EGTEI
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Emerging technologies/ techniques for LCPs up to 2030 (LCP > 500 MWth)

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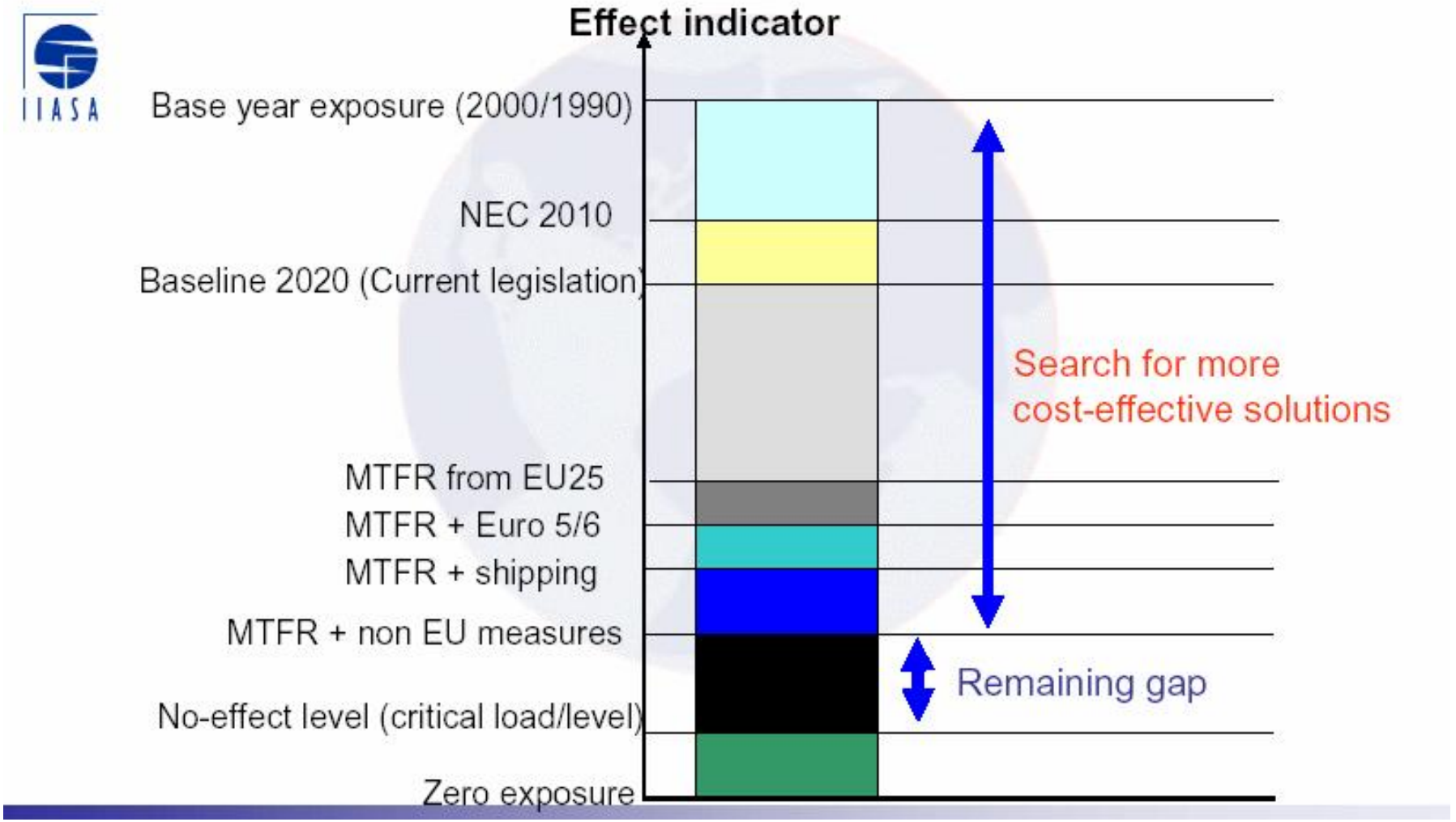
Expert sub-group on Emerging Technologies/Techniques



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EGTEI was mandated by UN ECE to:

Ø Initiate some work on emerging technologies/techniques in order to assess what could be done technically and economically to reduce air emissions from large combustion plants (LCP) up to 2030

Improvement in the modelling by:

Ø Replacing the current assumption with information from the technical improvements of existing technologies and abatement techniques

Ø Considering the impacts and costs of emerging technologies/techniques on emission reduction over time

Objective of the LCP2030 subgroup

Ø Provide technical and economical information for modelling work on:

- Emerging technologies and abatement techniques
- Emerging applications of existing abatement techniques
- Improvement of existing technologies and abatement techniques

"Emerging" techniques or technologies: not yet commercialized or in a early stage of commercialization

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Focus on:

- Their techno-economic characterisation (environmental performances, efficiency and CO_2 impact, costs, rate of penetration,…)
- LCP > 500 MWth
- Primary and secondary measures. Combinations of primary and secondary measures or combinations abating several pollutants at a time may also be considered.
- PM, SO_x, NO_x and CO_2 abatement

Methodology:

Ø Identification of documents and studies:

- IPPC BREF on LCP
- EU-project “Assessment of the air emissions impact of emerging technologies” 2003/2004
- Documents on Carbon Capture and Storage (CCS)

Ø Proposition of a list of potential technologies/techniques and review by the experts in order to identify technologies / techniques to be analysed with high priority

Ø Collect of information from LCP2030 subgroup experts or from interview of other experts

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Experts:

Ø Industrial experts:
EDF, RWE npower,
EDIPOWER, BOT Gornictwo i
Energetyka SA…

Ø Administration experts:
ENEA, ECN, Swedish EPA,
Federal Environmental Agency
Austria, Finish Environment
Institute…

Main views of the experts on emerging technology

Ø **IGCC** (Integrated gasification combined cycle)

- The **net efficiency** for existing IGCC plants operating on coal is around **43%** (LHV basis). IGCC could reach **50%** efficiency **around 2015**.

- **Investment** is estimated **between 1 and 1.5 M€/MWth** (demonstration plant). A study from IEA considers the specific investment of IGCC is about **20% higher than that of pulverized combustion**.

- IGCC technologies could be **commercially available around 2020 with CCS**.

Ø Oxy-combustion

- Oxy-combustion enables the capture of CO_2 by direct compression of the flue gas without further chemical capture or separation.

- Several **10 to 50 MW mock-up plants** worldwide are **planned up to 2010**, with **100 to 500 MW units** possible **around 2015**. Oxy-combustion technologies could be **commercially available around 2020**.

- Oxy-combustion process leads to the **decrease of NOx emissions**.

Main views of the experts on emerging abatement techniques

Ø Flowpac (Alstom)

- Flowpac is a promising **end-of-pipe desulphurisation** (wet FGD) technology using a bubbling technology instead of circulation pumps. Flowpac results in a **low capital cost**.

- The **electrical consumption is lower** in the Flowpac (1.3% of the power capacity) **than in the classical wet FGD** (1.7/1.75%).

- The system is **currently implemented in oil-fired plants** (< 340 MWe) and **needs to be demonstrated with coal-fired plants**.

Ø CO_2 abatement techniques

- There are three types of CO_2 capture processes: **post-combustion, oxy-combustion, pre-combustion**
- CO_2 capture and storage (CCS) in power plants is being demonstrated in a few small-scale pilot plants. **Large-scale demonstration plants with CCS** are planned by **around 2015** with the objective of **developing CCS by 2020**
- CCS costs are highly project specific. The objective is to **reduce CCS costs to below 25€/tCO_2 avoided by 2030**.

Main views of the experts on improvement of existing technologies

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- One of the ways of reducing the emissions of CO_2 from fossil fuel fired power plants is to **improve the overall efficiency** of plants. Because of the penalty of CO_2 capture, **CCS makes sense only for highly efficient plants**.

- The improvement of the following existing technologies were considered by the experts:

  - **Coal-fired power plant**
  - **Combined Cycle Gas Turbine (CCGT)**

Ø Coal-fired power plant

- **Sub-critical** coal-fired power plants can achieve **efficiencies of up to 40%** and **supercritical and ultrasupercritical of up to 45%.**
- From **2020**, coal-fired power plants with advanced steam cycle (350 bar, 700°C) could reach **efficiency of above 50%.**
- The challenge is the development of materials (nickel based alloys).

Ø Combined Cycle Gas Turbine (CCGT)

- The average **efficiency of a 400 MWe** combined cycle gas turbine (CCGT) is about **58%.** In **2015**, efficiency of **62%** could be commercially available. In **2035**, CCGT should reach, commercially, an efficiency of **70%** by improving the component efficiencies and using new materials.

Ø Combined Cycle Gas Turbine (CCGT)

- The increase of efficiency will follow the increase of the capacity of units. At present, the CCGT units (F technology) have a capacity of 430 MWe (in CCGT configuration). Technology of the H generation has a capacity of 530 MWe. **Experts assess that the CCGT units could reach capacities of 600 to 700 MWe in the future.**

- **The most recently build plants are able to reach 20 mg/Nm^3 without SCR**.

In the report, more information is available on:

- Emerging applications of existing abatement techniques (SO_3 injection to reduce PM emissions)
- Costs and performances of abatement techniques of existing installations
- Impact of energy efficiency increase on CO_2 and pollutant emissions
- Impact of energy efficiency and plant sizes on costs
- …

Future work:

- Some technologies/techniques (e.g. catalytic combustion), were considered as outside the scope of the LCP2030 subgroup which considered only power plants with capacities higher than 500 MWth.

- **Future work of the subgroup will consider lower capacities of the large combustion plants (> 50 MWth).**

Thank you for your attention

Report available on the following website:

http://www.citepa.org/forums/egtei/egtei_LCP2030.htm

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