EPPSA Response to EC's inquiry on
Effects of EU power plant capacity expansion until 2020/2050 in terms of additional needs of material and workforce
DG TREN

Brussels, 3rd February 2010

1. Issue

The European Commission, DG TREN, is currently developing roadmaps for 2050 energy perspectives in the EU and presented the following request:

> "….. EPPSA`s viewpoint on effects of (significant) EU power plant capacity expansion (nuclear, fossil, renewables) until 2020/2050 in terms of your expectations with regard to additional needs of raw materials, special manufacturing components and qualified workforce, and the main corresponding bottlenecks which you expect."

EPPSA members are companies both manufacturing components/systems for and constructing turnkey fossil fuel power plants. The following description is, therefore, limited to fossil power plants which also include biomass and waste as fuel and nuclear and thermal solar power in the respective steam-cycles.

2. Executive Summary

No major shortage is expected on raw material, manufacturing/erection capacities as well as qualified workforce including highly skilled engineering capacities, if we can assume a steady growth on demand on power plant orders including new, retrofit, modernisation and after ales services orders. Nevertheless, history shows that this was not at all the case. 2006/2007 was the last period of extremely high demand, which dropped sharply from the beginning of 2009 on. The reasons are various but the key issues are political support and low public acceptance together with time consuming approval procedures to which late changes often result in cancelling various projects in a very advanced stage.

In conclusion, power plant business needs specific resources (material, manufacturing capacities and qualified labour force including unique engineering know-how), which cannot be kept on hold for years. This is especially true for the best skilled engineers that will move to a different work field in order to avoid facing an extremely volatile market demand that characterises the power industry.

In this situation, a change is imperative and needs to be commonly approached by all parties involved with politicians taking the lead. The EU 27 should be aware that fossil fuel power plants are needed not only to ensure the reliability of power supply, but also to balance the gaps created by intermittent energy sources like wind and photovoltaic (PV).

3. Power demand in the period 2010 to 2020 / 2050

Various scenarios for the period 2010 to 2020 / 2050 predict a growing demand on electricity, both for industrial and private use.
EPPSA has worked with the following scenarios:

- ***EU-27 Energy Baseline scenario Trends to 2030 – update 2007***, DG TREN, European Commission 2008– see figure 1. We were informed that an update is under development and its release is scheduled for mid 2010. This update is expected to show the negative effects of the financial crisis in 2008 -2009 not taken into account in the previous version.
- ***Electricity Generation - Facts and figures 2009 /2010***, VGB Powertech**,** "Development of the European and Global Electricity Demand" that states that energy demand is expected to grow by 25 % up to 2030 referring to a 2007 base demand. At the VGB Congress in Lyon in September 2009 the data had been updated, showing a temporarily dip due to the impacts of the financial crisis with a following steadily increasing demand as predicted before.
- ***World Energy Outlook 2009,*** IEA, 10th November2009, London: "global demand grows by 40 % between 2007 and 2030 with coal rising most in absolute terms." Nevertheless, the demand is expected to decrease due to the financial crisis impact.

The trend is clear: steady growth by 30 to 40% until 2030. The same trend will represent as well the subsequent 20 years period until 2050.

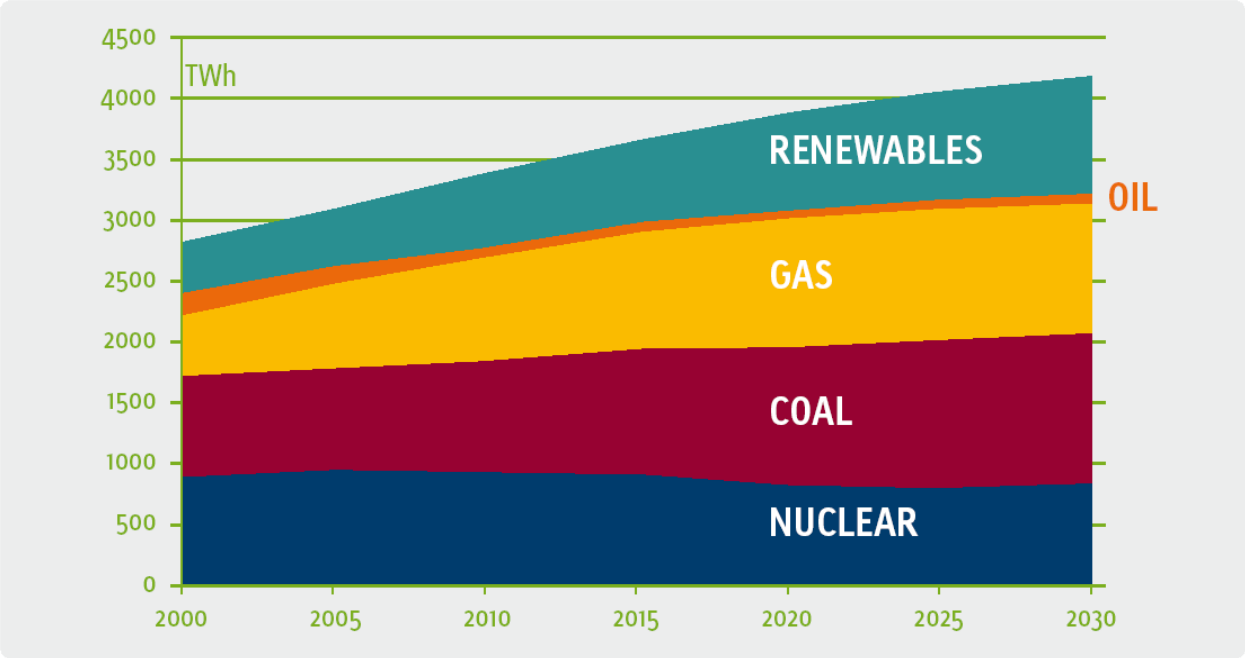


Figure 1: Increasing Power Generation in EU27 to 2030
Source: *EU-27 Energy Baseline scenario Trends to 2030 – update 2007,* DG TREN, European Commission, 2008

Coal (Period 2010-2020)

	GW	800 MW Units
New	73	91
Back-up	24	30

Gas (Period 2010-2020)

	GW	400 MW Units
New	74	185
Back-up	24	60

Figure 2: Fossil Power Plants – new and back-up to balance intermittent wind and PV power generation
Based on the *EU-27 Energy Baseline scenario Trends to 2030 – update 2007,* DG TREN, European Commission, 2008

This steady growth of power demand should be reflected in a steady growth of orders for fossil fired power plants - including new, retrofit, modernisation and after ales services orders - to satisfy the demand. Market demand is however too volatile to make this assumption.

The following assessment is done based on a continuous growth of the market demand.

4. Raw material

Power plant specific high alloy steel:
Piping with supports and vessels including valves are key components and are all made out of steel. High alloyed steel is a power plant specific item and it is used in high temperature/high pressure components in the steam cycle. The higher the temperature and pressure are, the higher is the efficiency of the power plant. Current design parameters are 285 bar/600 ^{0}C for live steam and 620 ^{0}C for reheat temperature. Next generation will achieve the 700 ^{0}C; power plant components tested prove suitable to reach an economic lifetime.

Welded or forged turbine rotors are key parts of a thermal power plant. Capacities have to be booked on a long term schedule, ranging from some months to several years. If firm orders have to be cancelled due to delays, penalties are high and time delays tremendous.

All this material is very specific for power plants application: alloys specifically developed, tested in demo plants and manufactured for power plant use only. Some of the alloys constituents are rare but up to our knowledge there is no general bottleneck visible.
Nevertheless, if the market demand is volatile, material suppliers will restructure or even close their manufacturing facilities to adapt to a lower market demand. A restart of these capacities will be extremely costly and time consuming, if not impossible, and will have an extremely negative impact on price and delivery time. A capacities resume will only be possible in the range of 3 to 5 years. During the restart, the product quality will be jeopardised; it takes years to reach again the excellent quality level necessary to secure the highly reliable operation of new plants.

Other material – not specifically designed and manufactured for fossil power plants:
Up to our knowledge there is no sign that any other material might fall short if a plant is to be built.

5. Manufacturing and erection capacities – including respective highly qualified manpower

A power plant is composed of quite a considerable number of rather specific components that are not broadly used in other plant processes as chemistry. Specific components/systems are listed below:

- Large steel structure systems;
- Large duct work for air and flue gas;
- Large Forced Draft or Induced Draft fans for the combustion air;
- Coal mills of all kinds for the broad variety of different coal, offered worldwide;
- Large heat exchangers for air, fluids as water and steam;
- Boilers of a broad variety including furnace and heating surfaces;
- Gas and steam turbines of a broad variety including specific hydraulic control equipment, heat exchangers and condensers and/or requiring large specialised forgings and castings;
- Generators requiring large specialised forgings and castings;
- Large cooling towers – wet, dry and mixed;
- High pressure feed water pumps;
- High Temperature/High Pressure piping, vessels and valves including power plant specific safety valves, large thick wall forged fittings (very few manufacturing facilities, worldwide);
- Large high quality demineralisation plants for feed water supply;
- On load boiler cleaning;
- Ash disposal systems including conveyer belts, bunkers;
- Flue gas cleaning systems as electrostatic precipitators, desulphurisation and DENOX plants; in the future we will have to add CO_2 capture plants – post-combustion, Oxyfuel and gasification (IGCC), including large air separation units;
- For nuclear power plants reactor pressure vessels, steam generators and safety control systems including the unique approval procedures for the safety related components and systems are the most critical bottlenecks. For details on that please refer to suppliers/operators organisations assessments as Atomforum.

Suppliers of the components and systems listed above do major portions of their total business volume in the field of power plants. If market demand is volatile, capacities have to be adapted accordingly. This is not possible without considerable delays, resulting in a dangerous shortage when market demand is increasing sharply after a period of low demand. Building up resources is time consuming and costly. Especially qualified manpower is very difficult to build up again. After a restructuring, qualified experts will find a new job in another area quite fast and will be extremely reluctant to come back when market demand in power plants rises again.

The consequence of a volatile market will be possibly a shortage of highly qualified workforce for a period of 3 to 5 years. Depending on the reputation of the branch and on the job alternatives, qualified workforce will be reluctant to come back if the new job offers a stable future.

6. Engineering, Commissioning and Project Management

6.1 General

Power plant processes are a quite demanding area that needs specific skills and know-how not possible to learn in a short time. Experience builds up over years:

- Young engineers, well educated at universities, learning from the older experienced,
- young engineers introducing new technologies,
- young and older engineers exchange knowledge.

This is a process which needs constant persistent care. Once broken through tough restructuring needs, it will take years to build up experience again.

Power plant specific know-how is imperative in the field of:

- Arrangement planning including 3-D modelling to create civil works, steel structures, piping, ducting etc. meaning the entire arrangement of the power plant equipment;
- Stress analysis including life time calculation of high temperature/high pressure pipe work;
- Design of large boilers with better efficiency, highly flexible for different kinds of coal, highly reliable for the calculated lifetime, able to operate at extremely low partial load with minimal negative impact on efficiency;
- Power plant specific control system design, including analogue and binary control, instrumentation, man-machine interface, safety related systems as well as unit load control to achieve a high manoeuvrability of the power plant requested to balance intermittent wind and PV power generation;
- Modelling of systems and components as well as the whole power plant in order to achieve optimal layout and design in respect of efficiency, cost and life time;
- Development skills for high temperature/high pressure materials.

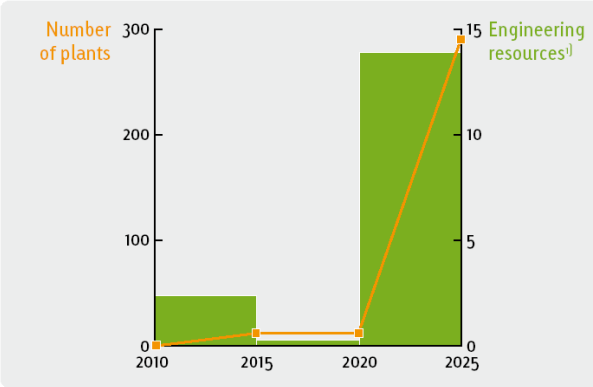
The above listed items are only some major areas, power plant specific know how is needed to successfully design, commission and manage a power plant project. The complexity is high and the interdependence between the different areas to cover is complex and manifold. Thus cooperation is decisive. Project management is the key to make a power plant project a success in time, at budgeted cost and defined quality.

A stop and go in market demand – as we face since years, with a trend to become worse with every cycle – is difficult to control especially for engineering, manufacturing and erection. An improvement on that aspect is urgently needed to keep our high level of power supply security in Europe. Steam power plants will be the backbone of our power supply for the next decades according all forecasts mentioned under item 3.

6.2. CO_2 Capture Plants to build in EU-27 in period 2010 - 2025

CO_2 Capture Plants are the solution to achieve a substantial CO_2 abatement when operating fossil fuel power plants. The basics of the technology are developed. Pilot plants are under operation, under construction or in the design phase. Large scale demonstration is scheduled to 2015. Experience gained is the basis to design, manufacture, commission and operate commercial plants.

Business as Usual



EPPSA proposal

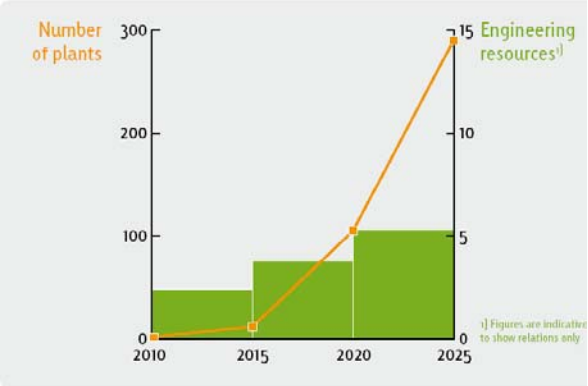


Figure 3: Engineering resources to build CO_2 capture plants in EU27

Commercialisation has to start following demo projects without any delay to maintain skills, obtain full benefit from demos and accelerate deployment. Figure 3 shows the cases:

- Business as usual
  is based on the actual situation resulting in the following bad development:
  - Commercialisation will not start from 2015 on, as political support and incentives to sign orders for CO_2 Capture Plants are missing
  - As a result no considerable reduction of CO_2 emissions will happen before 2020
  - Unique know-how and experienced engineers cannot be retained after commissioning of demo plants.
- EPPSA proposal
  is based on commercialisation starting immediately after demo projects without any delay resulting in a
  - Continuous build up of know-how and resources
  - Early reduction of CO_2 emissions

7. Other aspects

Material development needs a long-term activity. New materials have to be tested for at least 30 000 hours, better 100 000 hours. If targets are not reached in the first trial, tests must be repeated with new material features. Such costly development projects will only be run and continued if the respective industry sees a clear and sustainable market. The success of those developments is crucial for further efficiency improvements. Moreover a continuous development of highly sophisticated materials is the key for maintaining the know how in the long-run and supporting the European industry as a whole.

During the nineties many manufacturing shops closed down in Europe to adapt the capacity to the market needs of that time. Experience from 2006 to 2009 clearly reveals that Europe is missing essential manufacturing capacities and capabilities to assure the required reliability, quality and on-time delivery performance. Only a stable market can support the reviving of former European skills and create new work places for European citizens.

8. Conclusion

According to our knowledge, no bottleneck is visible to follow the growing demand on power supply from fossil power plants including biomass and waste as fuel and the respective steam-cycles of power plants using nuclear and thermal solar power.

It is imperative to change the volatile market demand on new and retrofit power plants and achieve a reliable steady forecast of the market volume. A “stop and go”, as in the past will result in bottlenecks with an absolutely negative impact on power supply in Europe. Power plant business needs too specific know-how and capacities in manufacturing, erection and engineering -and it would hardly be able to follow a volatile market demand with short cycles, as we face now.

Permitting capture-ready power plants and early deployment of CCS beyond the Demonstration projects are the keys to continuity, progressive build-up of resource/capacity and avoiding later bottlenecks.

If we do not achieve this there is the real risk that these jobs will be lost permanently and in future we will see all power plants in the EU being built by overseas companies (China, Korea, …).