EUROPEAN COMMISSION

SET-Plan
MONITORING & REVIEW of the IMPLEMENTATION PROGRESS

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The SET-Plan

The SET-Plan (Nov. 2007) is the TECHNOLOGY pillar of the EU's ENERGY & CLIMATE CHANGE policy - a priority for EU's 2020 Energy Strategy

- **Objective is to accelerate the development of low carbon technologies leading to their market uptake**
- **A firm commitment to position the European industry in a leading role worldwide in the transition to a low-carbon economy**

COM(2007)723 & COM(2009)519

SET-Plan in essence

- Joint Strategic Planning:
  - Steering Group (EC + MSs)
  - Information System: SETIS (led & coordinated by JRC)
- Effective Implementation:
  - European Industrial Initiatives
  - European Energy Research Alliance
  - Trans-European Energy Networks and Systems of the Future – transition planning
- Increase in Resources: both financial and human
- Reinforce International Cooperation

SETIS – the decision making support tool

[THE COUNCIL] REQUESTS the Commission to develop to its full capability the SET Plan Information System (SETIS)

- **to provide a robust technology-neutral planning tool, which reflects the current state of the art of the individual technologies and their anticipated technological development and market potential**
- **to monitor the progress of SET Plan activities towards their objectives in a transparent and objective way**
- **to assess performance and cost-effectiveness of SET Plan activities**

(Council conclusions 2009, 2010)

European Industrial Initiatives

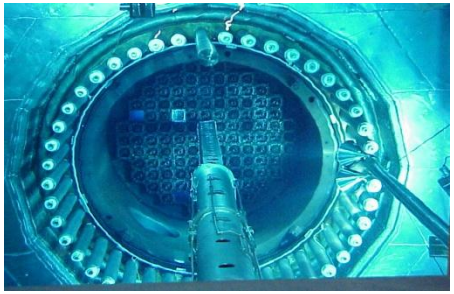
Wind

Solar

Bioenergy

CCS

Electricity Grid



Fission

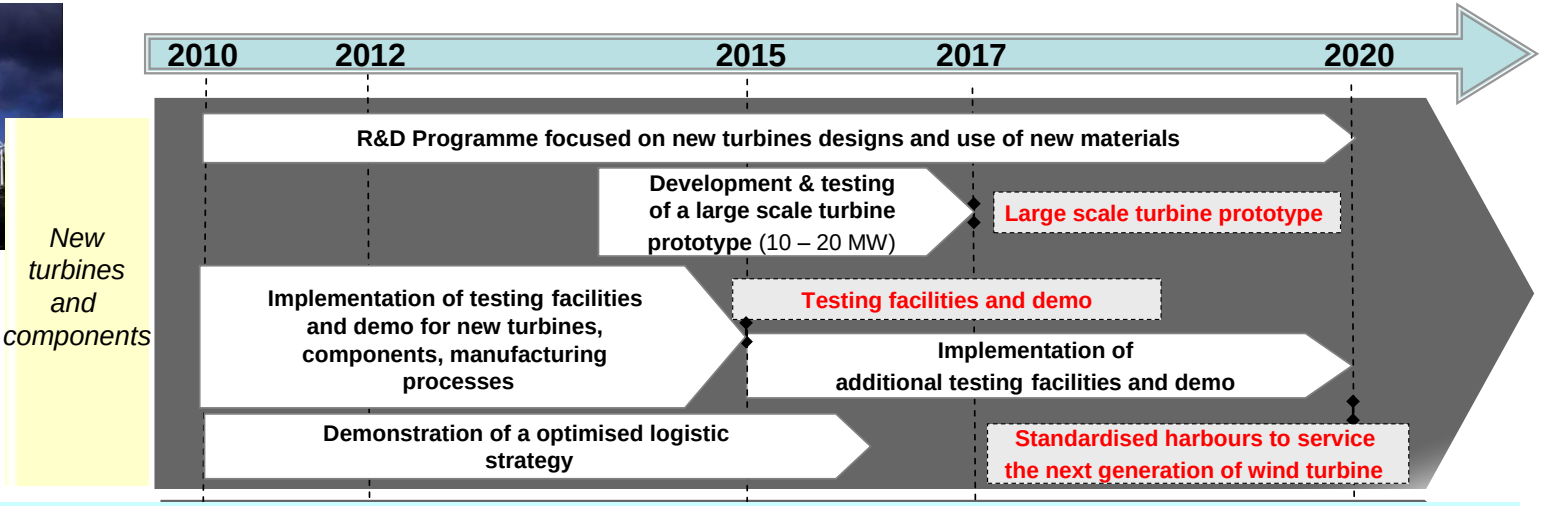
BUILD UP

manag€nergy

SMART Cities & Communities

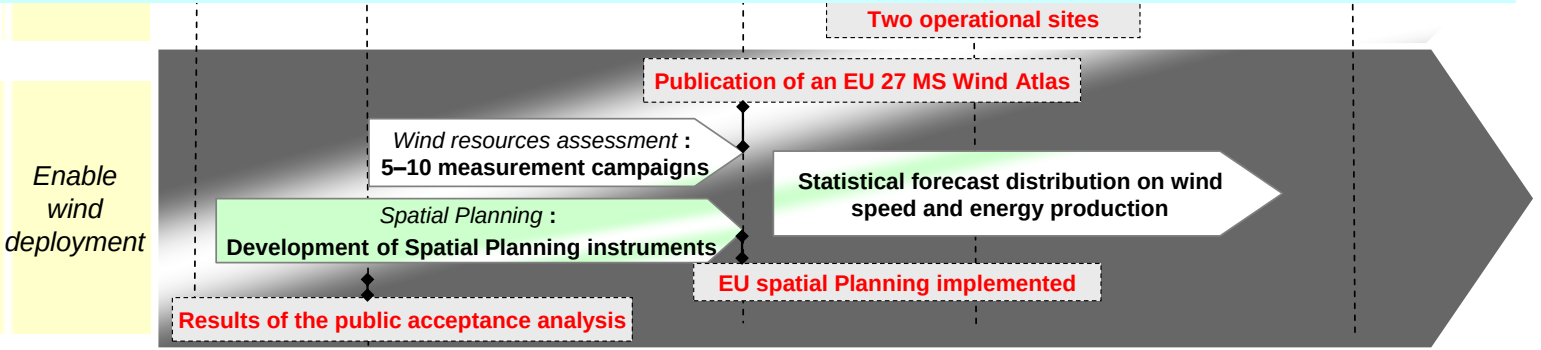
Fuel Cells & H2

WIND EII Roadmap 2010-20



- A wind energy penetration level of 20% in 2020;
- Onshore wind power fully competitive in 2020;
- 250.000 new skilled jobs created in the EU by the wind energy sector in the 2010 – 2020 period.

€ 6 bn



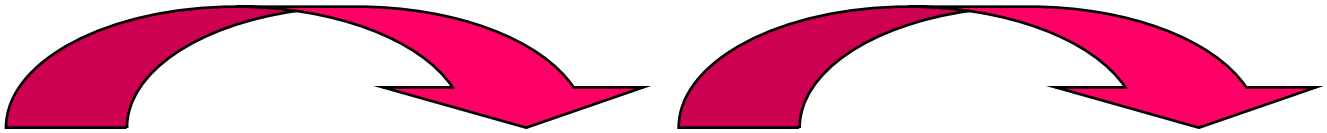
Monitoring & Review Concept

A two-stage process is envisaged

1) Performance assessment of implementation of the EIIs

2) Impact analysis of the implementation state

effectiveness **efficiency**



Monitoring & Review of EIIs

Focus: progress of projects, activities

Tool = KPIs

EIIs progress

SET-Plan benefits on policy goals

Focus: impact of the progress

Tool = System Analysis

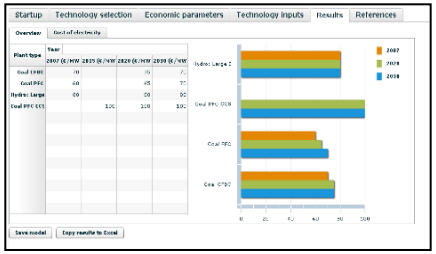
Monitoring & Review Concept

Monitor

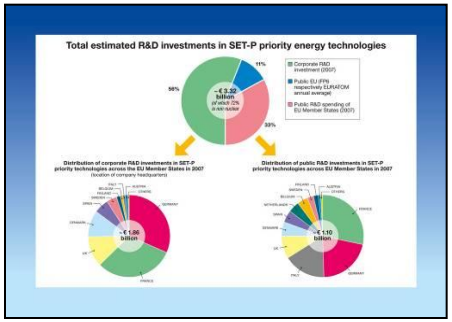
EII-level

mapping survey

project/action progress



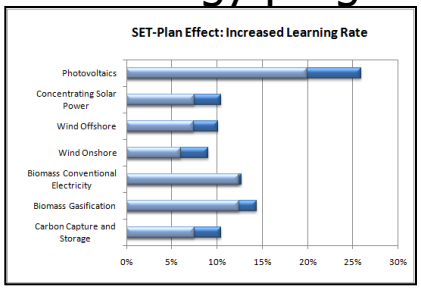
RD&D investments



Assess

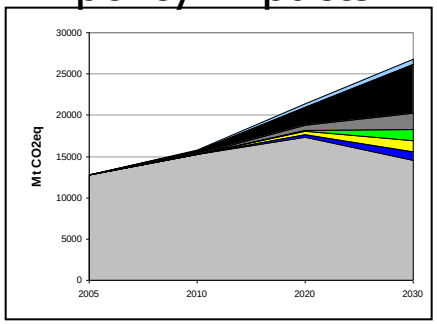
SET-Plan level

technology progress



EU level

policy impacts



- identifying needs
- prioritisation
- revise targets
- share knowledge

Introduction (I)

- ✓ KPIs represent an essential toolkit for monitoring and reviewing EII progress
  - **Overarching KPIs** measure the progress of each EII towards meeting its strategic objectives
  - **Second-tier KPIs** measure progress at project level
- ✓ KPIs are instrumental for planning future RD&D activities
- ✓ KPIs, already incorporated in the IPs, have now been further refined (defined and quantified) to form the **first generation of KPIs** focusing on ongoing and future RDD activities.

- **Constitution of the First Monitoring and Review Framework of the SET-Plan**
- **Data gathering, analysis procedures, knowledge sharing are currently discussed**

Introduction (II) - Modalities

- The first generation KPIs is the result of **joint efforts** between the EII-leads (e.g. ETPs & Sector Associations) and the Commission-SETIS
- Stemmed from the KPIs in the IPs and quantified based on joint **analytical work**
- Coordination between EII-leads and Commission-SETIS was ensured by dedicated consultation meetings – **quite cooperative process**
- The work has been presented, discussed, agreed with **EII Teams**

Example: CCS-EII KPIs (I)

Overarching KPIs

1. Levelised cost of electricity or of industrial product (€/MWh - €/t)
2. CO2 avoidance cost (€/t CO2)

2nd Tier KPIs

Progress in the demo programme	Cost effectiveness	Environmental effectiveness and safety	Public awareness
• Number of FIDs • Cumulative installed capacity (MW) • Projects in the CCS Project Network	•Additional CAPEX (€/kW) •Additional OPEX (€/MWh) •Plant availability (%) •CCS chain availability (%) •Plant efficiency (%) •Capture rate (%)	• Annual CO2 avoided (%) • Cumulative CO2 stored (Mt) • Instances of CO2 moved out of designated volume •Quantity of CO2 moved out of designated volume	•Number of storage project permits •Eurobarometer poles

Boundary Conditions

- Calculations for the overarching KPIs based on commercial large scale plant that starts operating in mid 2020s after successful demonstration, with optimised technology based on first commercial experience but still not mature (OPTI).
- CCS plants operate in baseload mode (7500 h/y)
- Transport and storage costs are excluded
- Reference systems
  - Coal: 736 MW, ultra supercritical, η=46%
  - NG: 420 MW, single shaft, F class combined cycle, η=60%
- Reference fuel
  - Hard coal from world market
  - NG on European market
- **Economic** assumptions
  - WACC: 8%
  - Project life: Coal: 40y, NG: 25y

Overarching KPIs (1)

1. **Levelised Cost of Electricity (LCoE) for power generation (€/MWh)**
   - **LCoP (LCO Product) for industrial applications (€/t)**

- Measured for reference (PF and NG) plants and CCS plants (average values for different capture technologies)
- Calculation based on 2nd tier KPIs:
  - Specific capital investment
  - O&M costs
  - Availability
  - Efficiency
- … and other assumptions:
  - Discount rate, lifetime
  - Load factor
  - Fuel costs (assuming coal and NG prices)
  - Carbon costs (assuming CO2 prices)

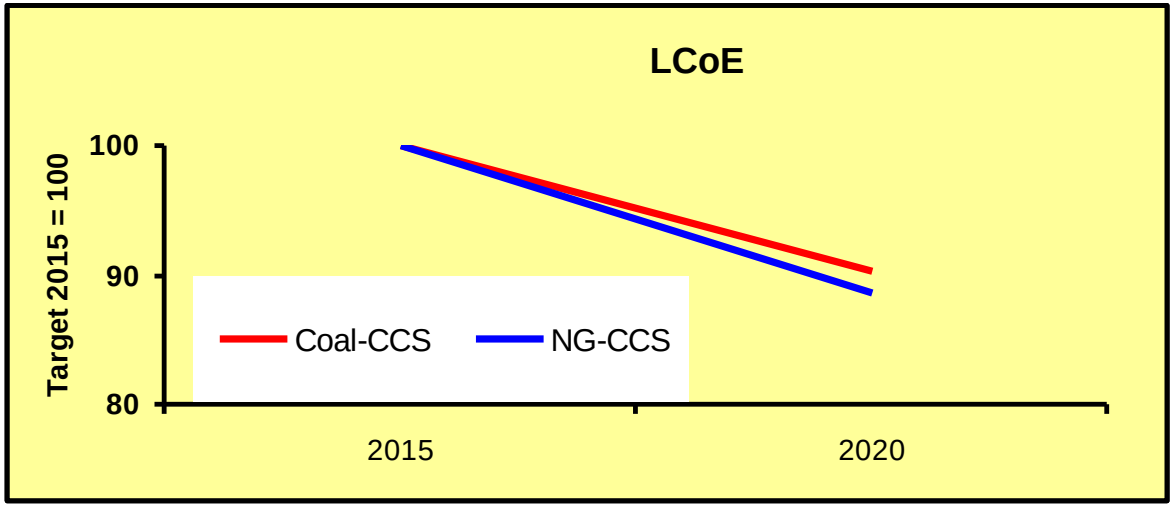
Example: CCS-EII KPIs (2)

Detailed calculation methodologies: The Example of LCoE

- Calculated for predefined reference (coal and gas) plants and CCS plants (average values for different capture technologies)
- Calculation based on:
  - 2nd tier KPIs (CAPEX, OPEX, efficiency, etc.):
  - Other assumptions (Discount rate, fuel and carbon costs, etc.)
- Target values for 2020 refer to an optimised large scale commercial baseload plant based on first commercial experience but still not mature (OPTI)
- Target values for 2015 are based on today's technology plant concepts (BASE)

Example: CCS-EII KPIs (3)

Evolution of Overarching KPIs



Δ(LCoE):

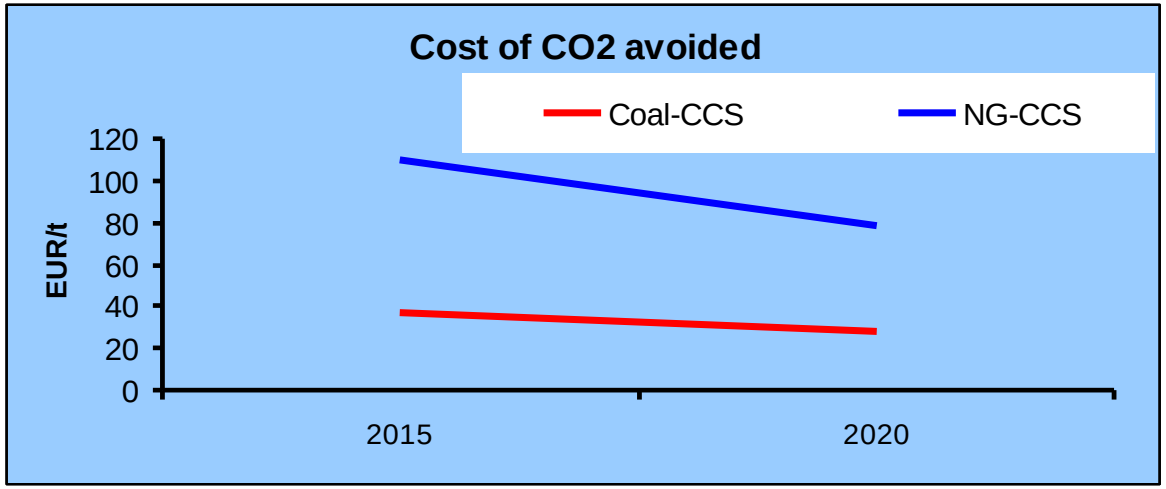
Coal: -8%

NG: -12%

Δ(AC):

Coal: -24%

NG: -28%



Example: Wind EII (i) LCOE - Methodology

$$LCOE = \frac{L.I. + DO\&M}{E}$$

LCOE (€/MWh)	The levelised cost of electricity	DO&M (€/y)	Annual discounted operation and maintenance cost
L.I. (€/y)	Levelised Investment	E (MWh/y)	Annual Discounted Energy Production

- Basic cost components:
  - Capital (Investment) cost,
  - O&M cost,
  - Energy production

Example: WIND EII (ii) LCOE

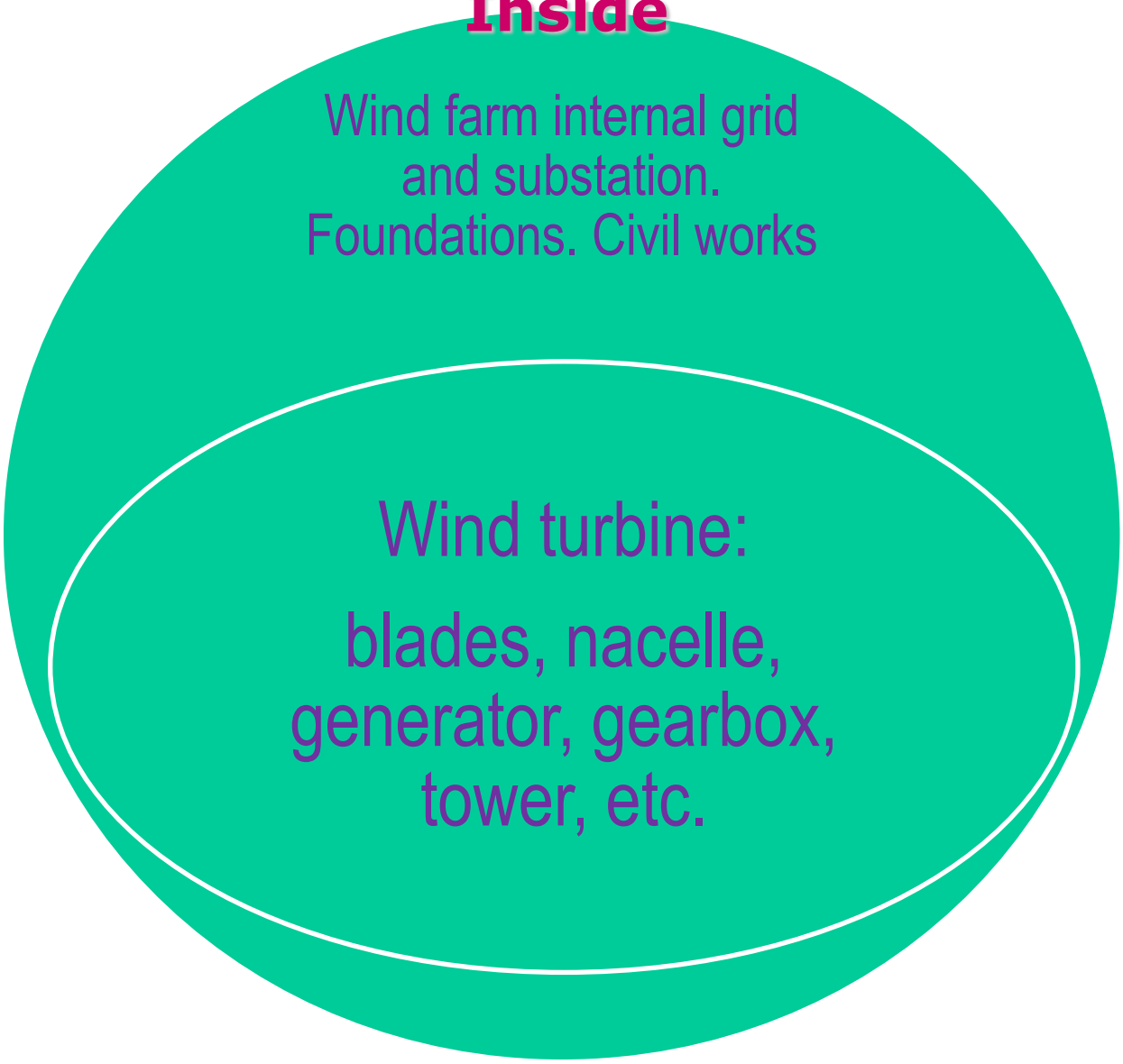
$$L.I. = C \cdot P \cdot CRF$$

$$CRF = \frac{d}{\left(1-(1+d)^{-N}\right)}$$

C (€/kW)	Capital Cost	D (%)	Discount rate
P (MW)	Installed Capacity	N (y)	Lifetime
CRF	Capital Recovery Factor		

CRF: converts the present value of the cost components into equal annual payments over a specified time (N) using specified discount rate (d)

Reference System Boundaries



Outside

- Permitting cost.
- Connection from the wind farm substation to the external grid.
- Civil works outside the wind farm (i.e. outside roads).
- Financing costs.
- Overheads (*this term is still unclear*).
- Decommissioning costs.

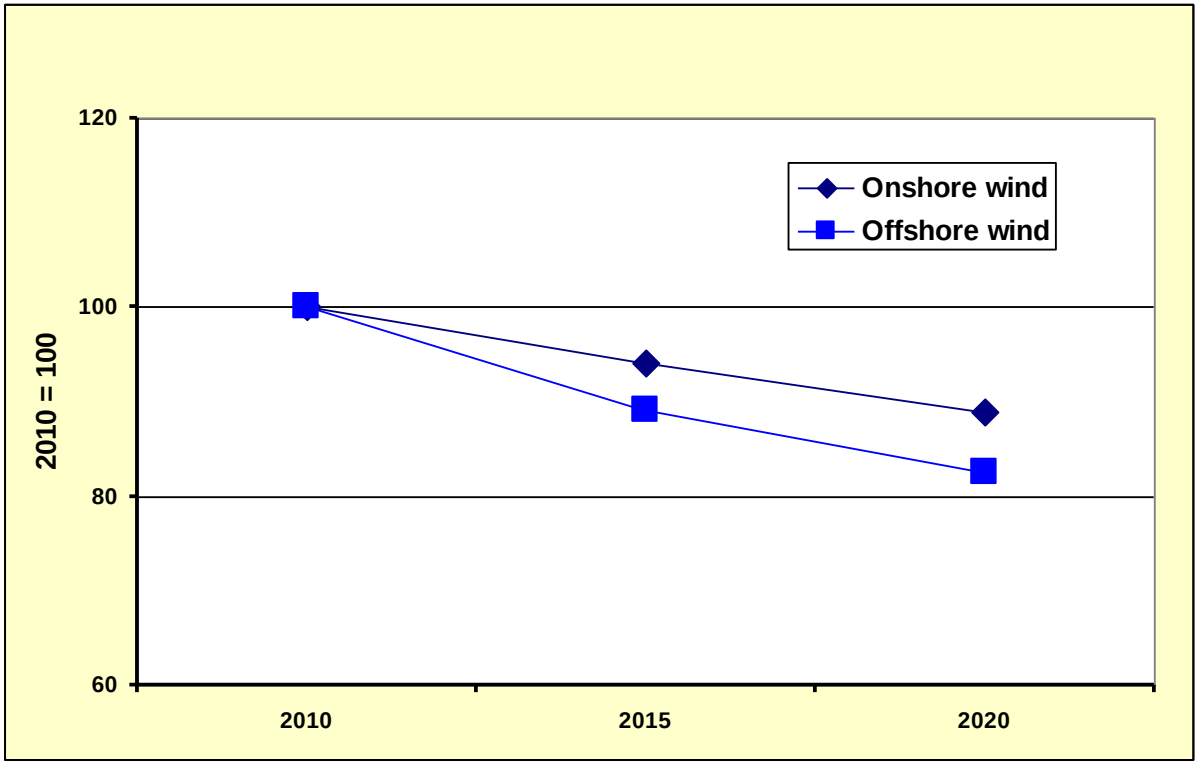
Reference Systems

WIND POWER FARM	ONSHORE	OFFSHORE
Total plant capacity (MW)	40	300
Size of wind turbines (MW)	2.5	5-7
Capital, investment cost (€/kW)	1 250	3 500
O&M costs incl insurance(€/kW-yr)	47 (21.5 €/MWh)	106 (30.3 €/MWh)
Balancing costs (€/MWh)	3	3
Capacity factor (%)	25	40
Real discount rate (%)	5.39	5.39
Project lifetime (years)	20	25
Accessibility time (%)	100 %	70 %

Example Wind EII (iii) KPIs

Overarching KPI

LCOE



2nd tier KPIs

WIND ATLAS – EU-27 coverage, 10% accuracy, 80m height, 1Km^2 ; Open source model, validated

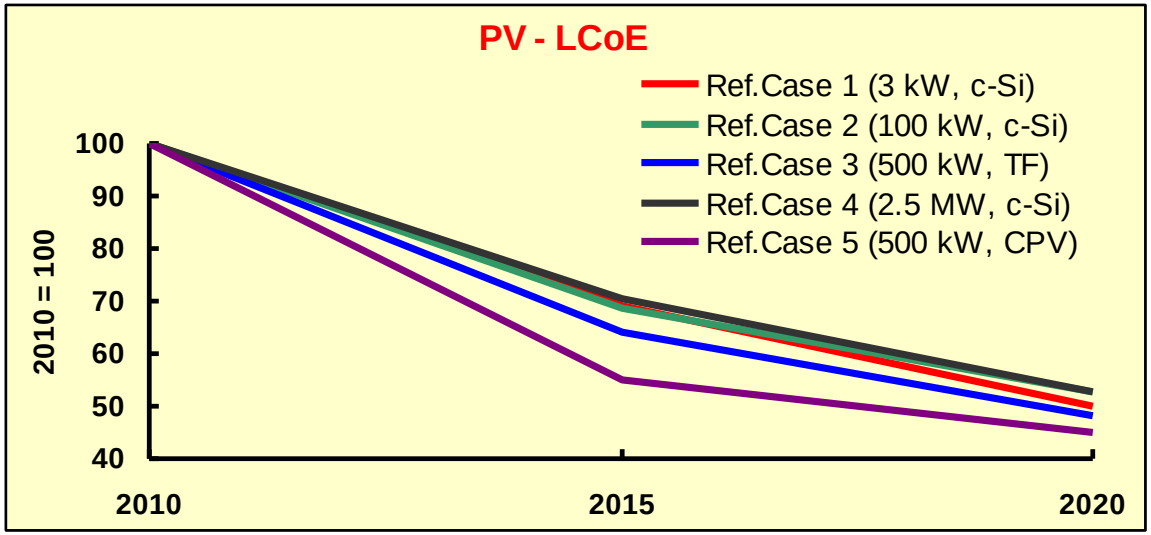
RELIABILITY – O&M costs reduced 40% by 2020

Example Wind EII (iv) Wind Atlas

Parameter	Wind atlas value	Model value
Availability	Public domain	Public domain
Scope	EU-27 plus EEZ	Based on wind atlas
Average wind speed/accuracy	Yes/10 %	Yes/5 %
Maximum height of data	80 m	100 m
Height intervals	10 m	10 m
Wind direction/accuracy	Yes/10 %	Yes/5 %
Turbulence/accuracy	No	Yes/ X %
Resolution	1 x 1 km	100 x 100 m
Measurement data	3-year	3-year

Parameters included in both cases: Weibull distribution, surface heat fluxes, natural spaces, military areas, infrastructure, and ISO icing days

Solar-EII
Evolution of overarching KPIs



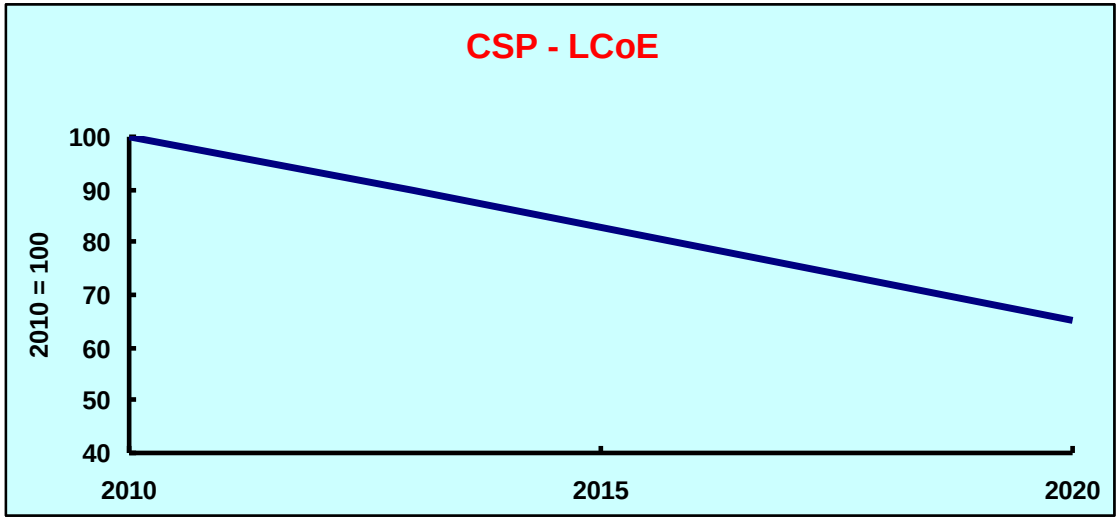
PV

Δ(LCoE): -47-55%

CSP

(50 MW in S.Europe)

Δ(LCoE): -35%



Assessment of SET-Plan impact

Model-based Impact Assessment - a novel methodology

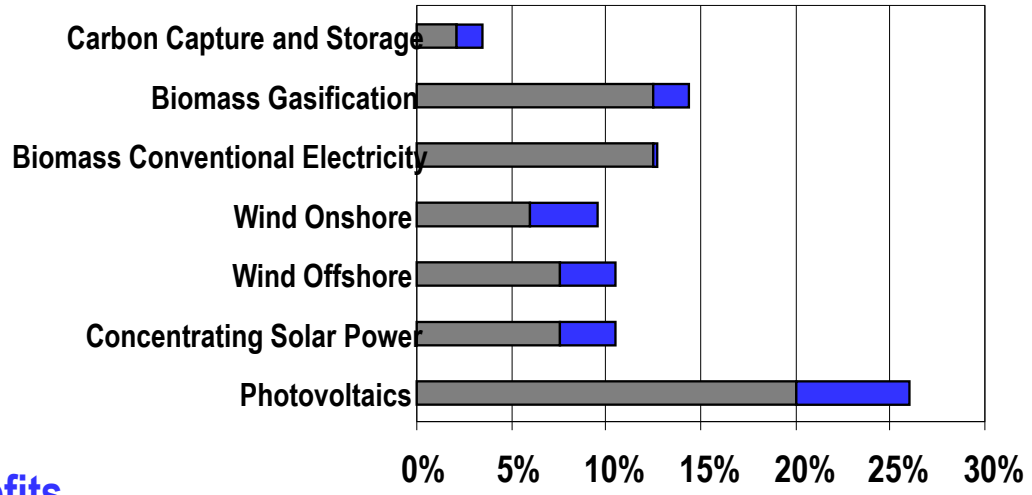
Questions addressed:

- **change in technology investment costs of SET-Plan priority technologies when accelerated RD&D efforts are implemented**
- **can SET-Plan increase in RD&D investments help reducing costs of achieving European energy and climate targets by 2020 and beyond and does it contribute to bringing new technologies into the market?**

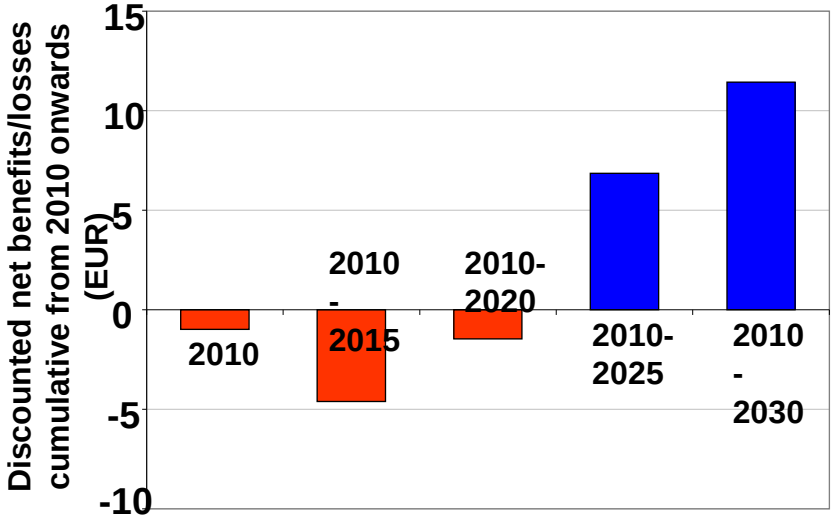
Quantitative Impact of SET-Plan

accelerated technology learning

SET-Plan Effect : Increased Learning Rates



SET-Plan Effect : Net benefits



2010-2030 period

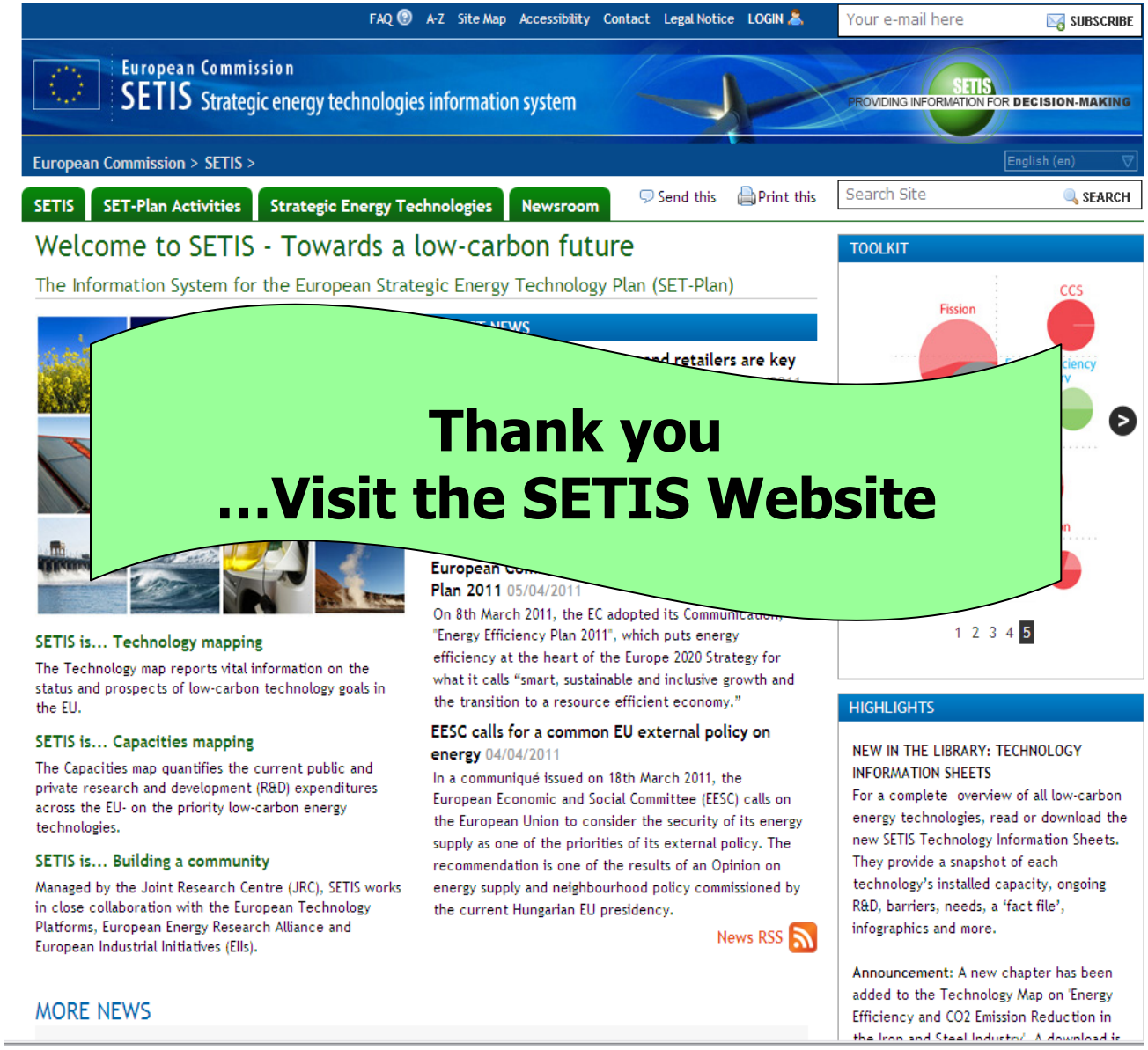
Input to the CSFRI – energy

KPIs - State of Play

	Bio-energy	CCS	Grids	Nuclear	Solar	Wind
Overarching KPI(s)						
2nd tier KPIs						
Reference system(s)						
Targets						

Next Steps

- Publication on the SETIS website
  - ✓ CCS, Solar & Wind
  - ✓ http://setis.ec.europa.eu/activities/eii-key-performance-indicators
- For the other EIIs, incl. the FC&H2 to be concluded by end 2011
- Procedures / Data collection/ Knowledge sharing etc..
  - ✓ EU funded projects will be required to demonstrate their link with the KPIs and to report
  - ✓ Work ongoing to advance the monitoring framework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SETIS is... Technology mapping
The Technology map reports vital information on the status and prospects of low-carbon technology goals in the EU.
SETIS is... Capacities mapping
The Capacities map quantifies the current public and private research and development (R&D) expenditures across the EU- on the priority low-carbon energy technologies.
SETIS is... Building a community
Managed by the Joint Research Centre (JRC), SETIS works in close collaboration with the European Technology Platforms, European Energy Research Alliance and European Industrial Initiatives (EIIs).
Plan 2011 05/04/2011
On 8th March 2011, the EC adopted its Communication "Energy Efficiency Plan 2011", which puts energy efficiency at the heart of the Europe 2020 Strategy for what it calls "smart, sustainable and inclusive growth and the transition to a resource efficient economy."
EESC calls for a common EU external policy on energy 04/04/2011
In a communiqué issued on 18th March 2011, the European Economic and Social Committee (EESC) calls on the European Union to consider the security of its energy supply as one of the priorities of its external policy. The recommendation is one of the results of an Opinion on energy supply and neighbourhood policy commissioned by the current Hungarian EU presidency.
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HIGHLIGHTS
NEW IN THE LIBRARY: TECHNOLOGY INFORMATION SHEETS
For a complete overview of all low-carbon energy technologies, read or download the new SETIS Technology Information Sheets. They provide a snapshot of each technology's installed capacity, ongoing R&D, barriers, needs, a 'fact file', infographics and more.
Announcement: A new chapter has been added to the Technology Map on 'Energy Efficiency and CO2 Emission Reduction in the Iron and Steel Industry'. A download is