

Energy Technology Perspectives 2014

Energy Technology Perspectives: Collaboration on Energy Systems Transition

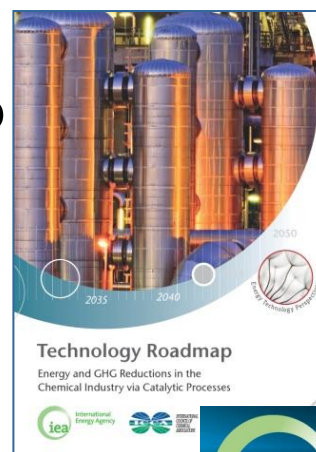
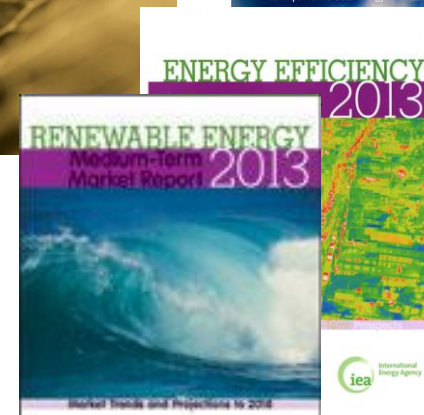
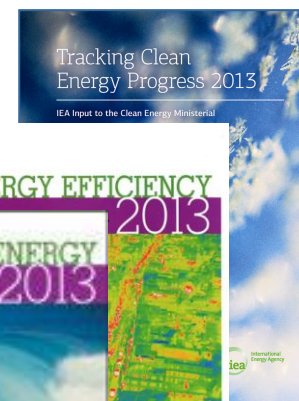
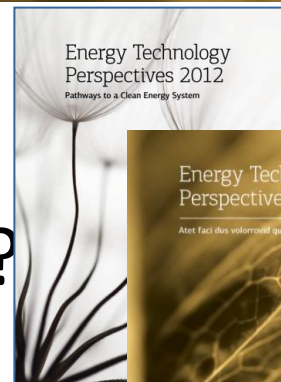
**Gaps and Strategic Opportunities in International Collaboration
on Low-Carbon Energy Technologies Workshop**

27 February, 2014

IEA's programme of work in energy technology

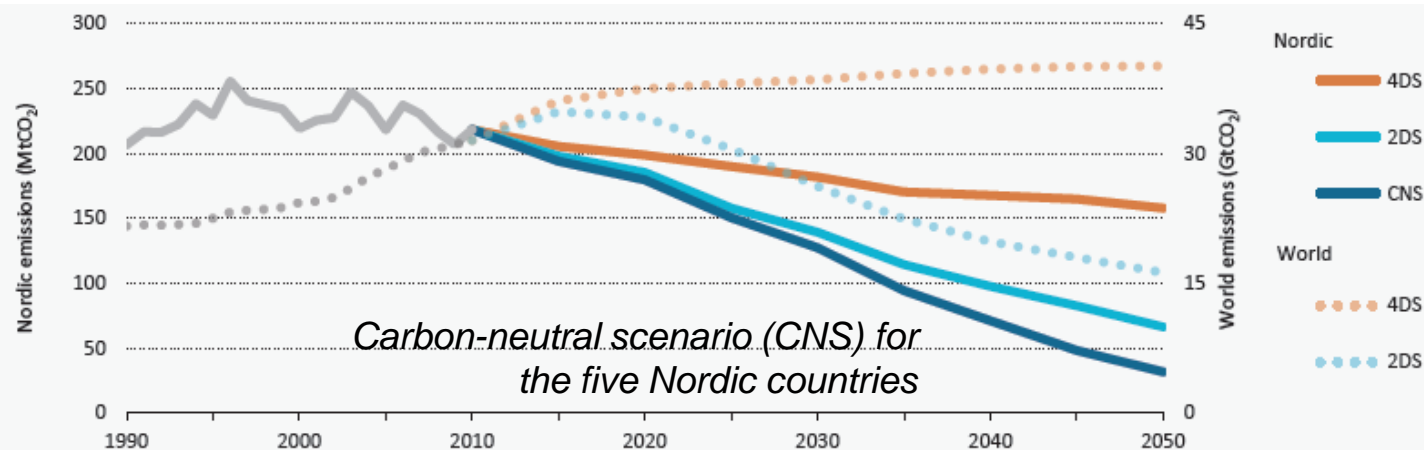
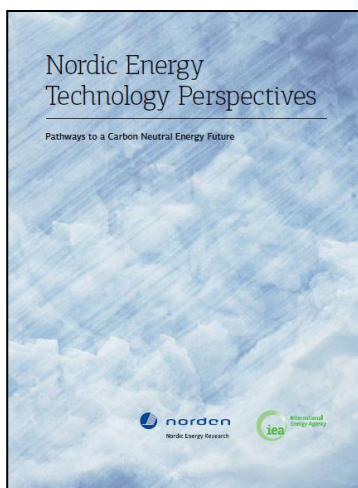
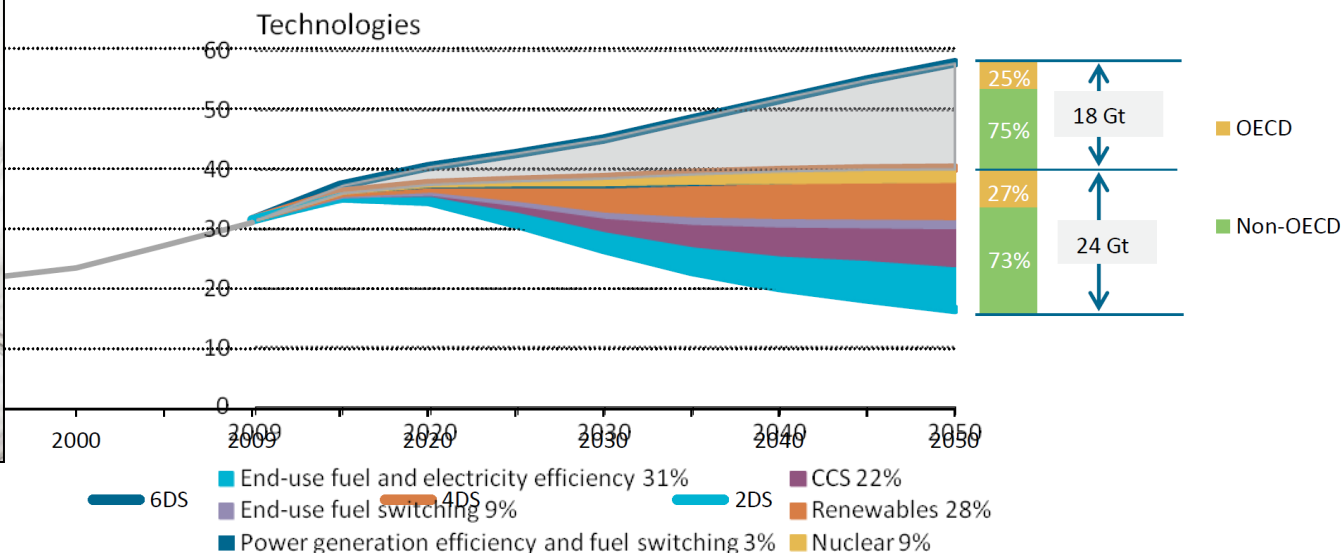
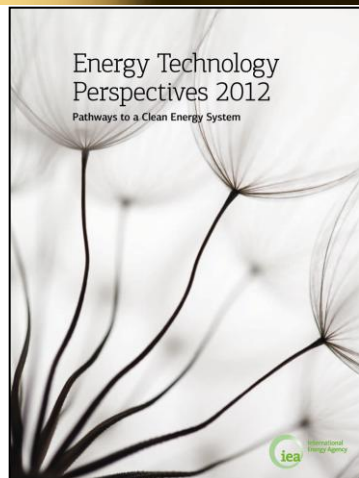
ETP
2014

- Where do we need to go?
- Where are we today?
- How do we get there?



Energy Technology Perspectives (ETP)

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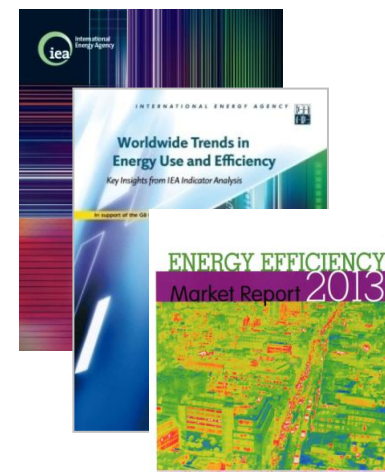


Note: Figures and data that appear in this report can be downloaded from www.iea.org/etp/nordic

Understanding where we are

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- IEA work on energy indicators
 - Energy Efficiency Indicators
 - ◆ Long history in the IEA
 - ◆ Recent push for better data
 - ID investment opportunities
 - Energy Technology and R&D indicators
 - ◆ Analysing Development and Deployment of Clean Energy Technologies
 - ◆ Emerging work stream
 - Defining solid and insightful indicators
 - Developing novel data sources



Two Complementary EE Indicators manuals being developed in parallel

- Development of indicators: to provide guidance and methodological tools to develop energy and energy efficiency indicators
- Statistics for indicators: to provide guidance on how to collect the data needed for those indicators
 - Includes a compilation of good and best existing practices from across the world
- Available from March 2014

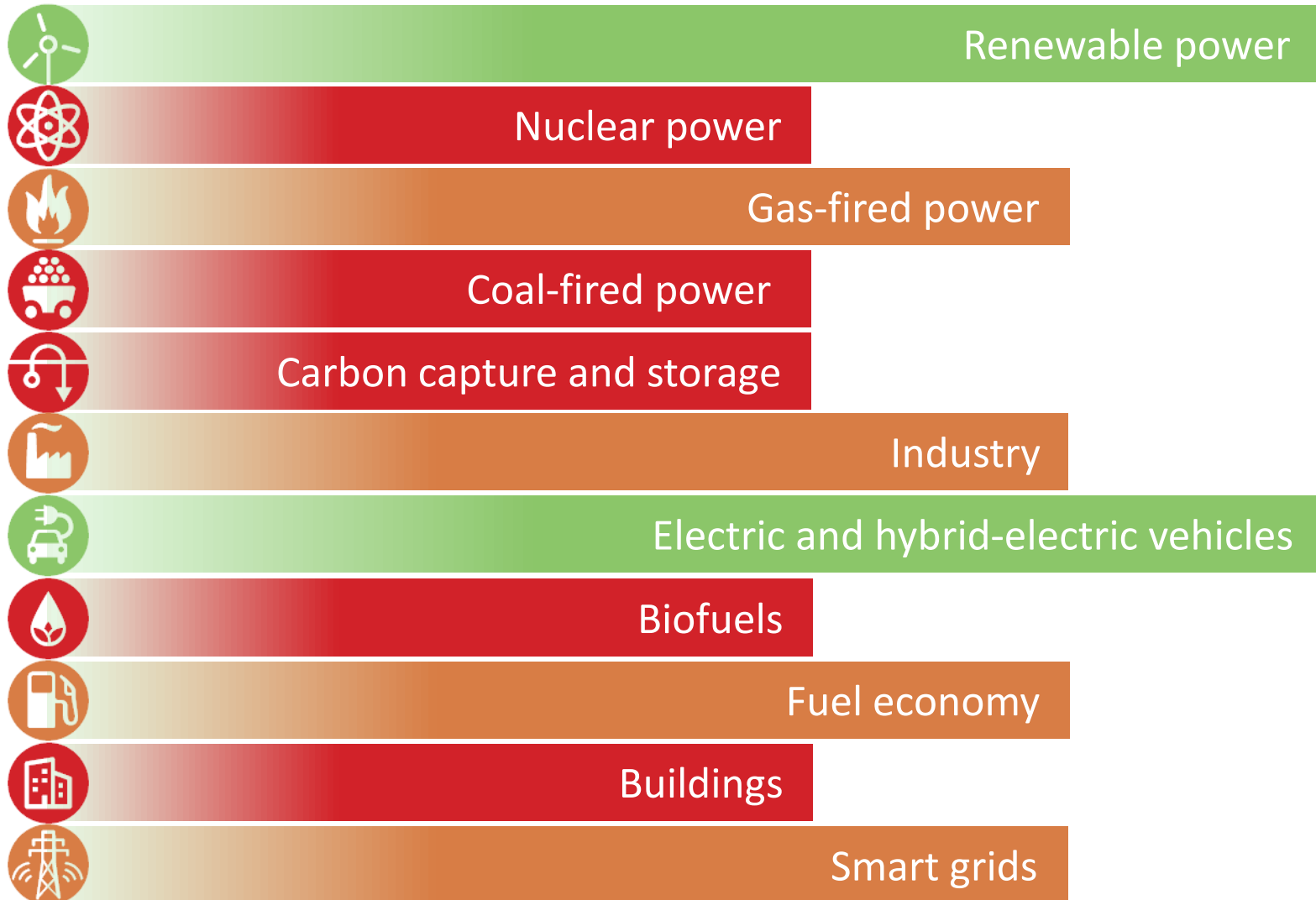
Manual
on Development of
Energy Efficiency
Indicators



Manual
on Statistics for
Energy Efficiency
Indicators



Tracking Clean Energy Progress



IEA Technology Roadmaps

Mapping where we need to go ...

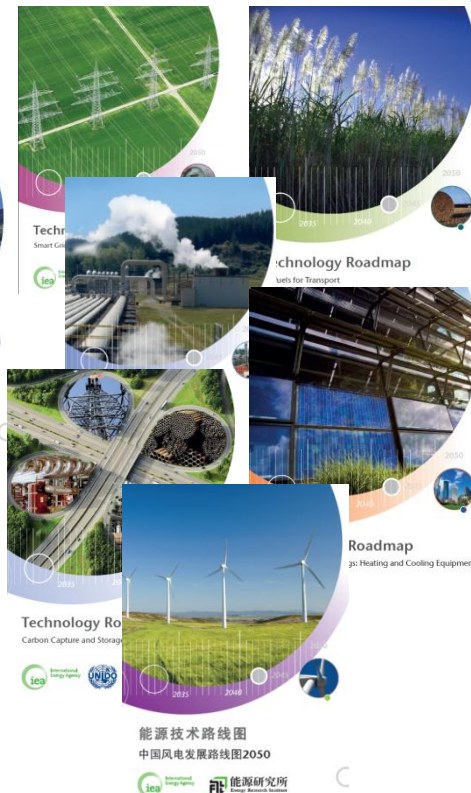
2009



2010



2011



2012



2013



2014

- Energy Storage
- Hydrogen

Energy technology roadmaps



... By building consensus among all stakeholders

- Goal to achieve
- Milestones to be met
- Gaps to be filled
- Actions to overcome gaps and barriers
- What and when things need to be achieved





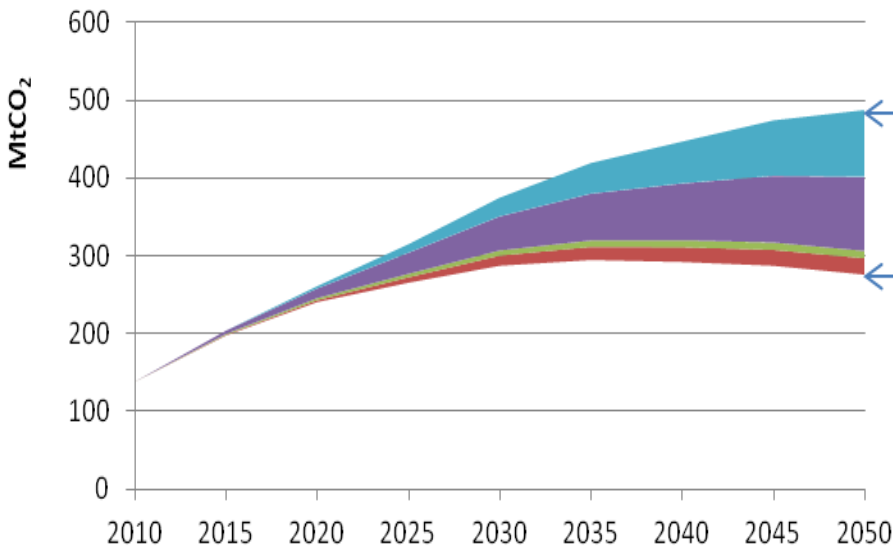
India Cement Roadmap: Regional Vision Implementation

Technology
Roadmap partners



Technology Roadmap

Low-Carbon Technology for the Indian Cement Industry



In consultation with



Industry supporters



Principal supporter

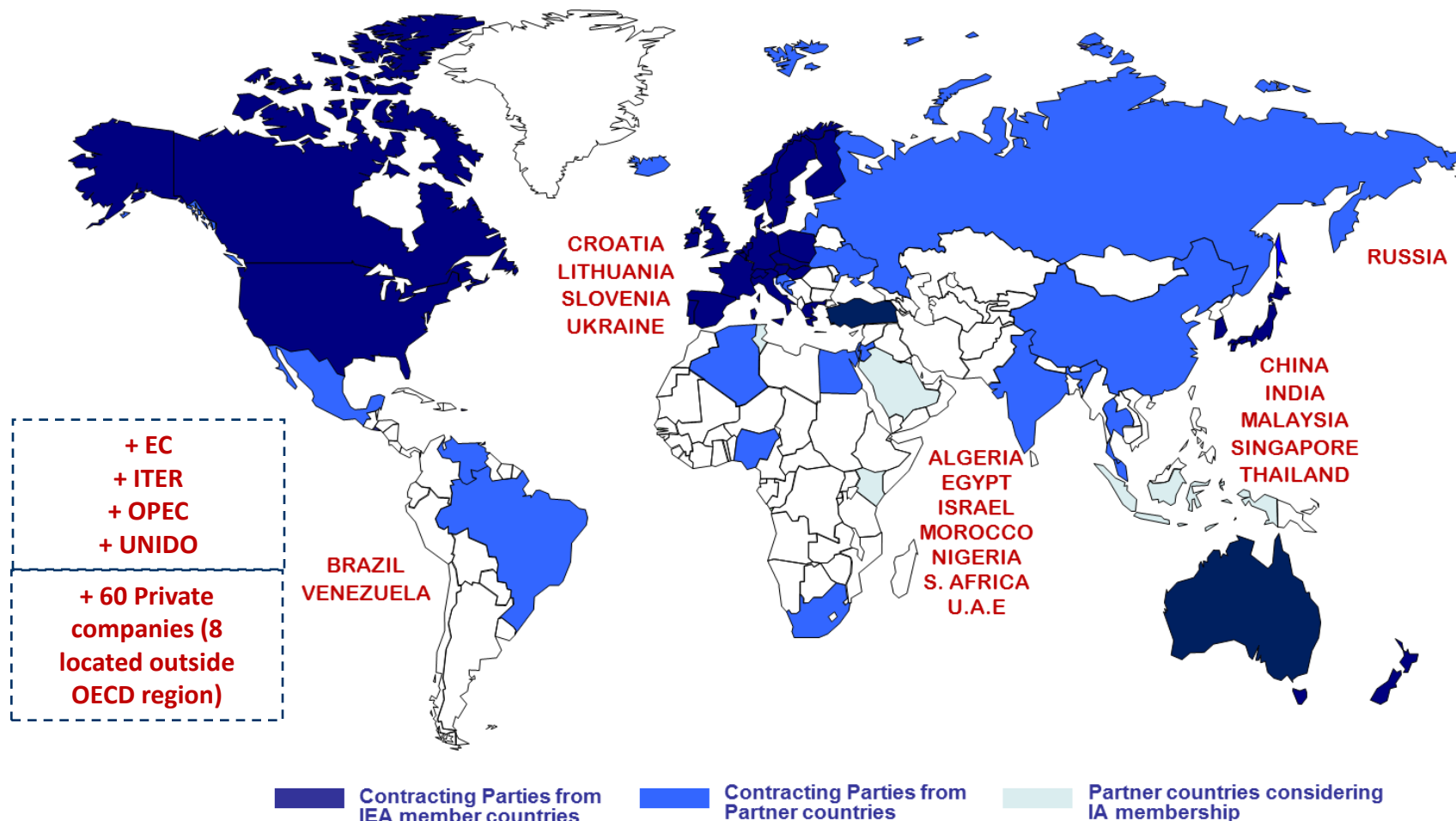


International Low-Carbon Energy Technology Platform

- ❑ Created in 2010 by the G8 and IEA Ministers
- ❑ **IEA key tool for multilateral engagement with emerging and developing countries**
- ❑ Entirely VC-funded

- ❑ Two main streams of work:
 - ❑ Dialogue workshops: sharing international best practice for deployment of low-carbon technologies
 - ❑ How2Guides: series of manuals for development of technology roadmaps at the national level

IEA Energy Technology Network



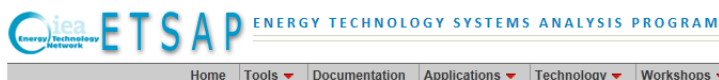
More than 1,300 research projects to date
Linking public and private – IEA Members and Partners
6,000 scientists and experts

Nearly 500 government agencies, research organisations, universities, energy companies, consultants

Energy Technology Data Source of ETSAP implementing agreement

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- Consistent data set for more than 50 energy supply and demand technologies
- Free access on www.iea-etsap.org



E-TechDS - Energy Technology Data Source



GianCarlo Tosato
E-TechDS
Coordinator



Giorgio Simbolotti
E-TechDS
Coordinator

MARKAL-TIMES models usually represent the entire energy system (i.e. demand and supply side) of a nation or region and need a huge amount of data on energy technologies to run (e.g. energy efficiency, lifetime, GHG emissions, investment and operation costs). Because MARKAL-TIMES models analyze and project the evolution of the energy system over time, data projections are also needed for each technology that is represented in the model.

ETSAP E-TechDS is an Energy Technology Data Source that offers consistent sets of data on energy demand and supply technologies to help analysts to build their own MARKAL-TIMES model. To put data in the right context, E-TechDS is conceived as a series of **Technology Briefs**, which provide basic information on process, status, performance, costs, potential and barriers for key energy technology clusters. Each brief consists of typically 5 to 10 pages including Highlights, full text and charts, and a summary data table.

The ETSAP Briefs are intended to offer essential, reliable and quantitative information to energy analysts, experts, policymakers, investors and media from both developed and developing countries.

Since September 2011, ETSAP E-TechDS is working in cooperation with the **International Renewable Energy Agency (IRENA)** to develop and update Briefs on renewable energy technologies.



Are you an Energy Technology expert?

You can contribute to the ETSAP E-TechDS project by:

- Reviewing/updating briefs
- Drafting new briefs
- Joining as a sponsor

Contact: ETechBriefs@iea-etsap.org

Contributions will be highly appreciated, and acknowledged with a free access to all briefs



Coal-Fired Power

HIGHLIGHTS

PROCESS AND TECHNOLOGY STATUS – Some 42% of the world's electricity production is generated by coal-fired power. The world's coal-fired capacity is 1,400 GW out of a global capacity of 4,600 GW. 25% of the total installed capacity (512 GW out of 710 GW, 2007) is based on coal-fired power. Coal-fired power is the dominant technology for new coal-fired power plants, pulverized coal combustion generate heat that is transferred to the boiler to produce steam. The steam is then used to drive a steam turbine and an electric generator. Pulverized coal produces a considerable amount of airborne emissions. A 1,000 MW pulverized plant emits about 140 t of CO₂ per year, in addition to smaller but significant amounts of SO₂, particulates and other pollutants. An alternative to the PCPC technology is the integrated gasification combined (IGCC) plants, a thermochemical reaction with oxygen and steam is used to convert liquid or solid (coal) into a gas mixture of carbon monoxide (CO), hydrogen (H₂), and carbon dioxide (CO₂), along a hydrogen sulfide (H₂S) after cleaning, the gas is fed in a turbine to generate electricity. The process produces superheated steam (in the heat recovery steam generator, HRSG) that drives a steam turbine. The IGCC technology is less mature than PCPC technology. Several IGCC plants are in the US and in Europe. They have efficiency similar to that of PCPC plants, but lower non-gaseous emissions.

PERFORMANCE AND COSTS – Technological development aims to increase the efficiency investment cost and the emissions of coal-fired power. The generating efficiency of PCPC plants is from the current 32% maximum value of 46% lower heating value, LHV, to some 50% technology in 2020. Efficiency and reliability improvements are also expected for the IGCC, hence dedicated to grow from 40% in 2010 to 52% in 2020. In the IGCC plants, the production of CO₂ of process offers the opportunity for capturing (sequestering) CO₂ capture and storage (CCS), which may plants some competitive and environmental advantages over PCPC. As far as costs are concerned, increasing prices of materials, steel and equipment, the investment cost of a pulverized coal plant is from \$1500/kW in 2000 to approximately \$2200/kW in 2008 (costs are quoted in US\$ 2008). IGCC investment costs have been slightly declining because of the reduction of the material cost and the lower demand for new capacity. The IGCC investment cost is relatively high, it may be the cost of PCPC plants. The operation and maintenance cost (O&M) cost, estimated at \$8/kW per year, of the investment cost per year for both PCPC and IGCC, but the IGCC plants may face higher of a lower technology maturity. Average costs of electricity today from PCPC are \$80-100/MWh (by which \$15-25/MWh is for the fuel). For IGCC plants, corresponding figure are \$90-100 (typically 1-25/MWh) for the fuel. In terms of cost projections, technology learning is not expected to decrease investment costs as the technology is mature. Therefore, the costs of supercritical and ultra-supercritical power plants are expected to decline from \$2200/kW in 2010, to \$1800/kW in 2020, while a 10% off-hand, technology learning may significantly reduce the IGCC investment cost from \$1700/kW then PCPC to \$1200/kW in 2020, while to \$1000/kW in 2020, more than PCPC.

POTENTIAL & BARRIERS – Numerous coal-fired power plants are under construction or in the pipeline. In the US, some 18 GW were under construction in January 2008 and a further 10 GW construction, some of which are to replace retired capacity. Coal-fired power offers advantages on the natural gas price is high and/or volatile, or in light of supply security issues. New coal-fired power efficiency and lower emissions of CO₂ per kWh than existing plants. Emissions of airborne pollutants (a disadvantage is the high investment cost (compared to gas-fired power) that is competitive cost. The price of CO₂ may also be a barrier for new coal-fired capacity. The current price in the trading system (some \$15-MACOL) is not high enough to discourage the construction of new plants. However, uncertainties about future CO₂ price can make it difficult to adapt new investment in storage technologies (CCS). This may significantly increase the investment cost and reduce the competitiveness. Therefore, long-term emission reduction policies and high CO₂ prices are needed to commercially enhance. Coal-fired power not only competes with gas-fired power, but also with its power. While some renewable technologies are growing fast and will have an increasing impact on the competition with its acceptance, and long-term.



Combined Heat and Power

HIGHLIGHTS

PROCESS AND TECHNOLOGY STATUS – Combined heat and power (CHP) can occur in a number of forms and processes, depending on the size of the plant and the type of fuel used. CHP is a process that generates both electricity and heat from a single fuel source. The most common form of CHP is the internal combustion engine (ICE) driven generator. Other forms include gas turbines, steam turbines, and fuel cells. CHP is a highly efficient way of generating electricity and heat, with efficiencies ranging from 70% to 90%. CHP is used in a wide range of applications, from small-scale residential heating to large-scale industrial power generation. CHP is a mature technology with a long history of successful operation. It is a key component of many energy systems, particularly in the industrial sector. CHP is a highly flexible technology that can be adapted to a wide range of fuels and applications. It is a key component of many energy systems, particularly in the industrial sector. CHP is a highly flexible technology that can be adapted to a wide range of fuels and applications.

PERFORMANCE AND COSTS – CHP is a highly efficient way of generating electricity and heat, with efficiencies ranging from 70% to 90%. The investment cost of a CHP plant is typically between \$1,000 and \$2,000/kW. The operating cost of a CHP plant is typically between \$0.05 and \$0.10/kWh. The total cost of a CHP plant is typically between \$1,050 and \$2,100/kW. The efficiency of a CHP plant is typically between 70% and 90%. The capacity of a CHP plant is typically between 100 kW and 100 MW. The lifetime of a CHP plant is typically between 20 and 30 years. The maintenance cost of a CHP plant is typically between \$0.01 and \$0.02/kWh. The fuel cost of a CHP plant is typically between \$0.01 and \$0.02/kWh. The total cost of a CHP plant is typically between \$1,050 and \$2,100/kW.

POTENTIAL & BARRIERS – CHP is a highly efficient way of generating electricity and heat, with efficiencies ranging from 70% to 90%. It is a key component of many energy systems, particularly in the industrial sector. CHP is a highly flexible technology that can be adapted to a wide range of fuels and applications. It is a key component of many energy systems, particularly in the industrial sector. CHP is a highly flexible technology that can be adapted to a wide range of fuels and applications.

Click for: [Sample brief](#) | [Energy Supply Technologies](#) | [Energy Demand Technologies](#)

Contributing Organisations:



ETP 3-years Publication Programme

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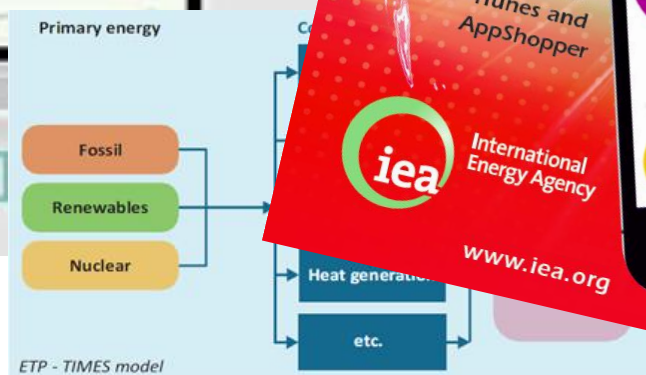
ETP 2014	ETP 2015	ETP 2016
<u>Part 1. Setting the Scene</u>		
Global Outlook, Tracking Clean Energy Progress		
<u>Part 2. Driving the Change (Thematic Focus) *</u>		
The age of electrification	Energy Technology and Innovation impacts on Climate change mitigation	Urban Energy Systems
<u>Partner Country</u>		
India	China	Mexico

* Each year included topics are: Low-carbon Generation, Fossil Fuels, Energy Demand, System Integration, and Policy and Finance

What is ETP?

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It's not just a book!



Analysis and modelling framework