ETH zürich

Problems of the energy system and role of the state

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Pasargad Summer School 2017

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Content

A. Problems of the energy system

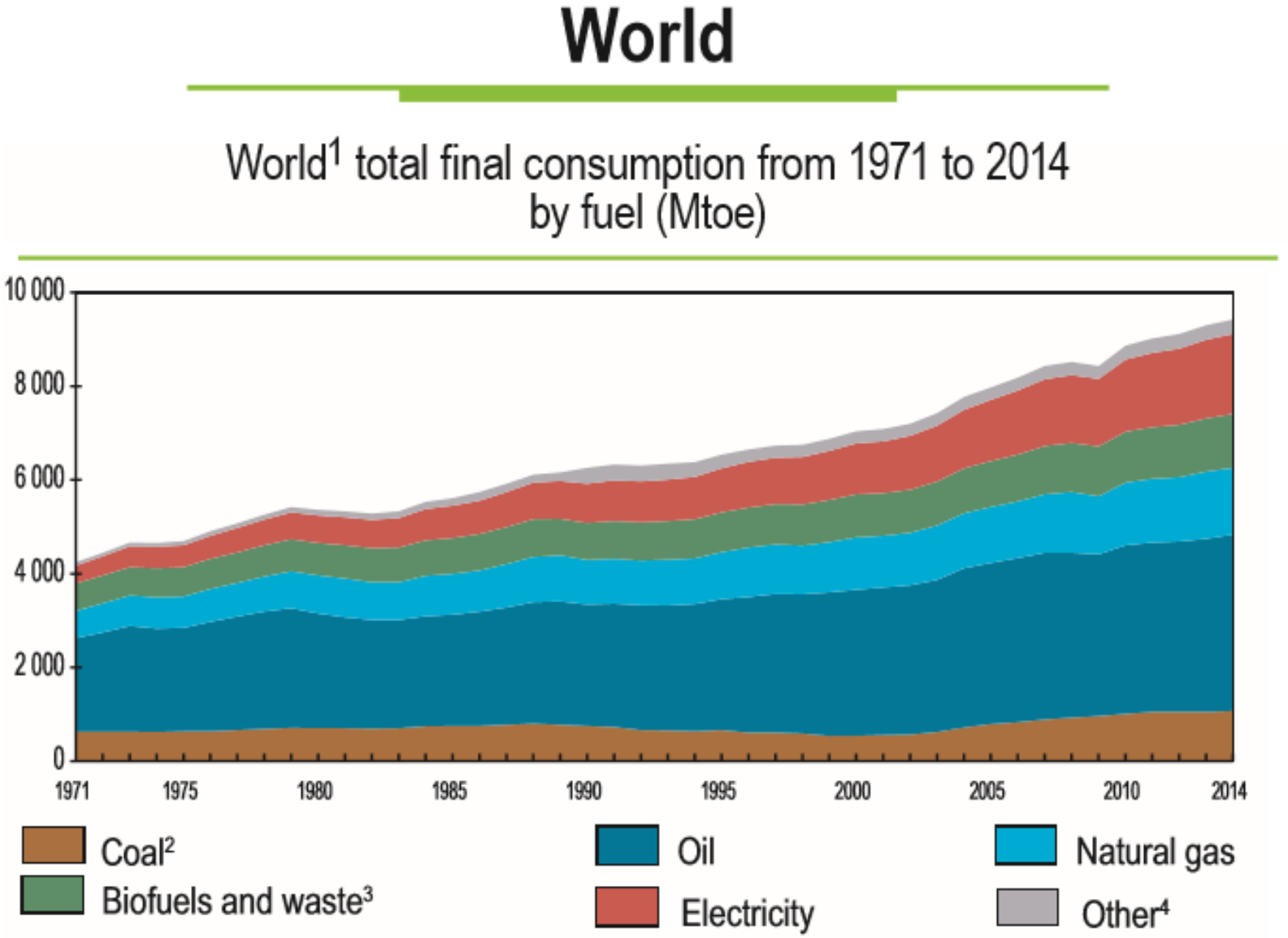
B. Market and behavioural failures and energy policy

- Fossil fuels

➢ *Environmental problems*

➢ *Inefficiency in the use*

➢ *Regional variation in the consumption and CO2 production*

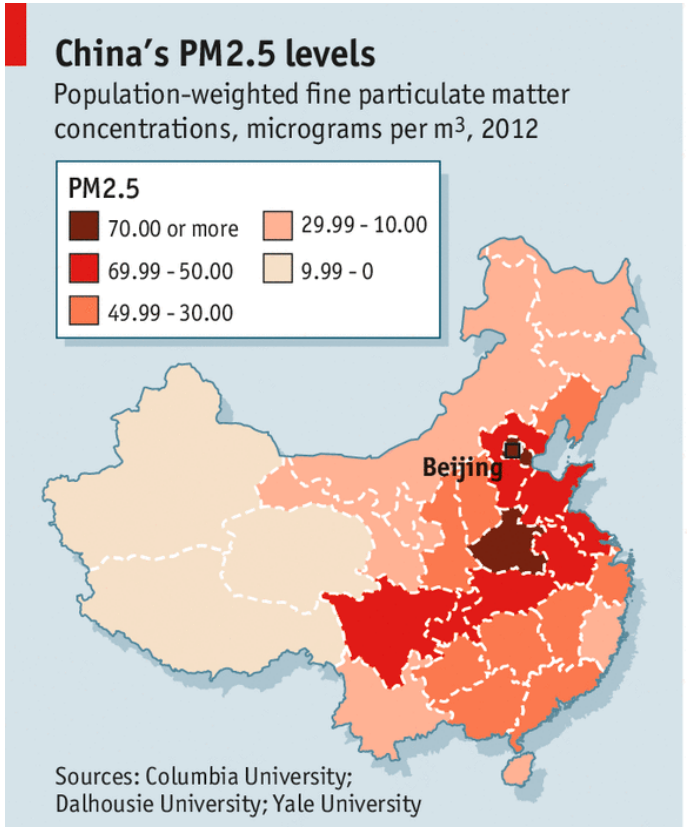


IEA (2016). Key World Energy Statistics

Global environmental problem

CO2 Emissions
Climate change
Damages
Negative economic impact on GDP

Local environmental problem



Air pollution and the negative impact on health

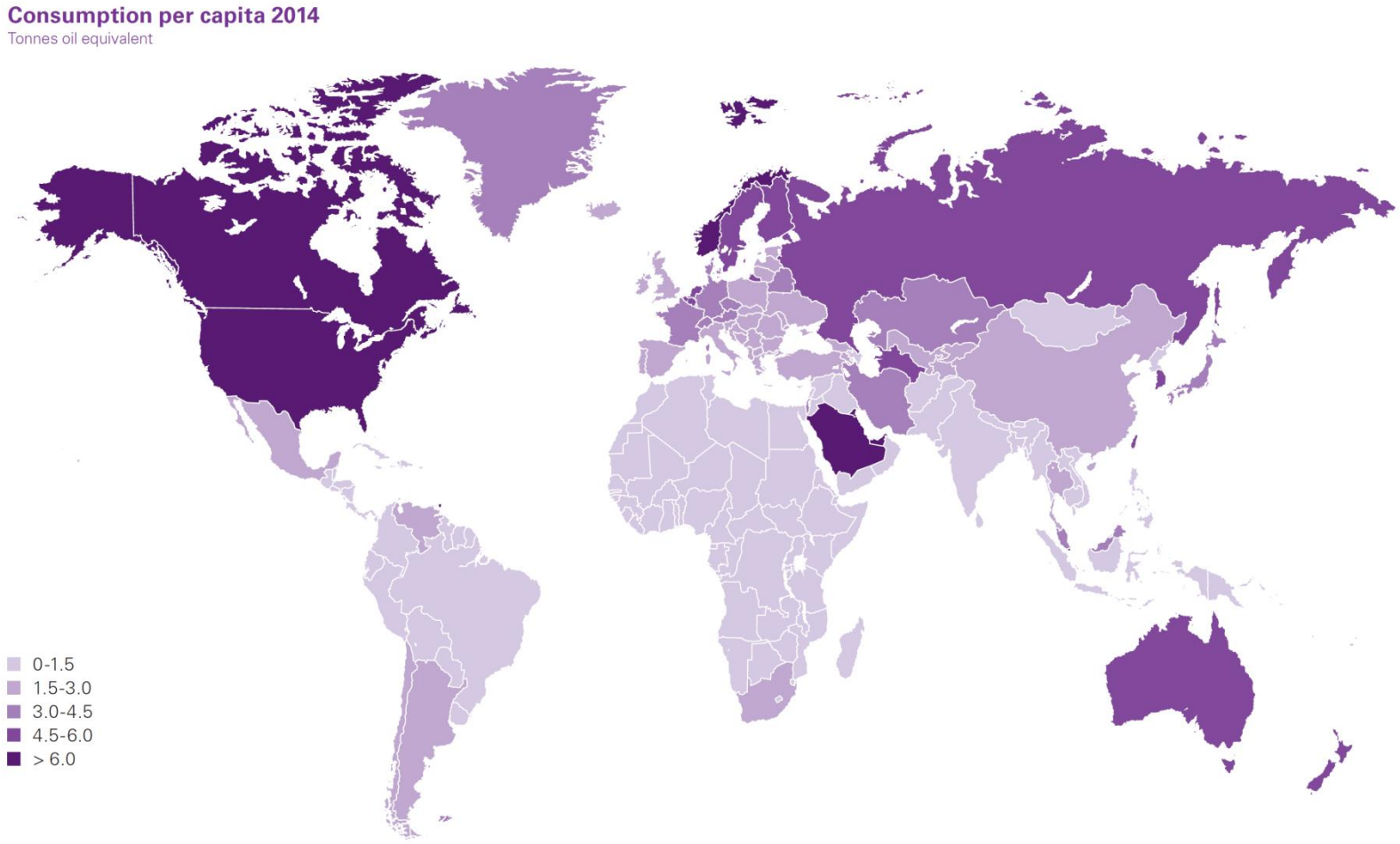
Tehran shuts schools as thick smog is linked to hundreds of deaths

Authorities in Iranian capital forced to take emergency action amid unprecedented levels of air pollution

Tehran's Milad tower behind a blanket of brown-white smog. Photograph: Atta Kenare/AFP/Getty

https://www.theguardian.com/world/2016/nov/15/tehran-shuts-schools-thick-smog-kills-hundreds-people-iran?CMP=share_btn_link

Regional variation in the energy consumption per capita



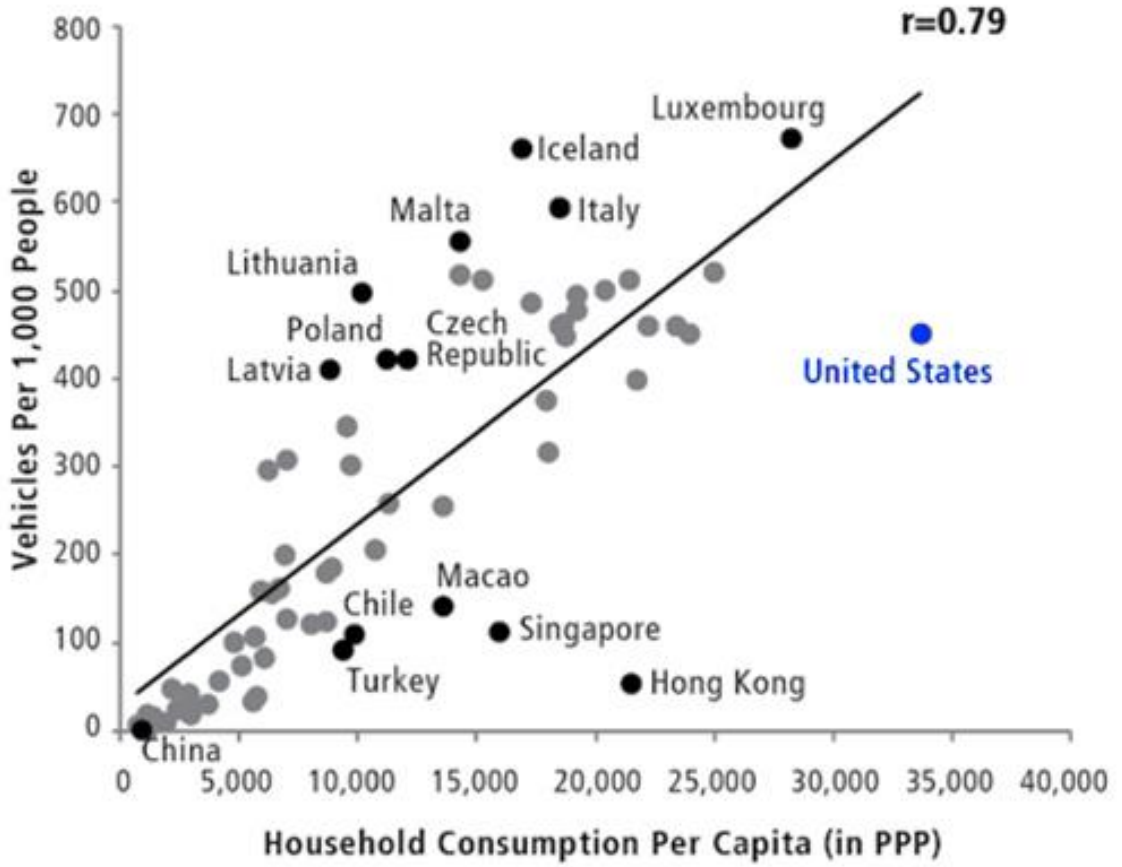
Source: BP Statistical Review of World Energy (2015)

Regional differences (2014)

Country	Population	Electricity consumption per capita (MWh)	t CO_2 per capita
USA	319.17 mio	12.96	16.22
China	1,364.12 mio	3.93	6.66
India	1,295 mio	0.8	1.56
Iran	78.14 mio	3.00	7.12
Switzerland	8.19 mio	7.52	4.61

Source: IEA

Number of vehicle per inhabitant



Which technologies?

The potential for increased vehicle ownership in emerging markets is enormous

Source: **Carnegie Endowment for International Peace*(2012)***

Inefficiency in the use of energy (waste of energy)

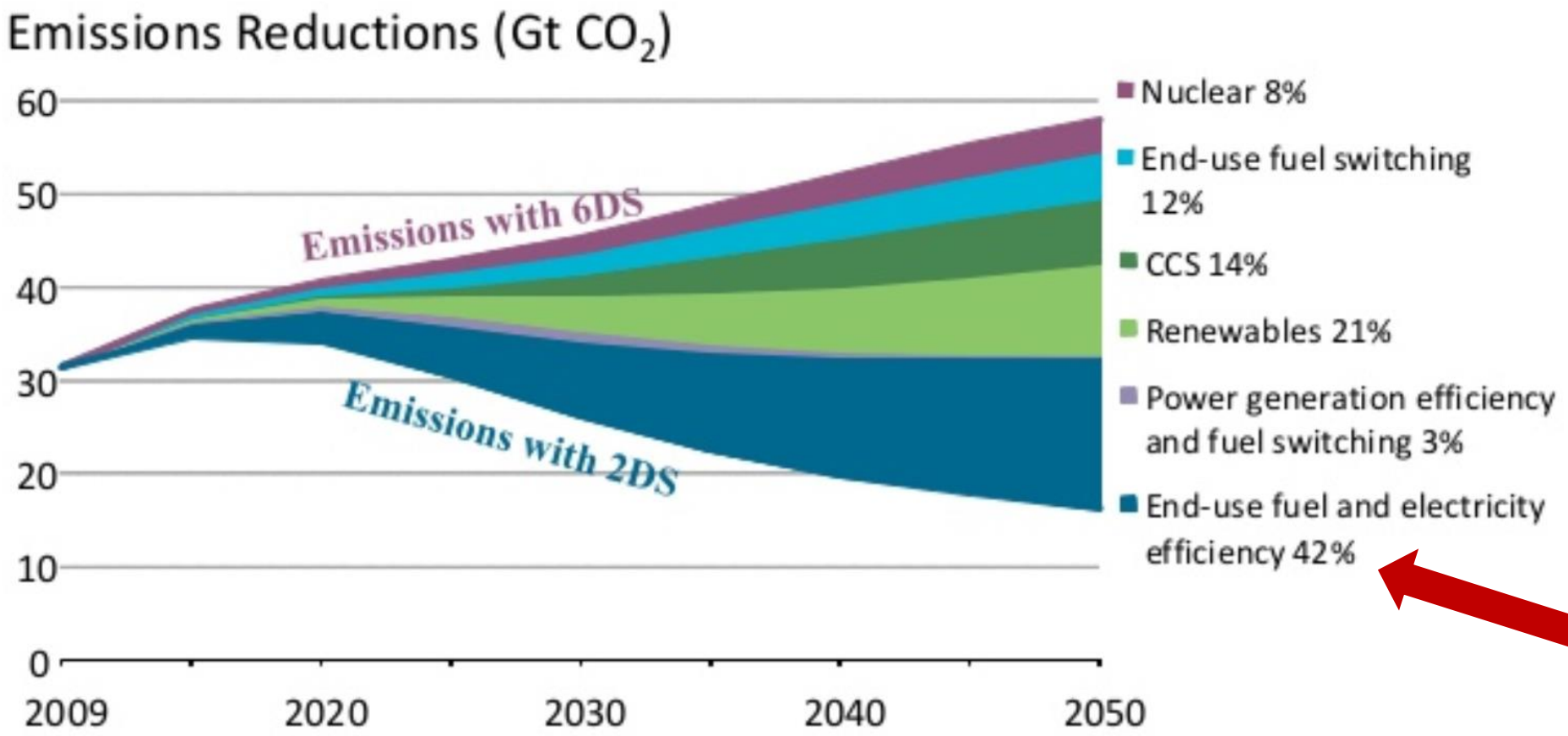
- **Energy inefficiency** at the country level (Filippini and Hunt (2011): OECD up to 20%)

- **Energy inefficiency in the residential sector** (Alberini and Filippini (2015): US up to 20%; Blasch et al (2016): CH up to 20%) is identified as being one of the areas **with the greatest potential for energy savings**

  ↳ old heating systems, electrical appliances, cars, …(non-optimal investments)

  ↳ non optimal use of heating systems, appliances (non-optimal behavior)

Portfolio of decarbonizing measures (IEA)



«The cheapest and cleanest energy choice of all is not to waste it»

The Economist

World politics | Business & finance | Economics | Science & technology | Culture

Special report: Energy and technology

Energy efficiency

Invisible fuel

The biggest innovation in energy is to go without

Jan 17th 2015 | From the print edition

Timekeeper

THE CHEAPEST AND cleanest energy choice of all is not to waste it. Progress on this has been striking yet the potential is still vast. Improvements in energy efficiency since the 1970s in 11 IEA member countries that keep the right kind of statistics (America, Australia, Britain, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands and Sweden) saved the equivalent of 1.4 billion tonnes of oil in 2011, worth $743 billion. This saving amounted to more than their total final consumption in that year from gas, coal or any other single fuel. And lots of money is being invested in doing even better: an estimated $310 billion-360 billion was put into energy efficiency measures worldwide in

- All countries around the world are implementing

  energy efficiency policy instruments

- **Improving energy efficiency using energy policy instruments** is one of the most cost-effective ways of

  ↳reducing CO_2 emissions and air pollution

  ↳increasing security of energy supply

Content

A. Problems of the energy system

B. Market and behavioural failures and energy policy

Main reasons for the problems

- **Market and Behavioral failures**

  - Negative externalities: polluter-pay-principle doesn't work; energy prices are too low)

  - Public good: the athmosphere is a common ressouce (not excludable and rival good ➔ available free of charge and one person's use of it reduces other people's use ➔ free-rider problem

  - Information problems

    - Bounded rationality (People make decisions using limited information and with cognitive constraints in processing information ➔ inefficient decisions
    - …

Energy policy

- Correcting market and behavioral failures in order to improve the **security of supply**, to **reduce the negative impacts** on the environment of the energy use and to promote the **competitiveness of the energy sector**

➔ Energy policy should be designed to maximize the net benefits to society

➔ However, to keep in mind that sometimes we observe state failures (ineffective policy measures)

Energy policy: general goals

Security of supply

Diversification of producers, renewable energies,...

In search of a balance...

Economical supply

Incentive regulation, Deregulation of markets,...

Ecological supply

Standard, energy efficiency, renewable energies, ecological fiscal reforms...

Energy Policy instruments

Market-oriented instruments (economic instruments)

- Energy taxes (e.g. pollution charges), Tradable permits to pollute, subsidies, assigning property rights, feed-in tariffs, green certificates,…

Non-Market-oriented instruments

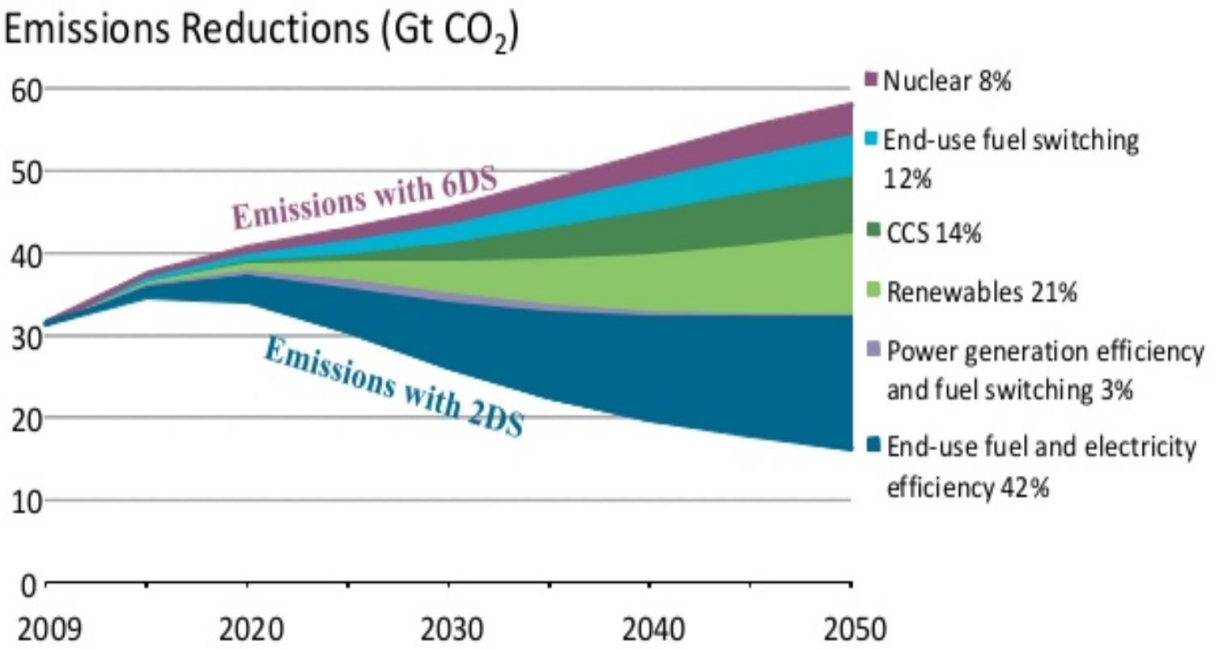
- **Traditional regulation ('command & control')**
  - ↳ Emission standards, technology standards, fuel quality standards
- **Promotion of information and education**
  - ↳ Labelling, information and educational campaigns or rating and certification..
- **Voluntary/negotiated approaches**
  - ↳ E.g. an industry makes a voluntary agreement with government to avoid a new law, …

Policy recommendation

- ***In case of market failures***
- Pollution taxes
- Subsidies for the adoption of new «clean» technologies

- ***In case of behavioral failures***
- Instruments to promote consumer empowerment (information, labels, audit, educational programs,….)
- Nudges, social norms
- Standard

- *Find the best second best solution ➔ mix of instruments*



- Definition
- How to measure
- Impact of the level of energy investment related literacy (financial literacy)

Appendix

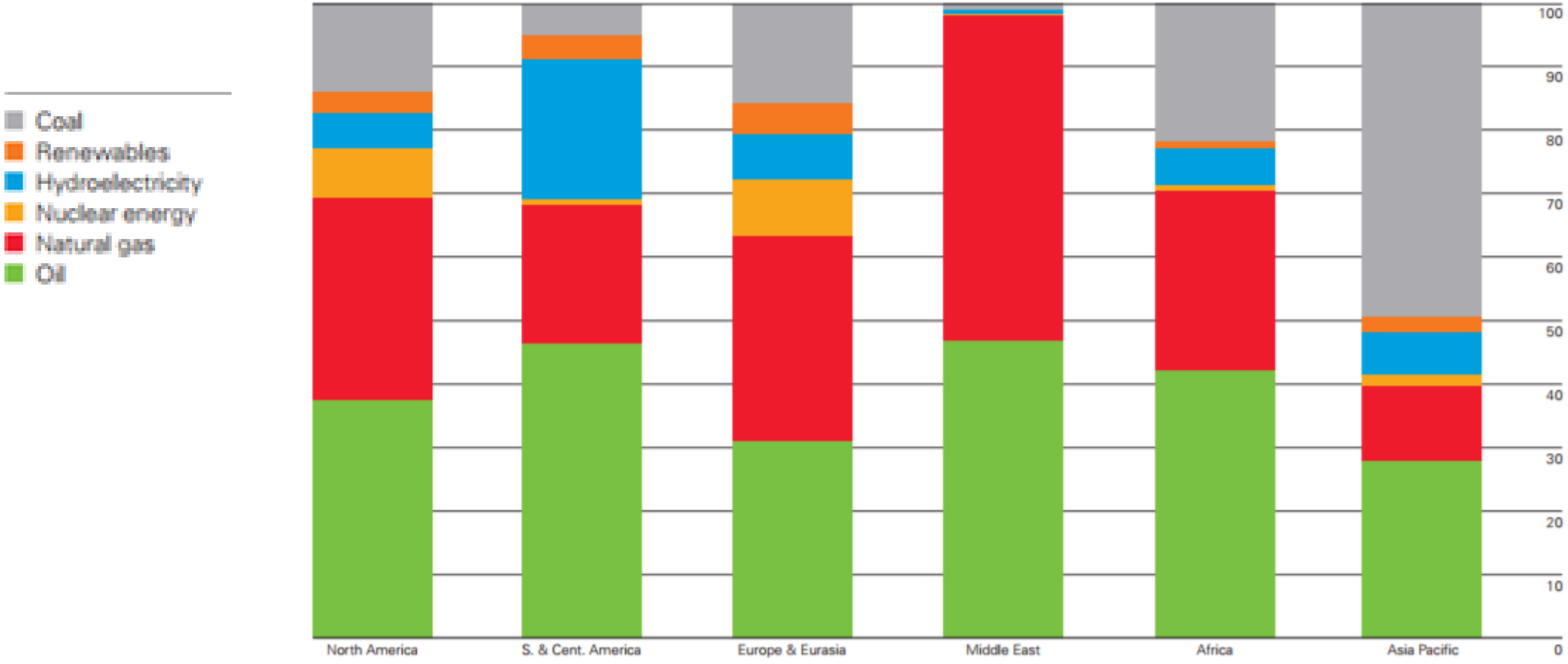
Market failures and instruments

Type of market failure	Possible market oriented instruments
Environmental externalities common resources	• Emission taxes • Tradeable emission permits • Property rights
Fuels (Fossil fuels) import Dependence	Oil import tax, subsidy
• Learning by doing spillovers • R&D spillovers • First adopters of new technologies	• Subsidies for R&D • Subsidies for consumers
• Consumers' lack of economic information about energy-efficient technologies • Asymmetric information • Principal–agent	• Information campaigns • Subsidy for consultancy • Subsidy for landlords for energy efficiency investments • Institutional arrangements

Behavioral failures and instruments

Type of behavioral failure	Possible policy instruments
Bounded rationality	Education, information campaigns, standards
Heuristic decision rules	Education, information campaigns, standards
Prospect Theorie (loss aversion) losses and gains are valued differently ➔status quo	Education, information campaigns, standards

Regional Primary Energy Consumption 2016



Source: BP Statistical Review of World Energy (2017)