Tools for Informed Energy Technology Policies and Evaluations

The SET-Plan Information System - Supporting and Monitoring a Policy Process

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I. Context: the EU Strategic Energy Technology Plan

II. The SET-Plan Information System (SETIS)

III. Mapping energy R&D capacities

IV. Assessing the performance of implementation: Key Performance Indicators

V. Model-based assessments: developing tools for assessing the impact of R&D

VI. Conclusions and Outlook
European energy and climate policy targets:

By 2020:

- 20% reduction in greenhouse gas emissions compared to 1990 levels (30% if global agreement)
- 20% reduction in global primary energy use (through energy efficiency)
- 20% of renewable energy in the EU's final energy mix

By 2050: indicative 60 to 80% reduction in GHG

→ The SET-Plan forms the technology pillar of the European energy and climate strategy

SET-P communication COM(2007)723
COM(2009)519 – Investment Com
Lines of action of the SET-Plan

Joint strategic planning

Steering Group and SET-Plan information system; annual ‘summits’

Effective implementation (focus):

• European Industrial Initiatives: strategic technology research & development industry-led partnerships
• European Energy Research Alliance: joint programmes led by research institutes
• Trans-European Energy Networks and Systems of the Future – transition planning

Increase in resources, both financial and human

Reinforcement of international cooperation
The SET-Plan development – Different stages, different monitoring tools

- SET-Plan Governance
- First Technology Priorities
- Launch of the EERA
- Setup of SETIS
- Roadmaps
- Investment Gap
- SETIS Website
- Launch of first Initiatives
- Monitoring and Review
- Impact Analysis
The SET-Plan Information System SETIS – SET-Plan Decision Support Tool

European Community SET-Plan Steering Group

- Technology Map
- Capacities Map
- Monitoring & Review of progress, KPIs
- Assessment of Impact on Policy Goals
- Evaluation of New Priorities
- Dissemination: SETIS – web portal

Member States, Industry & Research Communities

European Industrial Initiatives, EERA Joint Actions

SETIS

II – SETIS Overview
SETIS: Tracking Progress

Policy impacts

Project/Action progress

Programme progress

RD&D investments

EI Team

Graph showing Mt CO2eq emissions from 2005 to 2030

Bar chart showing SET-Plan effects: increased learning rate

Total estimated R&D investments in SET-P priority energy technologies

IEA EGRD – 09/10 November 2010
Mapping energy R&D capacity: Defining the starting point (Capacity Map 2007)

Input to SET-Plan SEC (2007) 1511

Aim: Status quo of the public national systems of energy-related R&D in the EU

- Institutional set-up
  - Literature review
  - Own research
  - Feedback from EU Member States
- R&D budgets and priorities
  - Eurostat GBAORD; GERD
  - IEA R&D statistics (19 EU MS)
- Corporate energy R&D expenditures
  - Eurostat BERD
  - EU Industrial R&D Investment Scoreboard

→ Status Quo analysis based on available information, qualitative & quantitative
Input to Financing Com COM(2009)519 final

Aim: Estimation of current corporate and public research investment in low-carbon technologies

• Focus on low-carbon technologies for which EII/JTI are proposed by the SET-Plan

• Public: EU and MS national budgets
  • IEA R&D statistics
  • FP6 commitments
  • MS consultation

• Corporate R&D investment
  • No systematic data available (BERD misses detail)
  • Information seen as confidential or strategic
  • R&D Investment Scoreboard misses detail

→ novel methodology developed: combination of available info, assumptions, expert opinions, direct contact

→ Quantitative assessment: development of monitoring tools
### Identification of key industrial players and their suppliers for the sector of analysis

<table>
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<th>Sources: barometers from EUROBSERV’ER, Technology Platforms or associations, expert knowledge, individual companies’ internet website</th>
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Mapping energy R&D capacity: results illustrated for wind energy

Corporate R&D investments account for ¾ of total → applied research & demonstration
Concentration of public and industrial R&D investors in (more or less) the same MS
Reasonable estimation: R&D intensity industry 2.9-3.2%; other studies ~ 180 Mio Euros (compared to 292 Mio Euros of present study)
Mapping energy R&D capacity: Total R&D investments to low-carbon techs.

Total estimated R&D investments in SET-P priority energy technologies

- 57% Corporate R&D investment (2007)
- 11% Public EU (FP6 respectively EURATOM; annual average)
- 32% Public R&D spending of EU Member States (2007)

Relative distribution of corporate R&D investments in SET-P priority technologies among EU Member States in 2007

Relative distribution of public R&D investments in SET-P priority technologies among EU Member States in 2007

- ~ 3.3 billion Euros (of which 72% is non nuclear)
- ~ 1.9 billion Euros
- ~ 1.1 billion Euros
Monitoring Progress:
European Industrial Initiatives (EIIs)

Objectives
• Led by industry
• Boost research and innovation
• Accelerate development of technology
• Define & realise clear targets (quantified objective)
• Deliver progress beyond business-as-usual
• Contribute to political goals
• Foster Public Private Partnership

Implementation and management
• Appropriate to break-down into 2-3 year’s Implementation Plans (2010 – 2012) ; derived from the Technology Roadmap
• Taking into account the existing EC financial contributions (FP7, Recovery Plan,…)
• Estimate the budgets (Member States, EC, industry)
• Monitoring through Key Performance Indicators
• Management through flexible governance architecture

Status quo
Wind, Solar (PV, CSP), Electricity Grids, CCS Initiatives launched June 3th, 2010
Imminent launch – Bioenergy, Nuclear Fission; in preparation: Smart Cities
Monitoring Progress:
ELLs Monitoring & Review Approach

Ell Objectives – Technology Roadmap

Overarching KPIs

Reference Systems

Specific KPIs

Review and Analysis

Knowledge sharing

Ell Teams & SETIS

SET-Plan

Actors

Reporting

Steering Group

Reporting

IV – Key Performance Indicators
Monitoring Progress:
The example of wind energy

Overarching KPI
Levelised cost of electricity production

New turbines & components
- Test turbines up to 20 MW
- Power output
- Availability
- Weight on top of mast per kWh
- MW and square meters of blades manufactured
- ...

Offshore structures
- Amount of material per turbine per depth
- Meters of substructures produced per year
- ...

Grid integration
- Ratio of wind farm power output to total electricity volume in transit
- Distance of HVDC cables per capacity
- ...

Resources & spatial planning
- Measurement points and DB use and accessibility
- Parties involvement in spatial planning
- ...

Specific KPIs
- ...
In-process evaluation of potential impact of policies

Two main questions investigated:

• What is the change in technology investment costs of selected SET-Plan priority technologies if accelerated RD&D efforts are implemented?

• Can an increase in RD&D investments along the lines of the SET-Plan help in reducing the costs of achieving the European energy and climate targets by 2020 and beyond and does it contribute to bringing new technologies onto the market?

Assess the impact of increasing RD&D efforts on several SET-Plan priority technologies at the same time in Europe?

Methodological problem: Can we establish a quantified relationship between R&D efforts and technology development?

Data challenge: How to calibrate such an equation? Are sufficient historic data available?

Implementation challenge: Can we model this RD&D impact?

Definition problem: What means ‘increasing RD&D efforts’? What are baseline efforts, what does the SET-Plan imply on RD&D investments?

Modeling challenge: Ensure that the model present well these (novel) technologies.

Methodological, data and model challenge: Learning effects are global—need to have data and a model that allows for a global assessment while having the necessary detail on the EU.
Well established: Unit costs are reduced with increasing production volumes

Two-Factor-Learning Curve: Establishes a relation between cumulative production, knowledge stock and technology costs

\[ C(Q, KS) = aQ^{-\alpha} KS^{-\beta} \]

With
- \( C \) = Costs of unit production
- \( a \) = Costs of the first unit produced
- \( Q \) = Cumulative Production
- \( \alpha \) = Elasticity of learning by doing
- \( KS \) = Knowledge stock
- \( \beta \) = Elasticity of learning by researching
**Model-based Impact Assessment:**

**Scenario definition**

- Additional R&D efforts (+15bn EUR between 2010-20)
- Reference R&D Investments faster due to additional RD&D
- Technology costs lower due to lower RES costs
- Set to achieve RES target
- Renewable support realised in both Energy efficiency increases
- Lower due to more CCS
- Set to achieve GHG target
- Carbon value met (actually: overfulfilled) by both GHG emission reduction targets
- Renewable targets

**SET-Plan Reference inputs results**

**Model-based Impact Assessment:**

**Scenario definition**

- Additional R&D investments (SET-P)
- Quantities (% of renewables and GHG emission reductions)
- Price

**Additional R&D**

- Investments (SET-P)
- Quantities (% of renewables and GHG emission reductions)
- Price

**Reference scenario**

**SET-P scenario**

**Cost savings**

**Quantities**

(% of renewables and GHG emission reductions)
Significantly accelerated technology learning due to additional RD&D investments
Model-based Impact Assessment: Results: Accelerated market uptake

Changes in installed capacities between the Global SET-Plan, the SET-Plan fixed price and the reference scenario in 2020 and 2030 in the EU
Discounted (3%) net benefits cumulated from 2010 onwards, EU-27

- Cumulative net benefit by 2030, 11.5 bn €
- 15% IRR over 2010 - 2030
• Investing in RD&D at global level in line with the SET-Plan lowers the cost of innovative low-carbon technologies, hence improves the economics of the transition towards a low-carbon power sector in the long run and benefits both to the consumers and industry.

• Up to 2030 and beyond, increased RD&D investment levels in line with the SET-Plan result in a positive Internal Rate of Return. Yet, these benefits will materialise mainly in the time horizon beyond 2020. Considering the shorter-term nature of corporate R&D investments, this suggests a need for public action - as the SET-Plan.

• This economic aspect combined with the role of the SET-Plan to ensure the availability and enhanced performance of new technologies confirms the enabling role of the SET-Plan for the transition of the energy sector towards the EU 2050 vision of a decarbonised energy system.

• The above effects are triggered by an ambitious increase in global research efforts, extrapolating the efforts done in the EU with the SET-Plan to other world regions. This highlights the need for a worldwide approach with respect to low-carbon research, as proposed in the SET-Plan and in the declaration of the leaders of the Major Economies Forum on energy and climate change (2009).

• Ancillary benefits to consumers and industry beyond the power sector can also be expected, such as cost reductions in other sectors due to the lower CO2 prices. Moreover, positive spill-over effects on the innovation in other sectors, such as transport and informatics, are likely to occur.
• Monitoring and assessing progress of a policy process (instead of a single project) requires a broad variety of quantitative and qualitative tools that flexibly adapts to distinct phases of the policy process:
  ▪ assessment of status quo
  ▪ estimation of impacts
  ▪ monitoring of specific actions

• A stable monitoring architecture is needed to ensure continuity in expert knowledge and facilitate a systematic exchange with experts, stakeholders, Member countries etc.

• There is a necessity for ‘tailor-made’ tools to adequately meet the needs of specific policy questions.

• Monitoring and review are key element in every single phase of the policy. They are explicitly pointed out in planning and implementation.

• The SET-Plan set up SETIS as a monitoring tool from the very beginning. Since then, SETIS actively interacts with all stakeholders to adapt the set of qualitative and quantitative tools needed to monitor progress.
THANK YOU

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http://setis.ec.europa.eu