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# A new EU energy technology policy towards 2050: Which way to go?

Sophia Ruester

Università degli Studi di Firenze

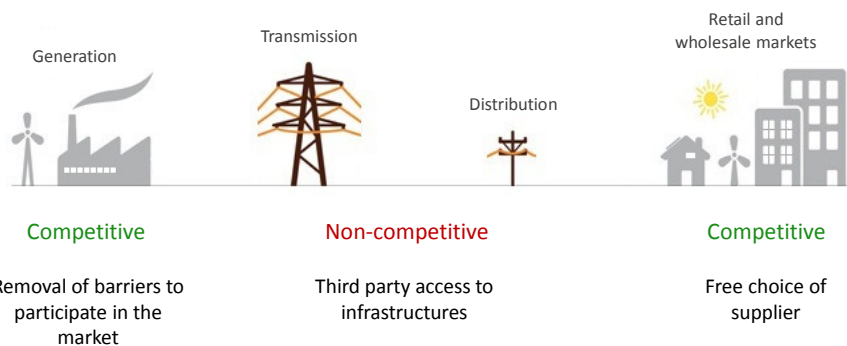
9 Ottobre 2013

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## Liberalization of the electricity sector

1996 - 2003 - 2009

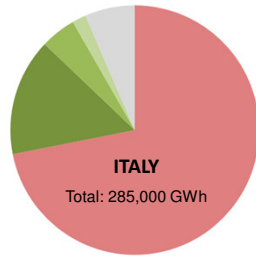
Independent (inter-)national regulators



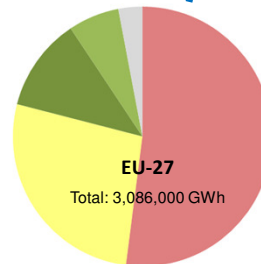
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## Electricity generation by source 2012 data (Eurostat database)



- Fossil fuels
- Hydro
- Wind
- Geothermal
- Other



- Fossil fuels
- Nuclear
- Hydro
- Wind
- Other

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## THINK Report #9

**“A new EU energy technology policy towards 2050:  
Which way to go?” (Published in February 2013)**



**Project leader:** Matthias Finger  
**Research team:** Sophia Ruester, Sebastian Schwenen and Jean-Michel Glachant

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# 1 – Background

The decarbonization objective



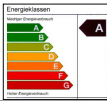
Different scenarios for decarbonization

Need for a new EU energy technology policy

## The 20-20-20 targets

... by 2020

Set in 2007...

<p><b>20%</b> reduction in EU GHG emissions compared to 1990 levels</p> 	<p><b>20%</b> share of EU energy consumption produced from RES</p> 	<p><b>20%</b> improvement in the EU's energy efficiency</p> 
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... and enacted through the “EU Climate and Energy Package” in 2009

- Revision and strengthening of EU ETS (Directive 2009/29/EC)
- Effort Sharing Agreement governing GHG emissions from sectors not covered by the EU ETS (Decision 406/2009/EC)
- Binding national targets for renewable energy (Directive 2009/28/EC)

## Commitment to the low-carbon economy ... by 2050

- In 2009, the European Council set the abatement objective for Europe at 80-95% below 1990 levels
- In 2011, the European Commission adopted the EU "Energy Roadmap 2050"

GHG reductions compared to 1990		2005	2030	2050
Power	CO2	-7%	-54 to -68%	-93 to -99%
Industry	CO2	-20%	-34 to -40%	-83 to -87%
Transport (incl. aviation, excl. maritime)	CO2	30%	+20 to -9%	-54 to -67%
Residential and services	CO2	-12%	-37 to -53%	-88 to -91%
Agriculture	Non-CO2	-20%	-36 to -37%	-42 to -49%
Other Non-CO2 emissions	Non-CO2	-30%	-72 to -73%	-70 to -78%

## Background The decarbonization objective

- "2050 objective": Commitment to reduce GHG emissions to **80-95%** below 1990 levels by 2050

↓ implies

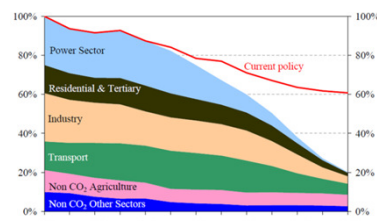
- Electrification of other sectors
  - Uncertain at which pace and to which extent

See e.g. visions regarding the penetration of electric vehicles:

	EVs in 2020	EVs in 2030
Baseline scenario	3.3mn	50mn
Pessimistic scenario	2mn	20mn
Optimistic scenario	5.5mn	93mn

Source: Kampman et al. (2011)

Very high degree of decarbonization of the electricity sector



Source: EC (2011 - COM(2011) 112 final)

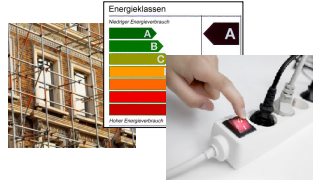
- Every policy must allow for such electrification

## Background

### A menu of decarbonization technologies

#### a) Consumption-oriented:

- Increase in energy efficiency
- Behavioral changes



#### b) Production-oriented:

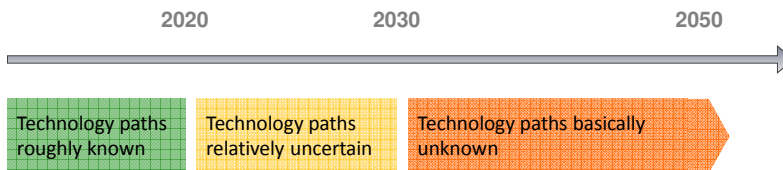
- Low-carbon generation (RES, nuclear)
- Decarbonization of fossil fuels (CCS)



## Background

### A menu of decarbonization technologies

- Huge uncertainty regarding the 2050 system...



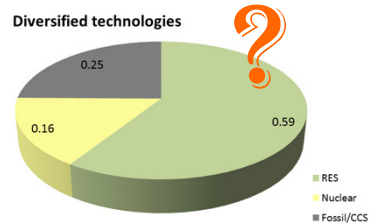
- ... coming from both **internal** and **external** factors

## Background

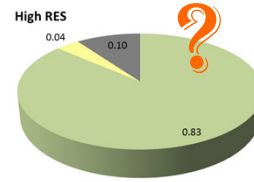
### Selected scenarios for 2050

Energy Roadmap 2050:

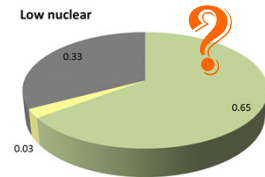
Diversified technologies



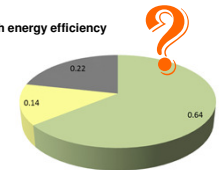
... or



Low nuclear



High energy efficiency



*“The energy transition will primarily result from countless private decisions on energy supply and use, shaped by the entrepreneurial actions of private innovators” (Lester and Hart, 2012)*

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## Background

### Other roadmaps

- Differ in assumptions, baseline and concrete 2050 scenarios
- ... but all have some aspects in common



- Energy efficiency improvements of utmost importance
- Three main variables are on the production side:
  - Shares of (1) RES, (2) nuclear and (3) CCS
- Way towards 2050, in any case, should
  - Be cost-efficient and
  - Foster European competitiveness



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## Background

### Four kinds of reasons for policy intervention

#### Market failures

##### Environmental externality

Reduction of GHG emissions is a global public good

##### Innovation externalities

Spillover effects and related appropriability problem

##### Capital market imperfections

... and resulting funding gap

##### Increasing global competition

Challenge: "remain at forefront of booming international market" at a time when MS curtail public spendings

Strategic trade and policy issues

## Background

### European players face global competition, but...



#### Wind sector:

- Top-European turbine manufacturers see reduction in their global market share
  - 67% (2007) – 58% (2008) – 46% (2009) → trend likely to continue
  - Chinese manufacturers gain (production 30% cheaper than in other regions)
- BUT: only European manufacturers active in **offshore wind** market

- Chance to use this advantage of being 'pioneer'?  
... and benefit from (1) domestic technology adoption and (2) exporting the technology

## Background

### European players face global competition, but...



#### Solar PV sector:

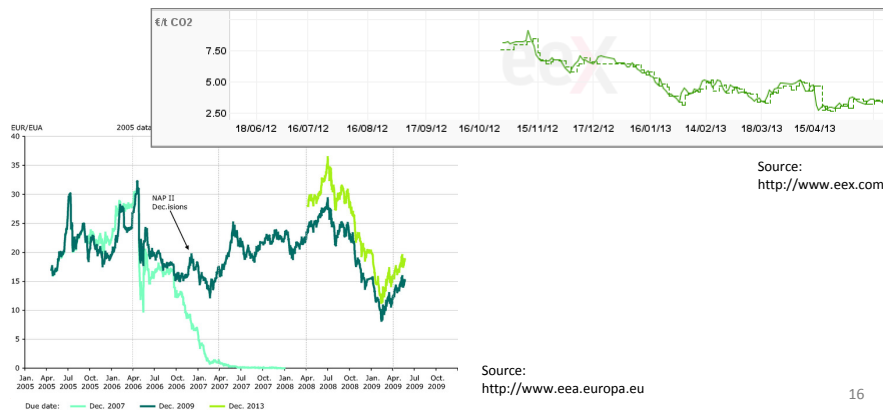
- Manufacturing of cells and modules: EU loses market shares
- BUT: still strong position of European firms in solar PV **manufacturing equipment** (high-tech segment) ... which is sold to Asian countries, too

- Argument for public support to keep this competitive advantage?  
... and strengthen the industrial base and benefit from economies of scale/scope

## Existing policies

### EU Emission Trading Scheme (Directive 2009/28/EC)

- Launched in 2005; major revision in 2009
- Cap-and-trade principle with a single (EU-wide) cap
- Covers about half of EU GHG emissions

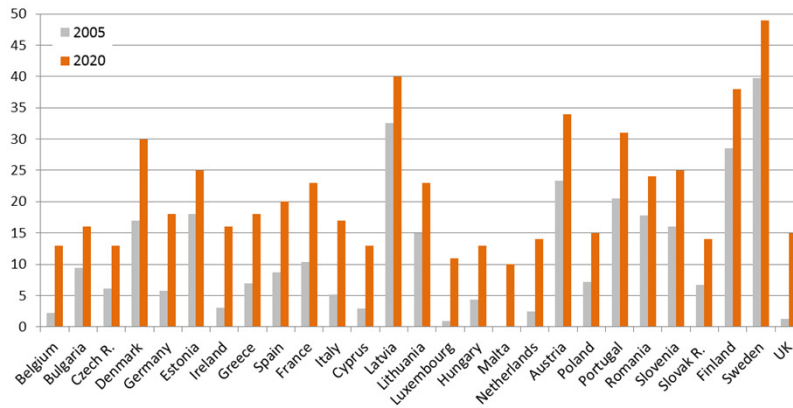




## Existing policies

### Renewables Directive (Directive 2009/28/EC)

- Mandatory national targets for the overall share of energy from RES in gross final consumption:



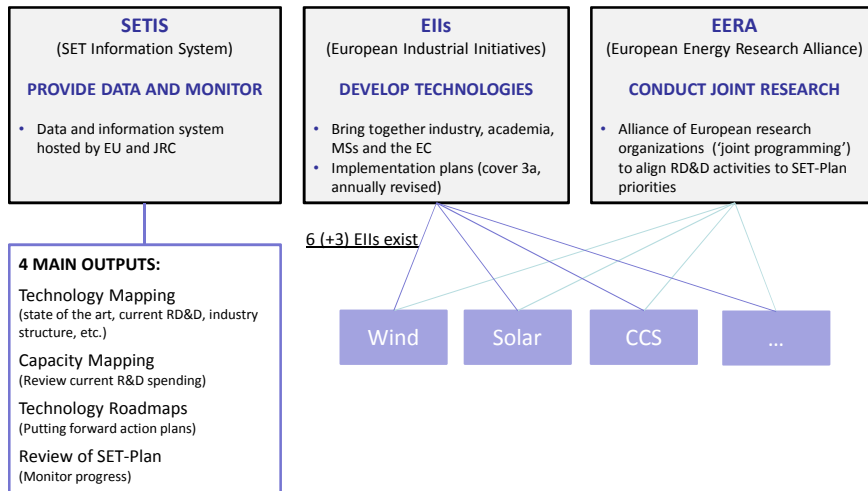
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## Existing policies

### Strategic Energy Technology Plan (COM(2007) 723)

“Technology pillar” of the EU’s energy and climate policy, launched in 2008



## Existing policies

### Limitations

- **Lack of one single and adequate carbon price**
  - EU ETS covers only a subset of emissions
  - Prices argued to be too low and too volatile
  - Heterogeneity of national approaches regarding non-ETS sectors and RES support policies
- **EU's Strategic Energy Technology (SET) Plan**
  - ✓ Bringing stakeholders together, more coordinated planning, joining of forces
  - BUT: limited time horizon (2020)
  - Within-sector approach regarding planning and priority setting
- **No adequate remedies to address new context**
  - EU financial crisis and institutional frictions
  - Increasing global competition

## 2 – Possible paths for a new EU energy technology policy

### Three policy paths

Is one path superior to the others?

## A new EU energy technology policy ... can be described using a 'toolkit'

- **Market pull** instruments (“creating markets”)
  - a) Building on strong price signals and/or
  - b) Providing signals through quantitative targets
- **Technology push** instruments (“direct support to innovation”)
  - a) Directed technology push and/or
  - b) Technology-neutral support to innovation
- **Governance** of instruments
  - a) ... decentralized national action and/or
  - b) ... centralized

## A new EU energy technology policy Three (polar) policy paths

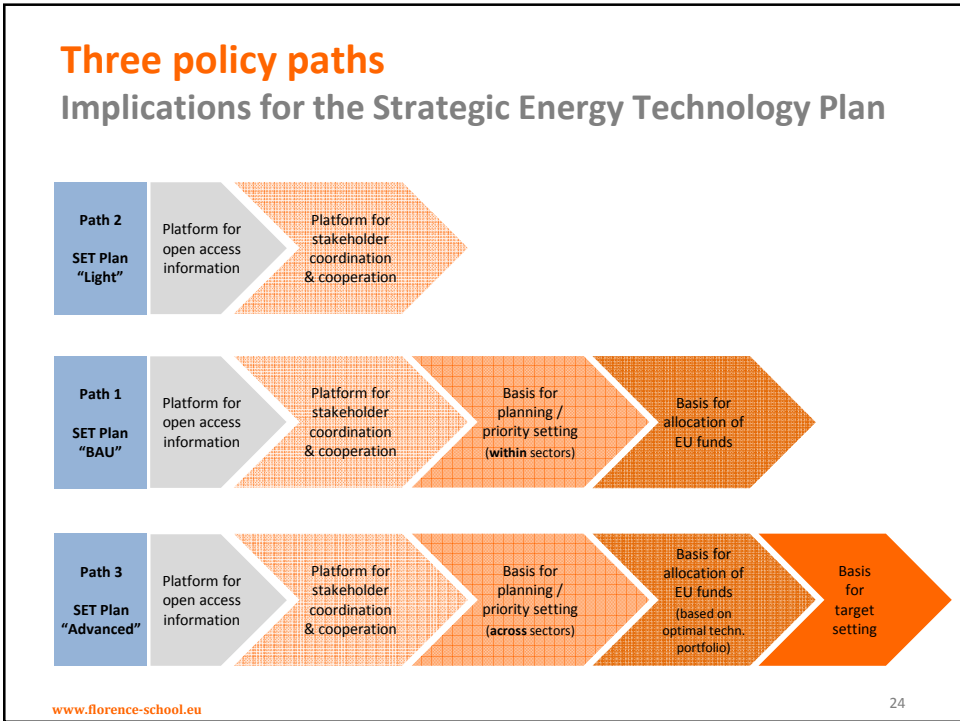
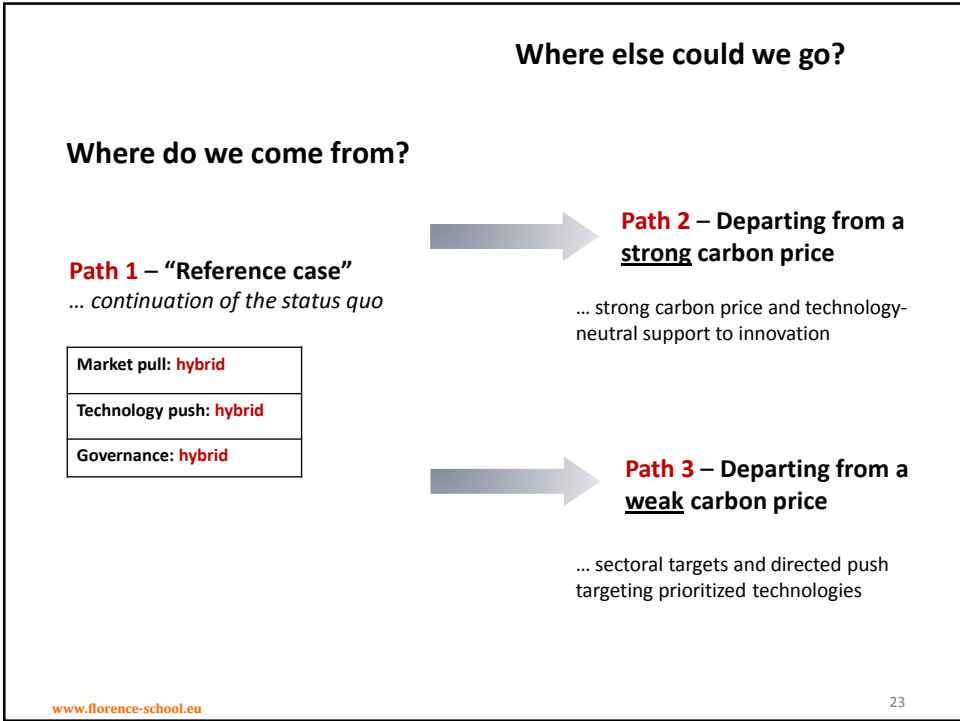
### Policy path

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### Reference case

... continuation and extrapolation of current policies – replicate SET plan for 2050 horizon

- **Market pull: Hybrid**  
'Weak' carbon price, EU level targets for RES and EE (à la 20-20-20), national energy policies to meet national targets
- **Technology push: Hybrid**  
Information exchange, planning and priority setting within European Industrial Initiatives  
Some directed TP as well as funds for which innovation projects compete
- **Governance: Hybrid**  
Centralized (e.g. EU ETS, Framework Programmes, EERA, etc.)  
... as well as decentralized instruments (e.g. non-ETS emissions, RES support policies, etc.)



## What way to go?

### Evaluation criteria

*Assumption:* Decarbonization objective can be reached under all policies



... alternative policies then can be evaluated based on a **set of criteria:**

- Green growth
- Robustness to EU financial crisis and institutional frictions
- Cost-efficiency
- Implementability

## What way to go?

### Policy evaluation

**Path 3** best able to support **green growth**

- Strong role of directed technology push
- Possibility to explicitly support domestic firms

**Path 3** most **robust to crises**

- Sectoral targets provide stable investment signals
- Ability to account for different national technology push programs and adjust the burden of decarbonization among Member States

**Path 2** most **cost-efficient** solution

- Abatement costs across all sectors and abatement channels are minimized

**Path 1** most **easy to implement**

- Implementation efforts are low
- Subsidiarity compatibility is given



## 3 – EU technology push in an uncertain policy context

Uncertainties not recognized in the 2050 Energy Roadmap

Recommendations for a renewed SET Plan and technology push

## Uncertainties not recognized in the 2050 Roadmap Technological revolutions

Technological revolutions could have important and unpredictable impact on

- (a) the available set of and
- (b) the relative cost of

decarbonization technologies:

- Shocks might **eliminate** technology options
  - E.g. Fukushima accident
- ... or **add** new means of decarbonization
  - E.g. a global shale gas revolution
    - 'Rational' price of carbon might fall extremely low
    - Shale gas may substitute for *dirty* coal but also for *expensive* RES
      - ... but gas still is a fossil fuel...

## Uncertainties not recognized in the 2050 Roadmap

### There are three EU energy policy objectives

Alternative policy objectives could outrank decarbonization:

- **Competitiveness** could rank particularly high on political agenda
  - Possible negative impacts of a unilateral climate policy on competitiveness of the regulated agents
  - Can hamper successful implementation of decarbonization policies
- **Supply security** could rank particularly high
  - A balanced portfolio ensuring a well-diversified supply mix calls for stronger (also directed) push policies

## Recommendations

### A renewed SET Plan



- Should allow for all possible future policy paths
- Should be more focused than the current SET Plan and provide the basis for planning and prioritization among decarbonization technologies

**Step 1:** Identification of technological progress and future research needs within Industrial Initiatives

**Step 2:** Identification of priority technologies\* based on a comprehensive approach across sectors

\* technologies (a) being key to achieve 2050, and/or (b) helping to support growth within the Union

**Step 3:** Determination of selected technology targets and EU funding of innovation – in line with SET Plan prioritization

## Recommendations

### Corresponding technology push



Several reasons justify some directed technology push (TP):

#### 1. Certain low-carbon technologies

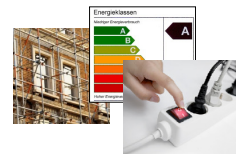
- ... are key to achieve 2050 objectives
- ... reasonable concerns that they will not developed and deployed at the necessary scale / on time
- E.g. CCS

#### 2. European technology push to respond to fierce global competition and to help to keep wealth within the EU

- Directed TP can be designed such that it favors domestic players
- BUT: **BEWARE!** Industry- and trade policy measures are a possible “regret measure”

## Recommendations

### Push consumption-oriented measures



Prioritization of production-oriented technologies bears risk of “picking the wrong winners”

In contrast, pushing **consumption-oriented measures** is

- **Politically feasible:**
  - Consensus about importance of these measures
  - Benefits all EU industries
  - Rather labor-intensive instead of manufacturing-oriented – creates jobs throughout all Member States
- **Robust** with respect to future energy market developments:
  - Consuming less is always a no-regret policy



## Recommendations

### Push enabling technologies



- Also pushing **enabling technologies** is a no-regret policy
- But, the appropriate magnitude of investment will depend on the
  - amount and
  - type... of RES that enters the system

E.g. electricity grids: Optimal system architecture will depend on whether we move

- a. Towards 'European-wide energy superhighways' or
- b. Towards a system of rising local energy autonomy, featured also by widespread demand side management

## Recommendations

### Create options for technology breakthroughs



- Also the **creation of options** is a no-regret policy
  - ... not leading to lock-in effects or stranded investments
- For all technologies *early in the innovation chain*, the argument that one or another might be more feasible to be pushed and more likely to create green growth stimuli does not apply
- Broad technology funding
  - ... over time and as the probability of success increases, funds should become more concentrated

## To conclude

- 2050 climate objective = huge challenge
- There are possible futures not yet recognized in the EU Energy Roadmap 2050
- No policy path is clearly superior to another



1. A renewed, post-2020 SET Plan should
  - Allow for all possible future paths
  - Offer a basis for planning and prioritization among decarbonization technologies
2. Pushing energy efficiency enhancing and enabling technologies dominates other push strategies
3. Creation of options for technology breakthroughs has to be a main pillar in any future SET-Plan



## Thank you for your attention

Contact: [sophia.ruester@eui.eu](mailto:sophia.ruester@eui.eu)

<http://think.eui.eu>