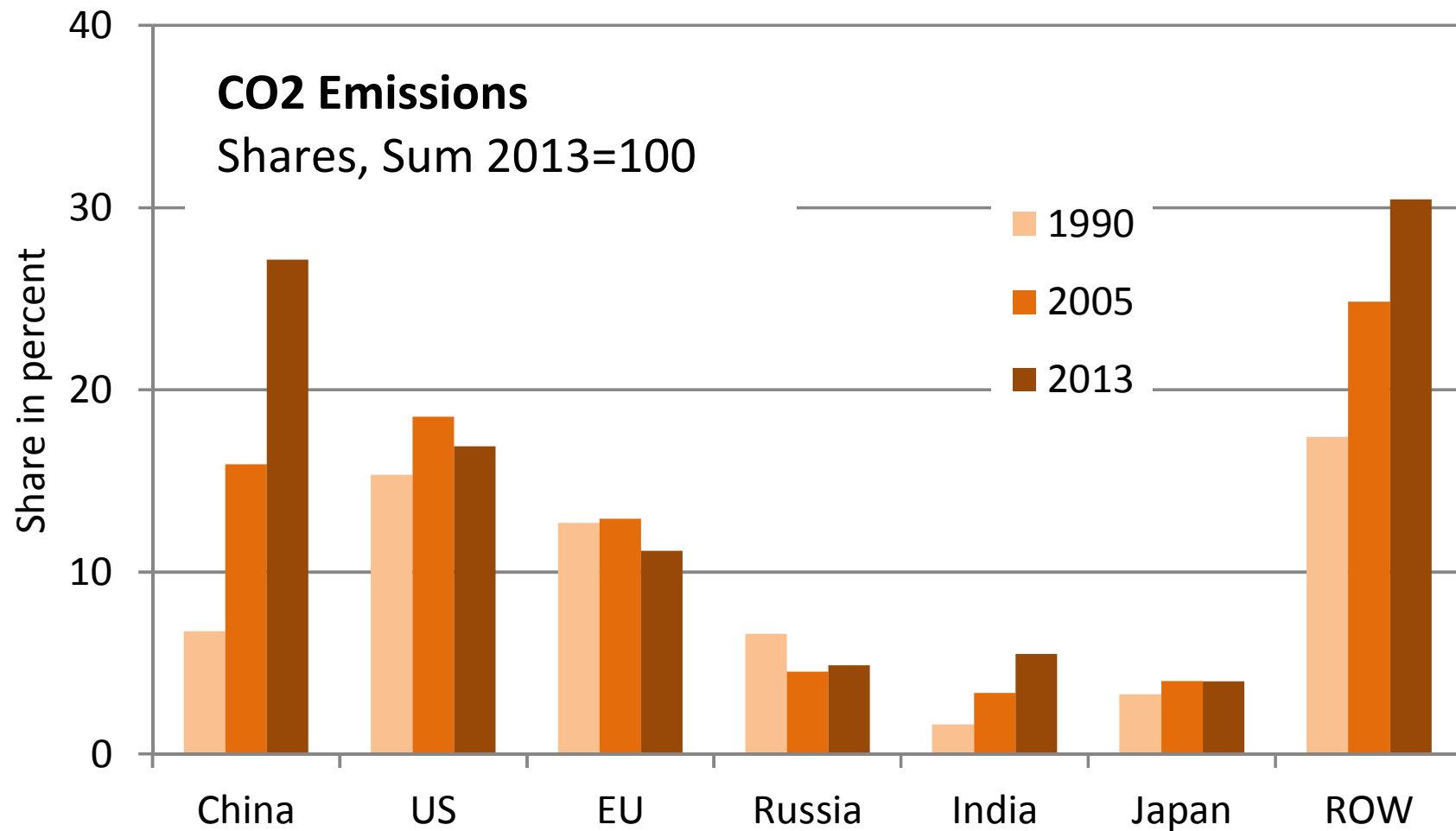
# **Step 1**

## **Getting a better understanding of the facts**

# Global demand for primary energy



# Global emissions of CO2

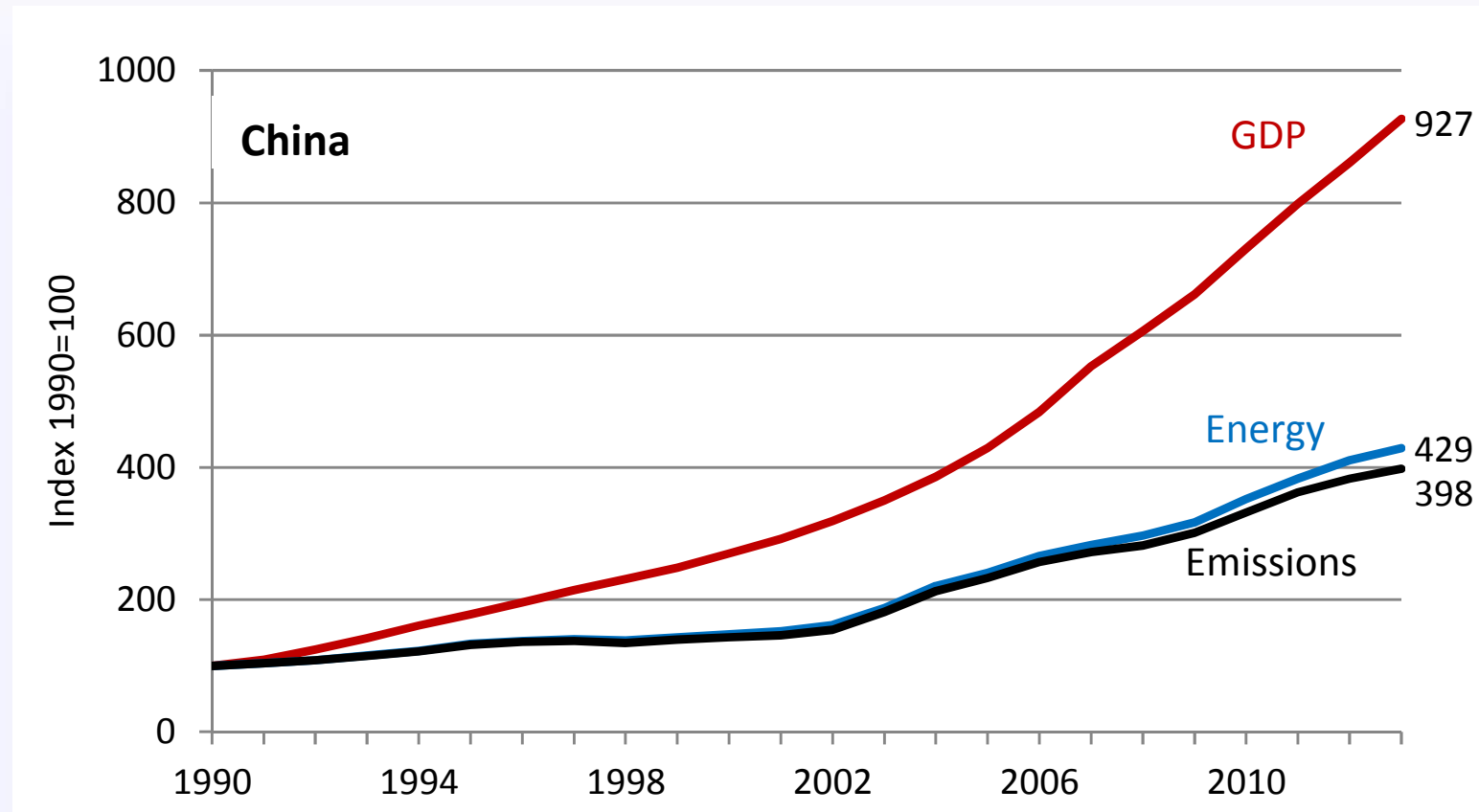




# Modeling the basic indicators of an energy system

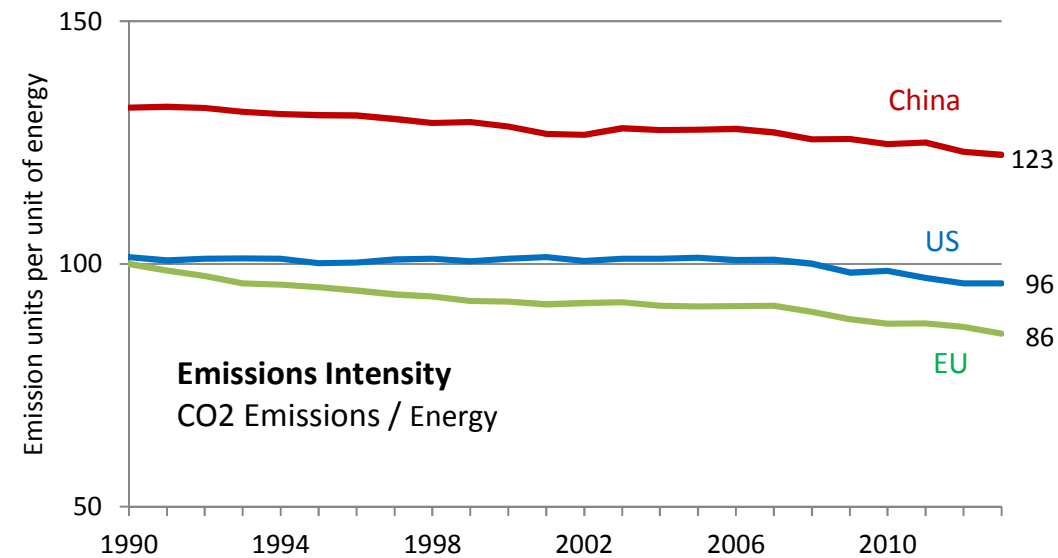
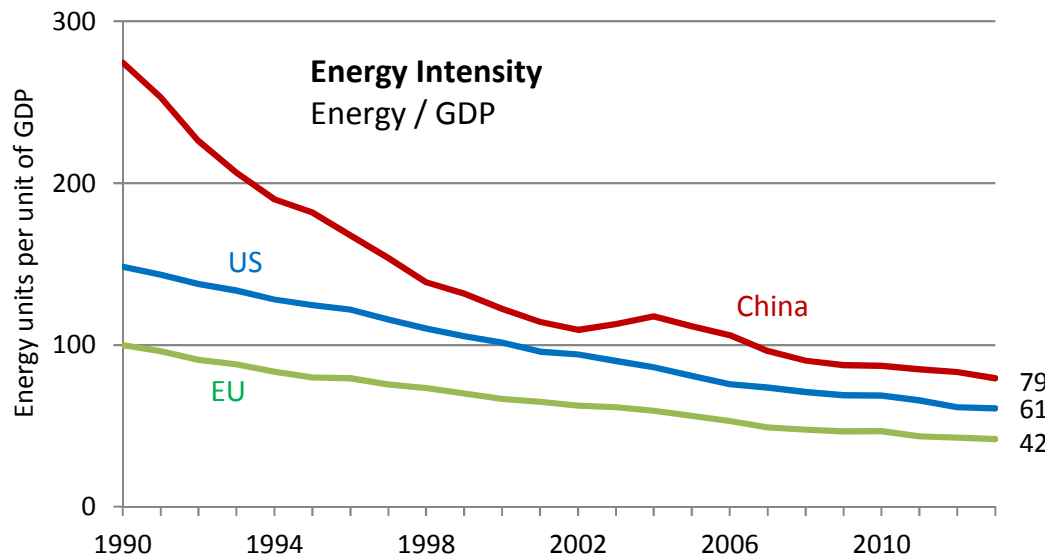
## Energy flows, economic activity, emissions

- **E** Energy
- **Q** GDP
- **C** Emissions



# Basic structural parameters of an energy system

## Energy and emissions intensities



- $(E/Q)$  Energy intensity of GDP
- $(C/E)$  Emissions intensity of energy

# The basic structural model

## Understanding the interactions of energy flows and emissions

$$\text{Emissions} = \text{Emissions Intensity} \times \text{Energy Intensity} \times \text{GDP}$$

$$C = (C / E) \cdot (E / Q) \cdot Q$$

C Emissions  
E Energy  
Q GDP

$$E = E^{\text{fos}} + E^{\text{res}} + E^{\text{nuc}}$$

$$(C / E) = \cdot [1 - (E^{\text{res}} / E) - (E^{\text{fos}} / E)]$$

Carbon intensity of fossils

$E^{\text{fos}}$  Fossils  
 $E^{\text{res}}$  Renewables  
 $E^{\text{nuc}}$  Nuclear

# Understanding the design of policy targets

## The EU targets for 2020 and 2030

(1)  
Emissions

(2)  
Renewables

(3)  
Efficiency

**Emissions = Emissions Intensity x Energy Intensity x GDP**

$$C = (C / E) \cdot (E / Q) \cdot Q$$

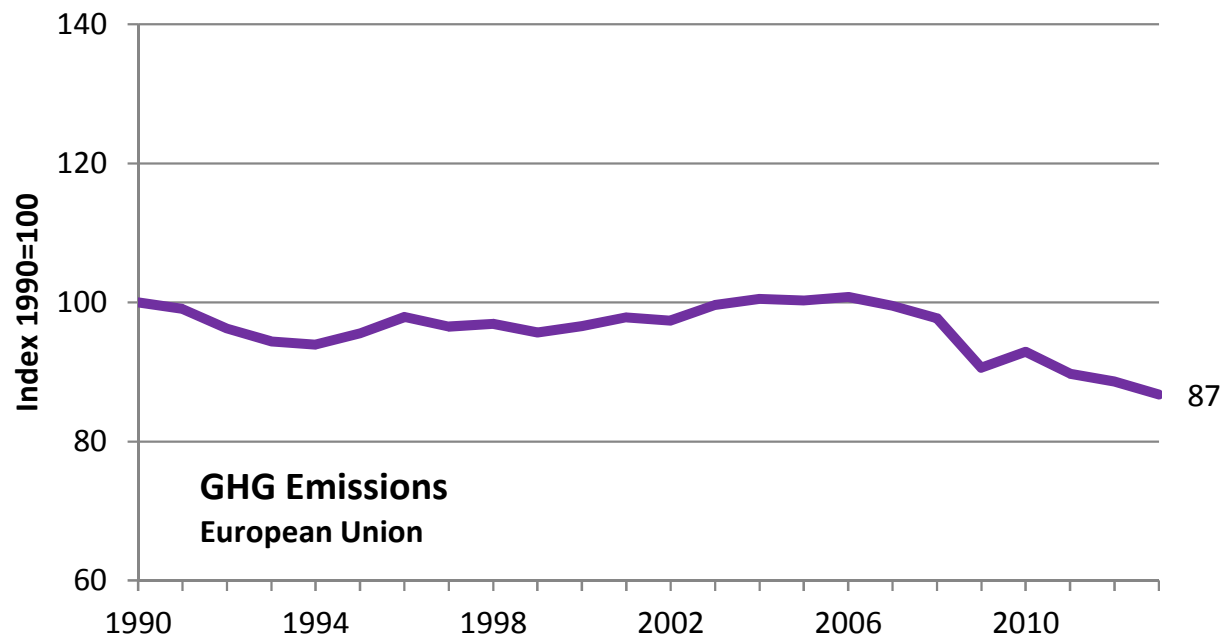
C  
E  
Q

Emissions  
Energy  
GDP

- Cap for emissions
- Share of renewables in energy consumption
- Efficiency of energy use



# Basic structural parameters can be used for explaining CO2 dynamics



**C** Emissions  
(CO<sub>2</sub>)

**E** Energy  
(primary)

**Q** GDP  
(volume)

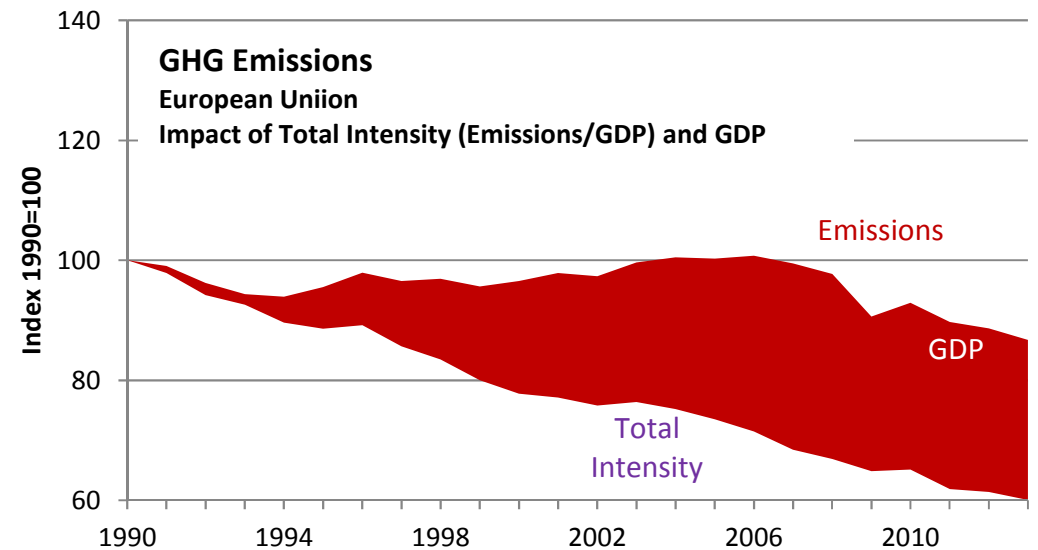
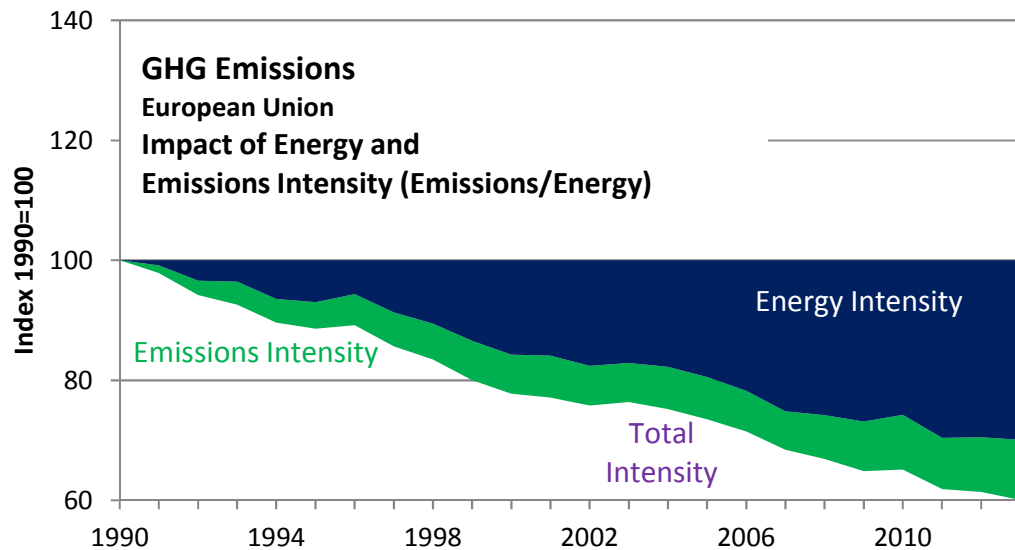
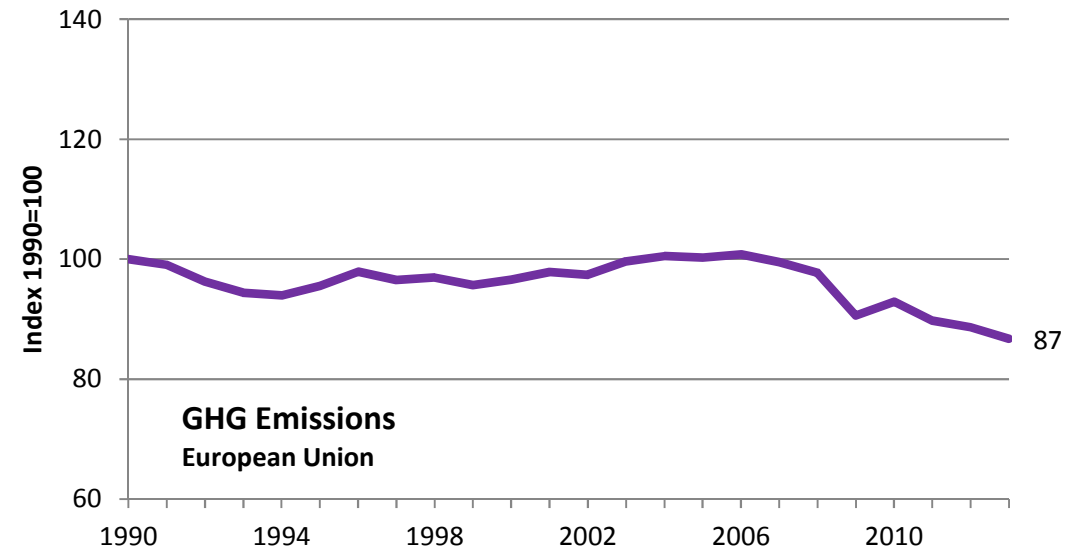
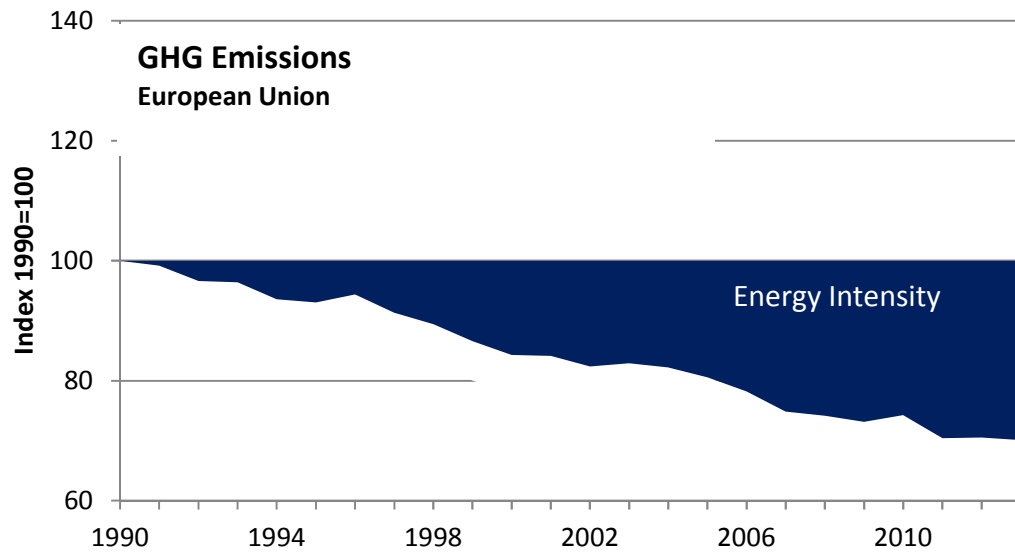
**(C / E)** Emissions intensity of energy  
(impact of renewables)

**(E / Q)** Energy intensity of GDP  
(impact of energy efficiency)

**Q** Economic activity  
(Impact of GDP)

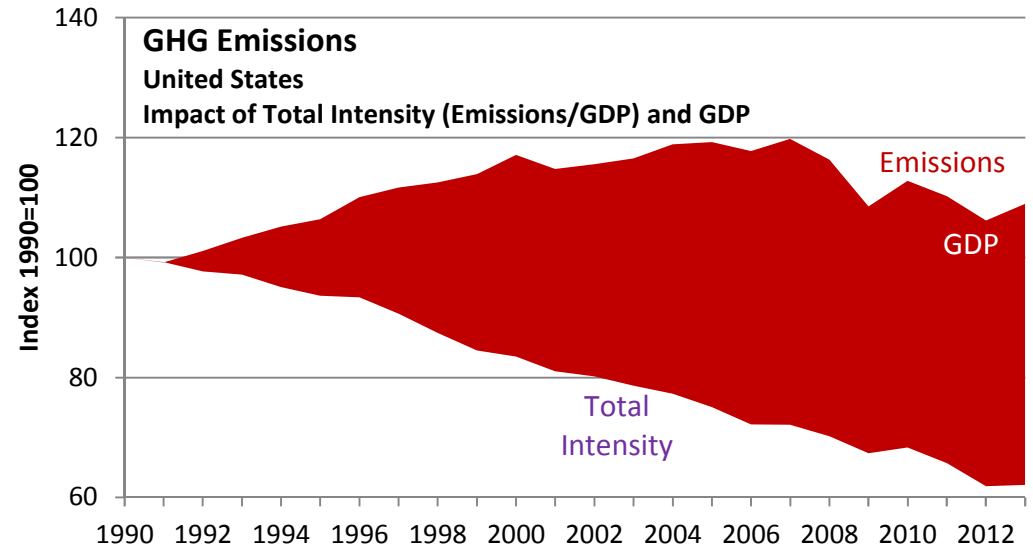
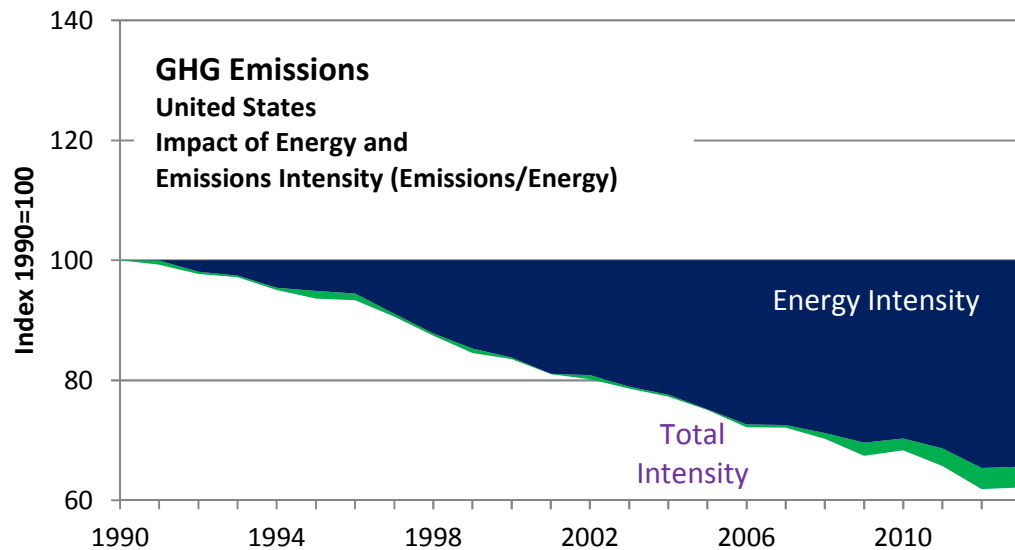
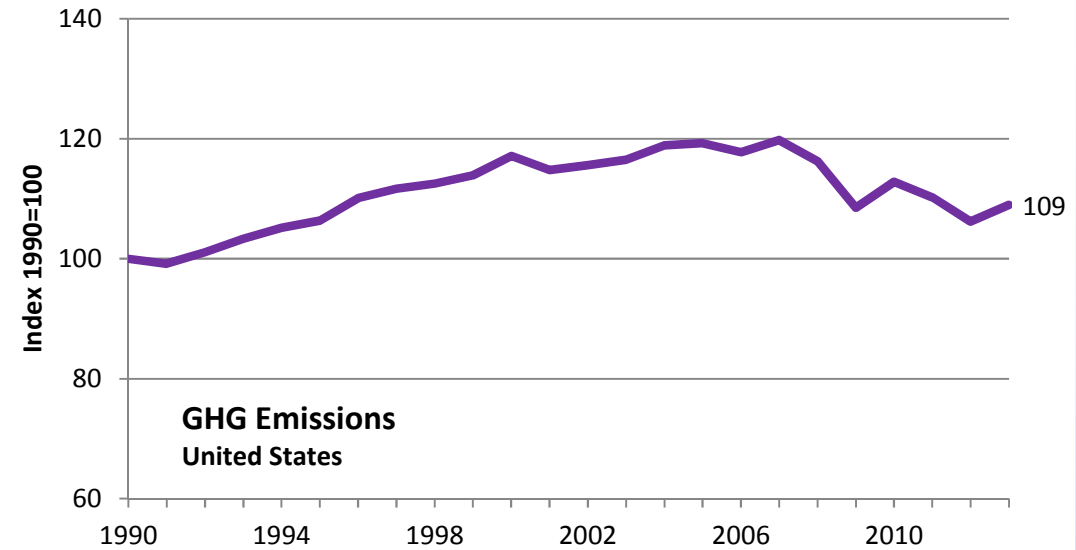
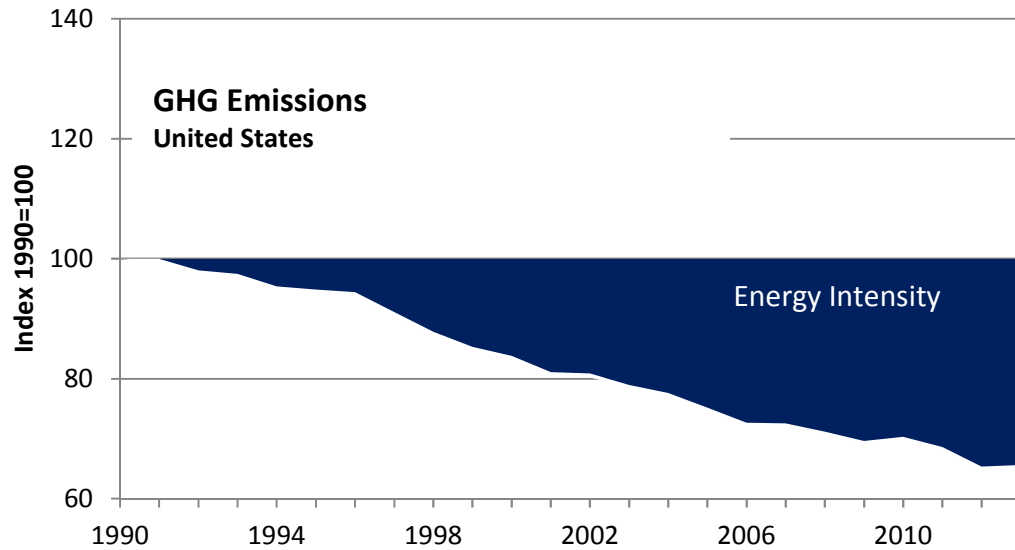
# European Union

## Impact of structural change on emissions



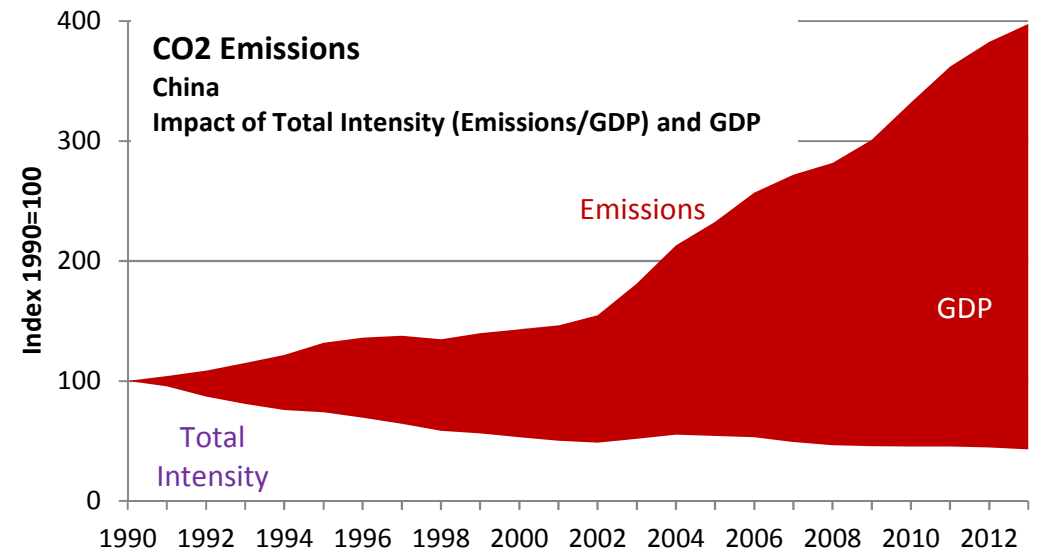
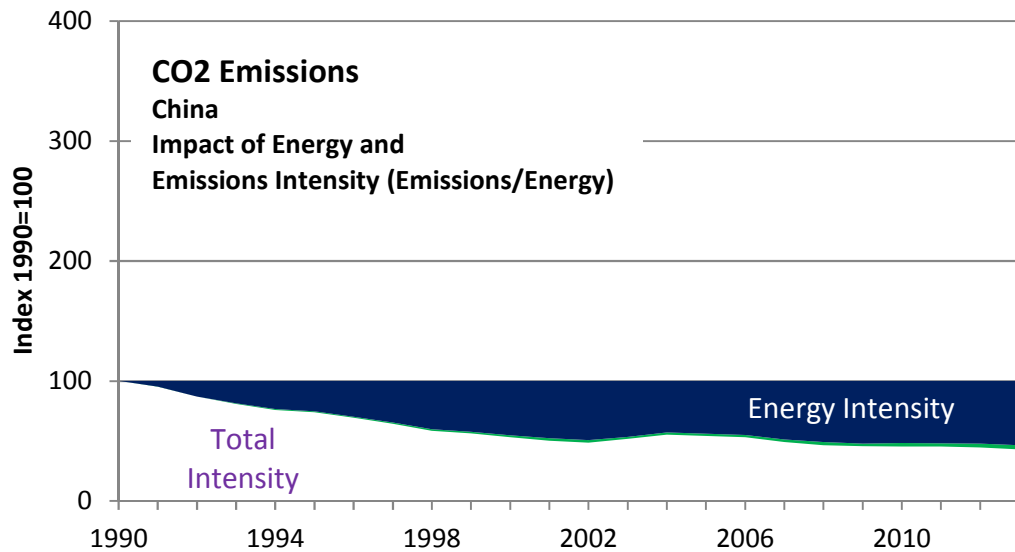
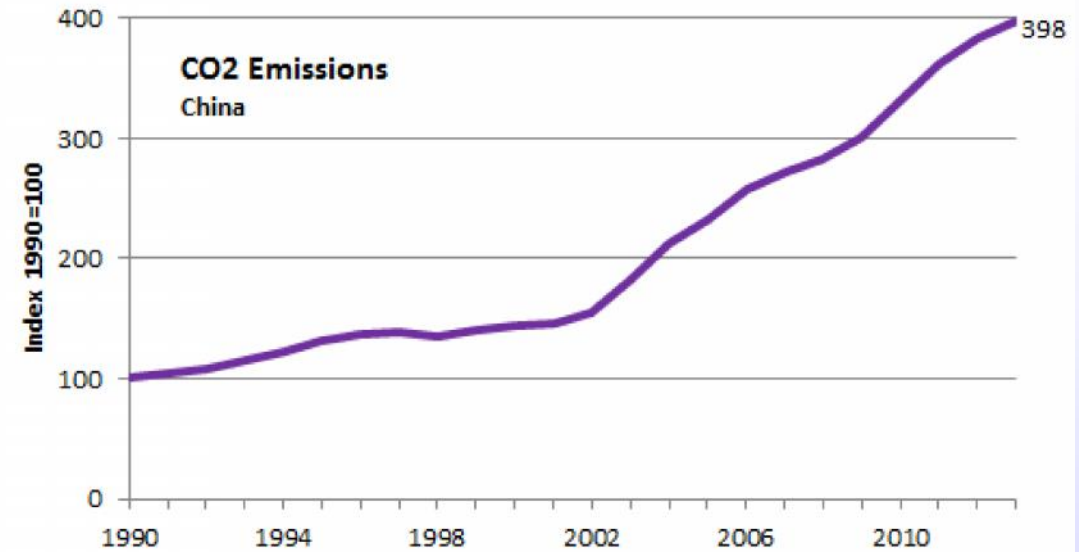
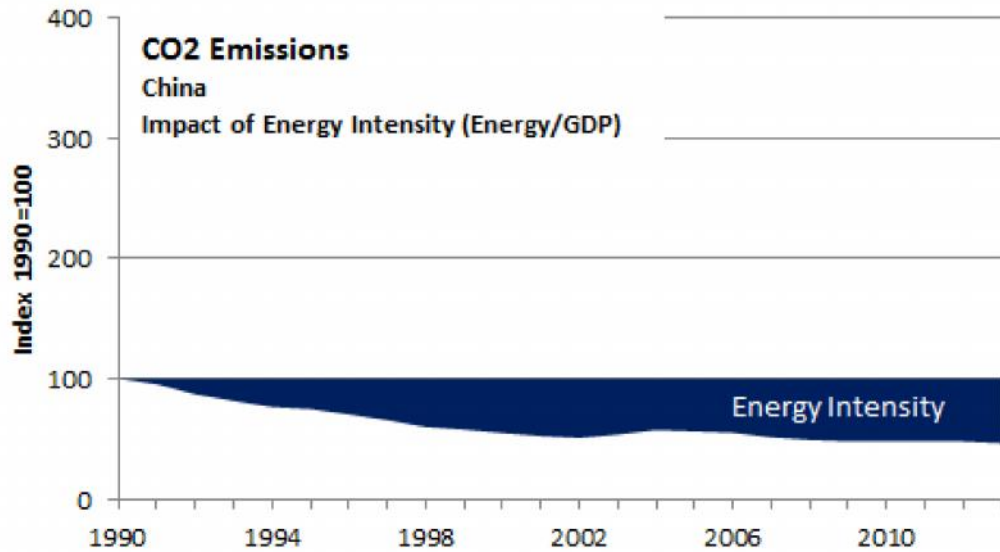
# United States

## Impact of structural change on emissions

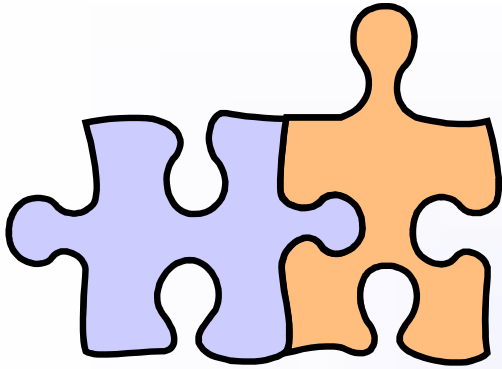


# China

## Impact of structural change on emissions







## **Step 2**

# **Getting ready for breakthrough technologies**

# Buildings

Life Cycle Tower One  
Dornbirn, Austria





# The future of buildings

## It is available already now

- **Wood-hybrid house**
  - 8 floors
- **Extreme low-energy standard**
  - 1/10 of buildings average
- **Modular construction**
  - Prefabricated elements



**Life Cycle Tower One  
in Dornbirn, Austria**





A large industrial additive manufacturing machine, likely a Selective Laser Melting (SLM) system, is shown in a factory setting. The machine is a long, narrow, enclosed structure with glass safety barriers on both sides. Inside, a large, complex metal part is being printed layer by layer. The part has a textured, porous appearance and features several cylindrical protrusions. The machine's interior is illuminated by bright lights, and the background shows other industrial equipment and a factory floor.

# **Big area additive manufacturing**

The future of manufacturing



# A new mindset for mobility and production

## The evolution from transport to mobility

- **Localization of production**
  - Local Motors intends to build micro-factories near big cities
  - Mobile factories wherever demand unfolds
- **New business models**
  - Access instead of ownership
  - Access to the car is sold, not the car itself
- **The next technology stages**
  - Self-steering



# Solar Impulse 2

## Solar-powered, composites-intensive aircraft

- On its Round-the World mission
  - Currently on thr 120-hour leg from Japan to Hawaii





# **Electrical energy storage**

## **Tesla Gigafactory under construction in Nevada**

# The new electricity storage technology

## A breakthrough technology for the energy system

### ■ Full-electric cars

#### ➤ The Tesla S example

- Battery for 85 kWh – could provide over 8 days electricity demand of a household

### ■ New grid-structures for electricity

#### ➤ Steven Chu, former US secretary for energy

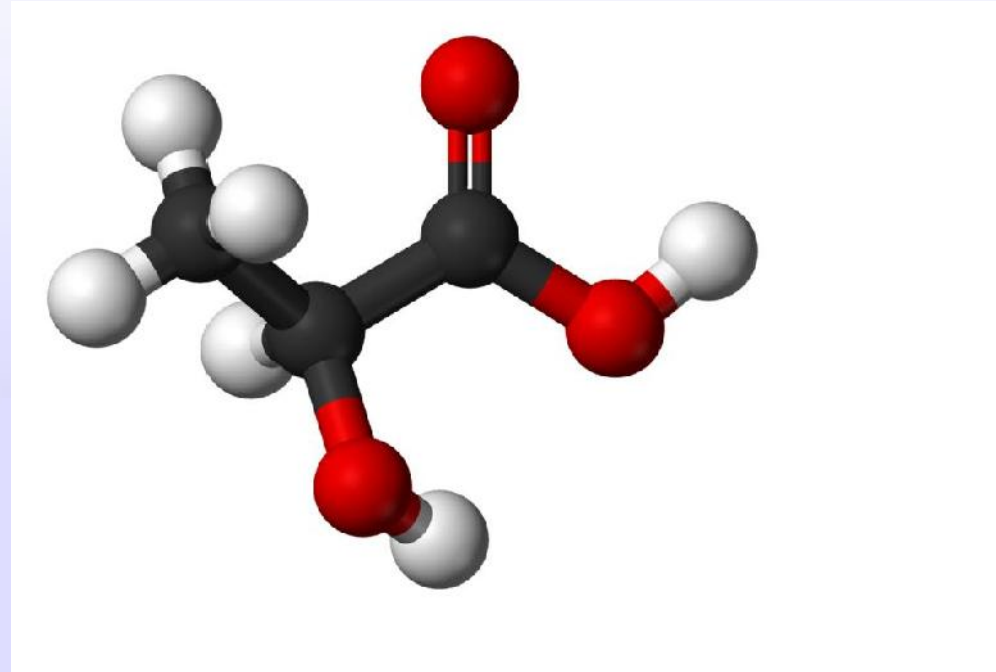
- Distributed Generation for electricity and heat
- Households will install batteries for \$10k to \$12k together with PV and hardly need the grid anymore
- Utilities will install this technology at location of end-users



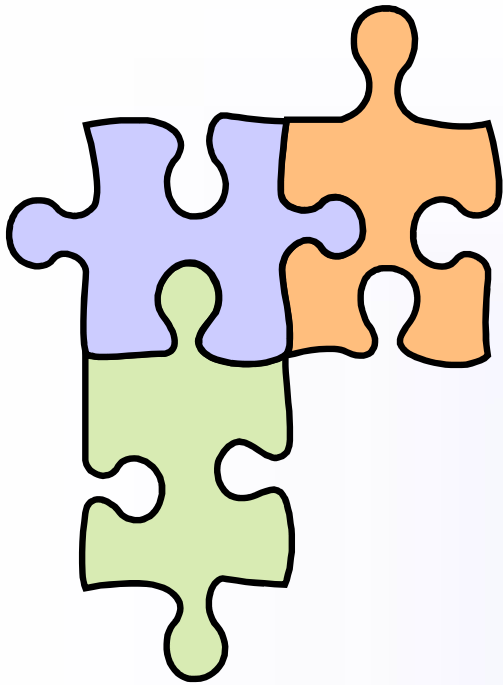
# New materials

## Substitutes for fossil and metallic raw materials

- Phase-out of fossil raw materials
- Polymers from biogenous substances
- Ceramics
- Graphene







## Step 3

A new understanding of  
energy and emissions

# A Copernican (not a German) Energiewende

## Learning to put different questions

- Energy policy with an expiration date  
Looking back through the rear-view mirror

„From where will we get plenty and cheap energy?“

- Energy policy with a problem solving potential  
Looking ahead through the windshield

„What for what will we need how much energy of what quality?“

# What for do we need energy NOW?

2015

16 Losses
27 Mobility
22 Low temperature
17 High temperature
10 Light, motors
8 Non-energ.

We still don't know enough

- The most relevant energy services are rather unknown

# What for will we need energy in the FUTURE?

2050

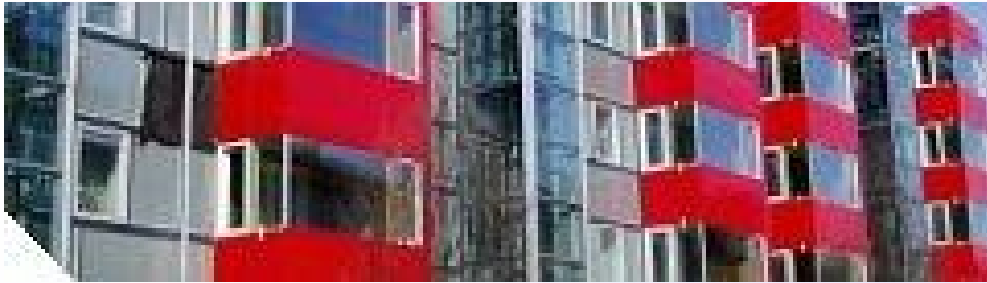
?

We already know quite a bit

- Just look at the emerging energy technologies

# The new buildings

## Energy self-sufficient and plus-energy standards



2015

22 Low  
temperature

2050

6 Low temp.



baumschlager eberle  
2226 House, Lustenau

# The new mobility

## Mobility powered by electricity



2015

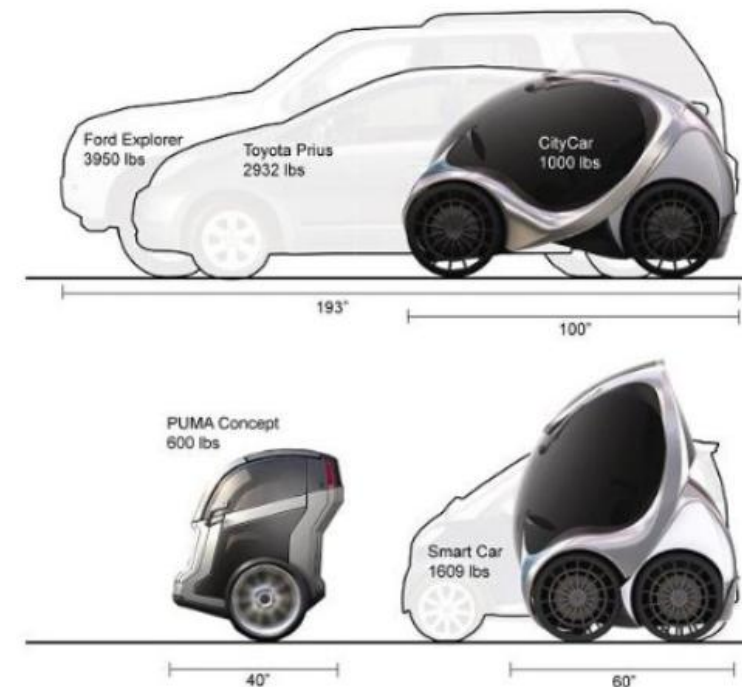


2050

27 Mobility

7 Mobility

- ❑ Plug-in cars serve as a storage of electricity in the grid
- ❑ Mobility services are sold instead of the car



# The new energy supply technologies

## Efficient transformation and distribution



GE Jenbacher

Vaillant fuel cell



2015

2050

16 Losses

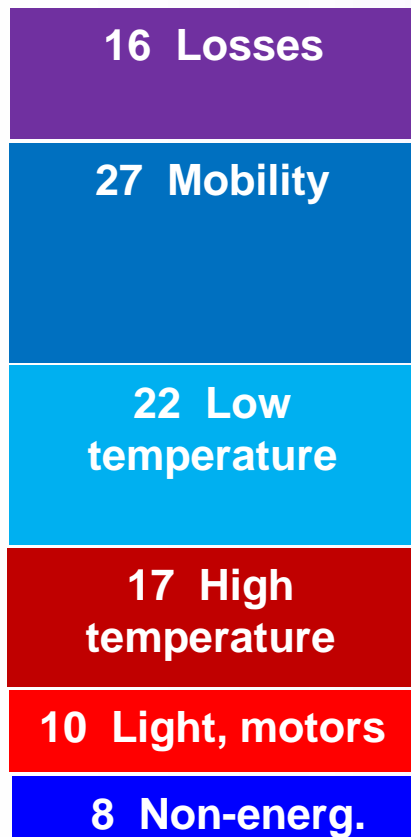
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- ❑ Combined generation of electricity and heat
- ❑ Renewables
- ❑ Distributed Generation
- ❑ Smart Grids

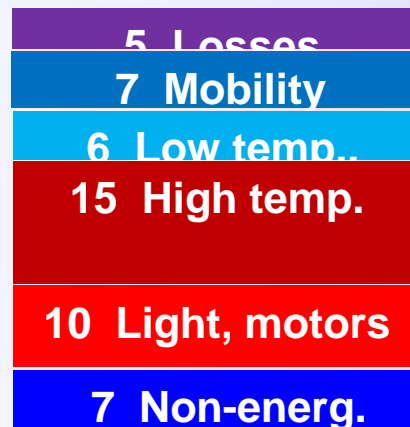
# The emerging energy system for 2050

## Efficiency and renewables

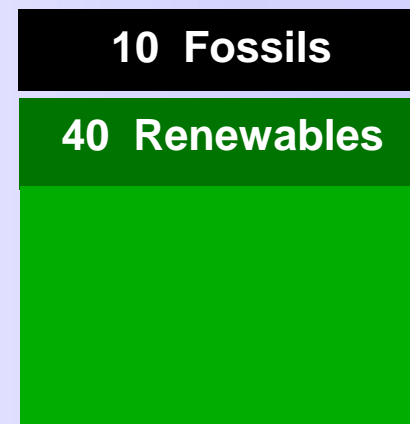
2013



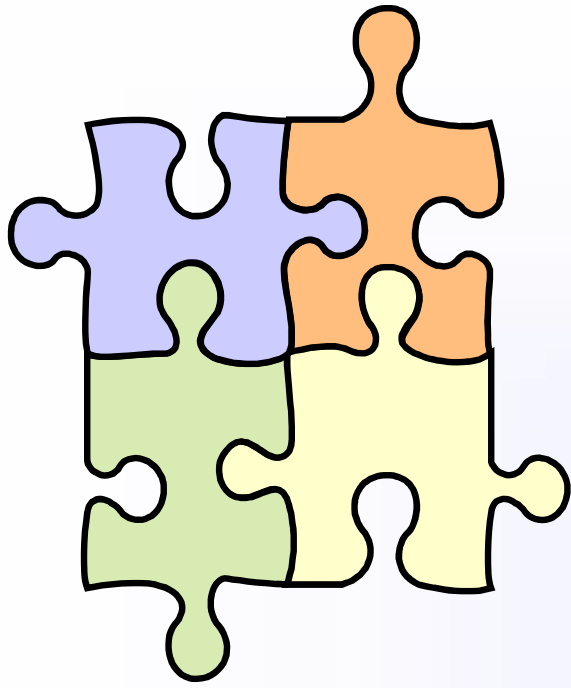
2050



2050







**Some (seemingly)  
provocative suggestions**

(1)

# Realize that the pillars of current EU energy & climate policy are collapsing

- **EU Emissions Trading System can't be revived**
  - Surplus of two years emissions in the carbon market by 2020
- **EU energy and climate targets for 2030 are close to useless**
  - GHG emissions target is vulnerable to economic activity
  - No effort sharing among Member States for renewables
  - Energy efficiency target is redundant and not operational



(2)

## Be prepared that the climate deal in Paris 2015 will be a no deal

- The outcome of Paris is (more or less) already negotiated
- The magic keyword INDCs:  
Intended Nationally Determined Contributions
  - Pledges for emissions reductions were due until March 31



**(3)**

## **Insist that the ongoing economic crisis in Europe needs a different policy design**

- **Innovation should become the new keyword for all areas of policy actions**
- **Innovative policies of ECB and EIB are required**
  - **Targeted project funding**
- **Innovating EU infrastructure**
  - **Building stock**
  - **Mobility system**
  - **Production technologies**
  - **Energy supply infrastructure**
- **Innovative designs for our cities**

**(4)**

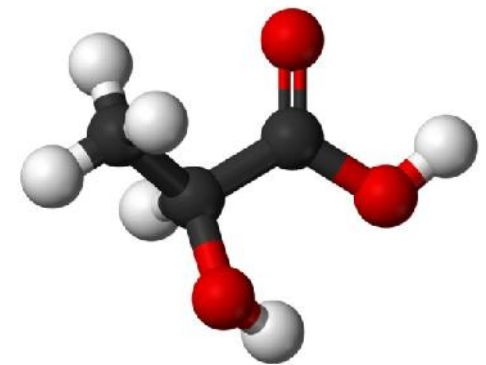
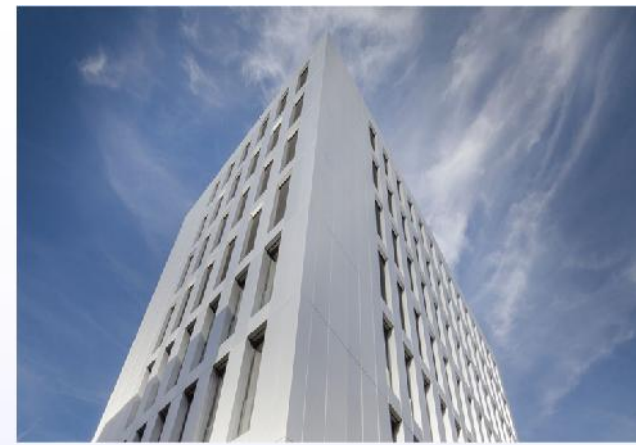
## **Push innovation policies for implementing the current energy and climate policies and targets**

- **In the wind shadow of the other innovation driven policies all currently envisaged energy and climate targets can easily be met**

**The end of  
climate policy  
(as we knew it)**



**The future  
of climate  
policy  
(as we would  
need it)**



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**Thank you**