

Renewable Energy Sources in Europe in View of the “20-20-20” Target

energy centre
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European Target “20-20-20” in Renewables

In March 2007 European leaders
signed up to a binding EU-wide target to source:

20% of European energy needs from renewables,
including biomass, hydro, wind and solar power,

by 2020.

To meet this objective,

**“Directive 2009/28/EC
on the promotion of the use of energy
from renewable sources”**

was issued by European Parliament as of 23 April 2009

(amending and subsequently repealing Directives 2001/77/EC and 2003/30/Ec)

New directive stipulates target to reach 20% share of renewable sources on all energy generation in European Union by the year 2020.

To reach this goal, individual targets were set for individual countries for each member state. For example, following targets were set for member states involved in Project SET@W:

**Sweden 49%, Portugal 31%, Denmark 30%, Italy 17%,
Bulgaria 16%, Poland 15%, Slovak Republic 14%,
Czech Republic 13%, Germany 13%, etc.**

Historical Milestones

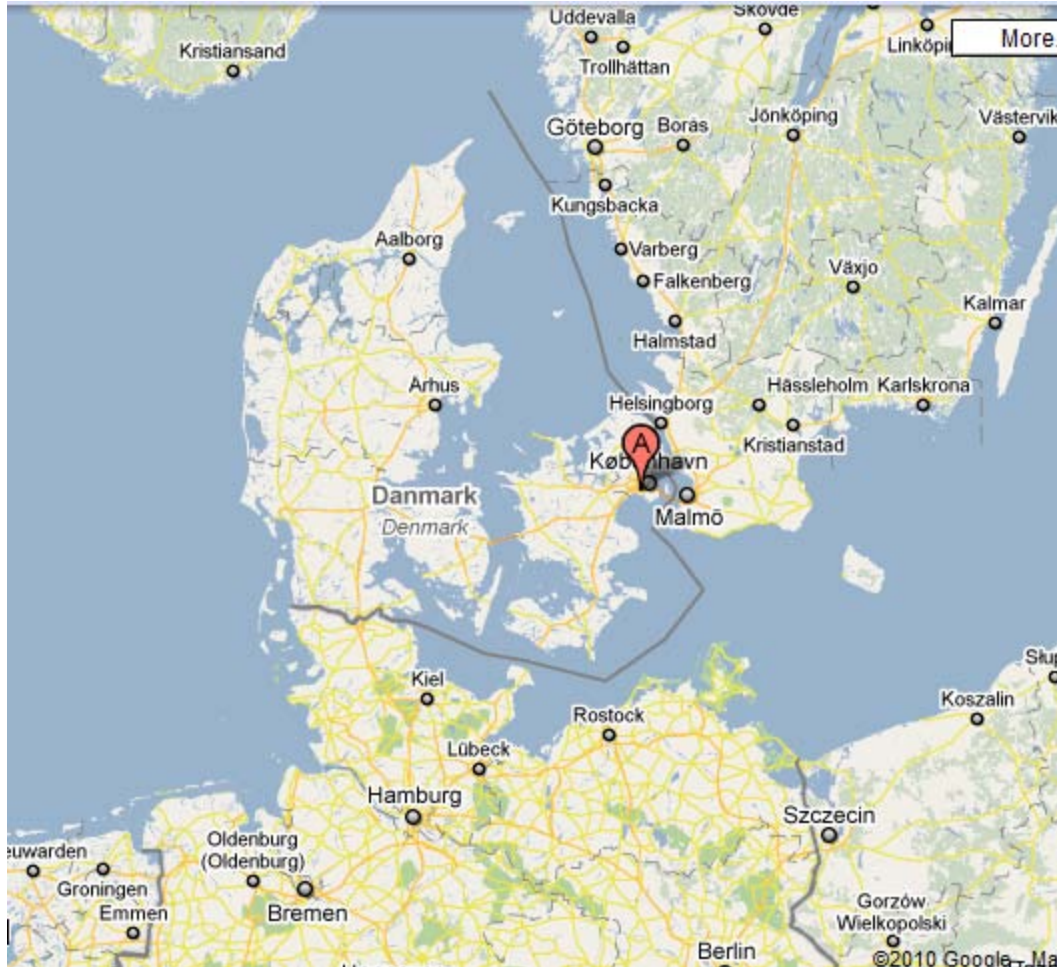
- Nov. 1997:** European Commission (EC) publishes White Paper setting out a Community Strategy and Action Plan for renewable energy sources (RES).
- Sept. 2001:** EU adopts Directive on the Promotion of Electricity from RES
- May 2003:** EU adopts directive on the promotion of the use of biofuels for transport.
- 10 Jan. 2007:** European Commission (EC) presents Renewable Energy Roadmap.
- March 2007:** EU summit endorses a target to source 20% of EU energy from RES by 2020.
- 23 Jan. 2008:** EC presents a proposal for a new renewables directive.
- 9 Dec. 2008:** EU summit agrees final version of the Renewables Directive.
- 30 June 2009:** EU issues template for National Renewable Energy Action Plans.
- 30 June 2010:** Deadline for EU states to present National Renewable Energy Action Plans.

Good Practice Examples

**of some remarkable European projects
in Renewable Energy Generation**

are as follows:

***Multifuel Ultra-Supercritical
Power Plant
Avedore-2, 585 MWe,
Copenhagen, Denmark***

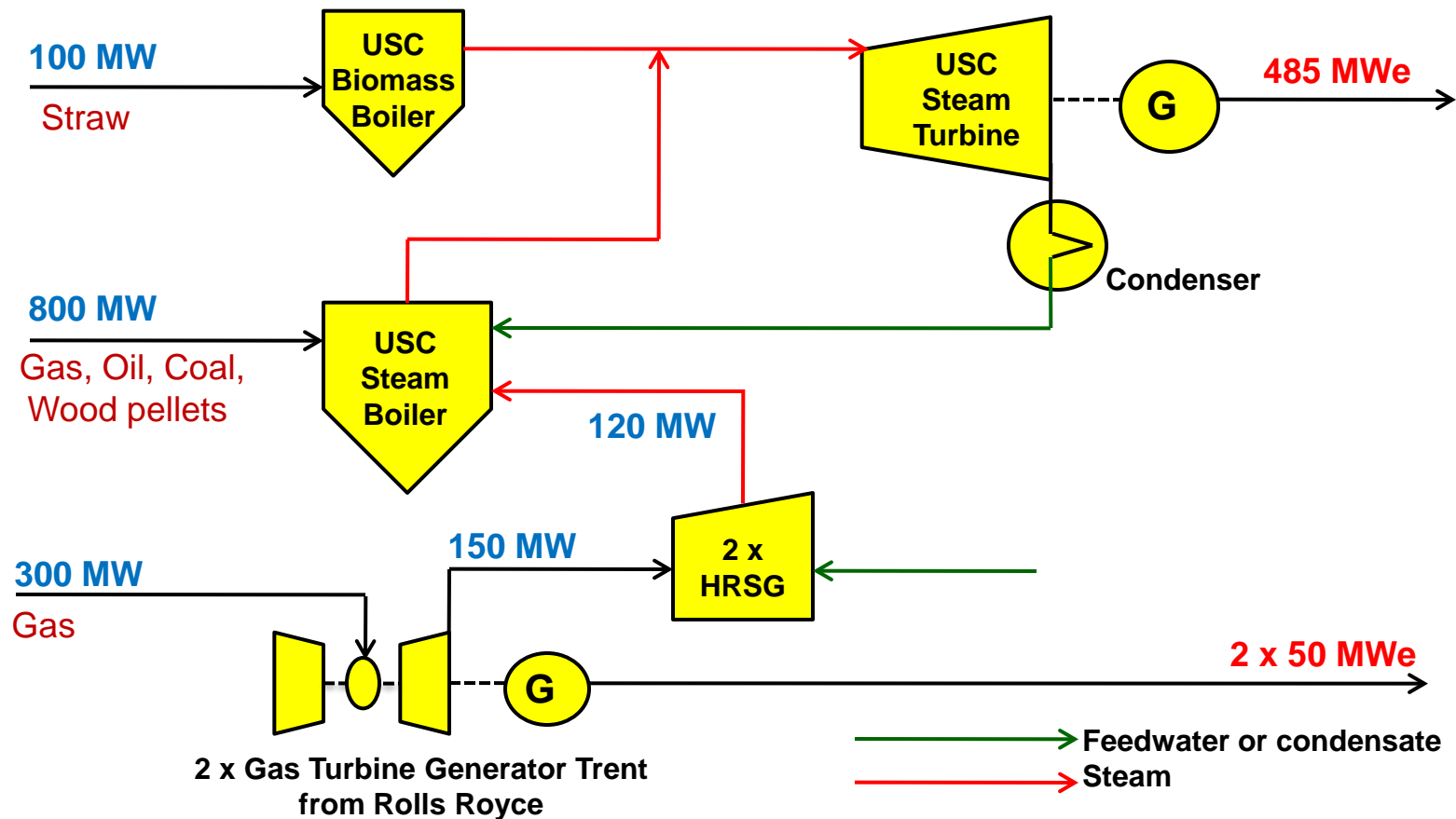


Location

Power Plant Avedøre is located at the West coast of the Zealand Island at the outskirts of Copenhagen, capital of Denmark.

Avedore2 - Heat Flow Diagram

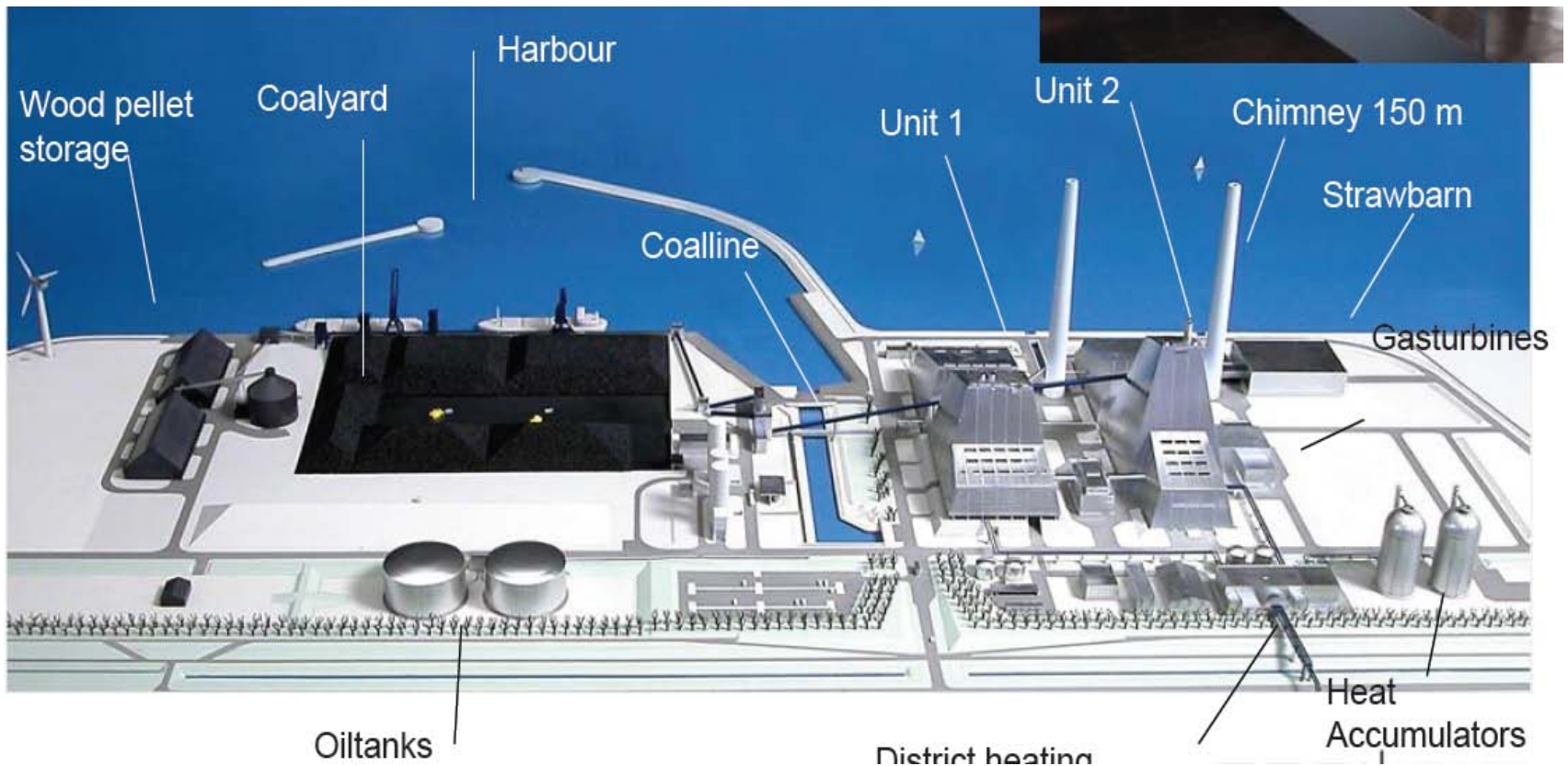
Avedore-2 has two Ultra-supercritical boilers, one of them running on biomass (straw) and two gas turbines from Rolls-Royce.



Site Foto Avedore 2 is situated in one common site together with coal-fired plant Avedore-1, 250 MW.



Avedore – Artist's View



Babcock & Wilcox Volund A/S (BWV) - Denmark

constructed the steam turbine
and the ultra supercritical
straw-fired boiler plant.

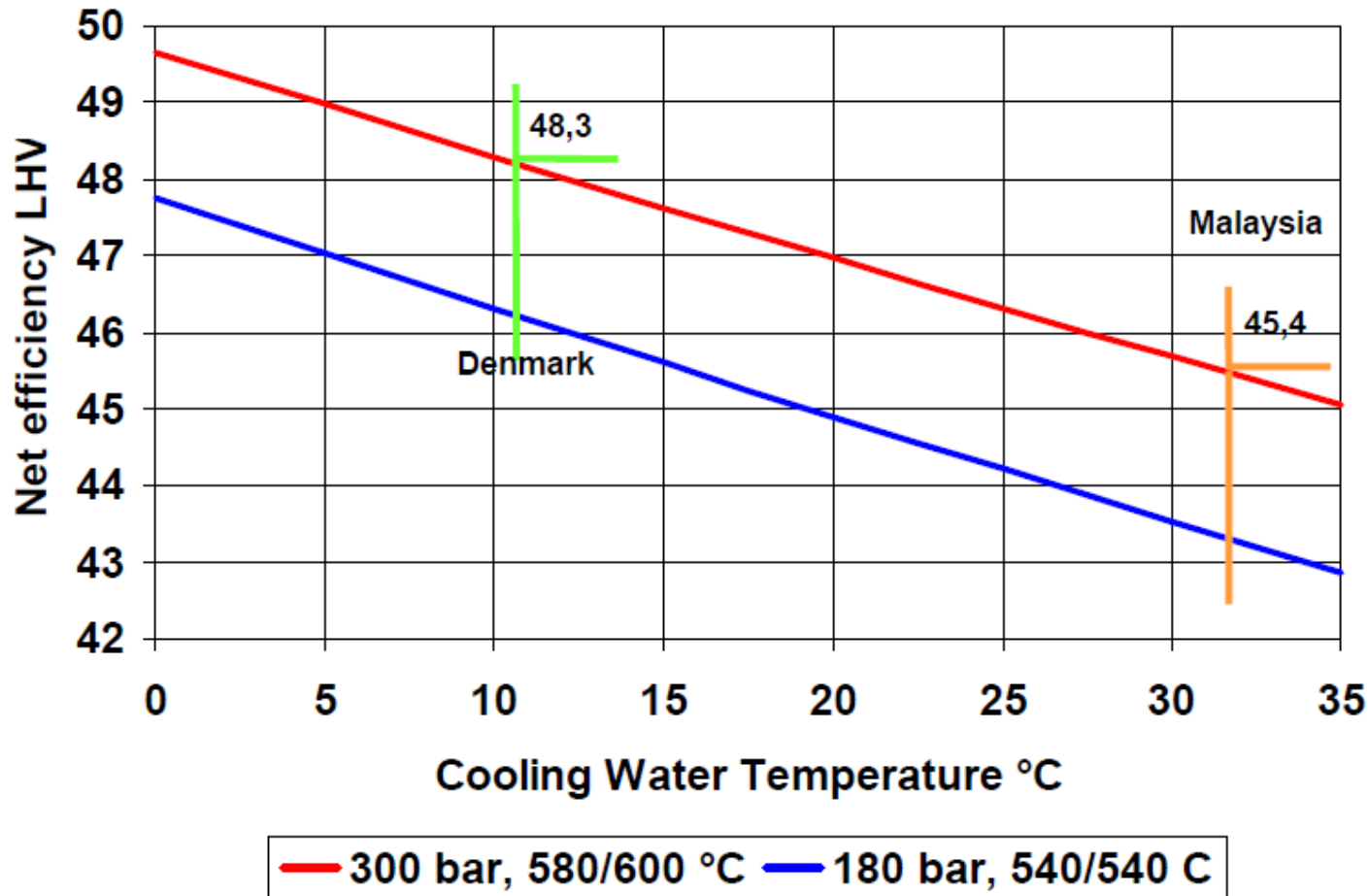
The Plant represents
a completely new technology
and is the World's **largest plant** of its kind.

Electrical efficiency 50%

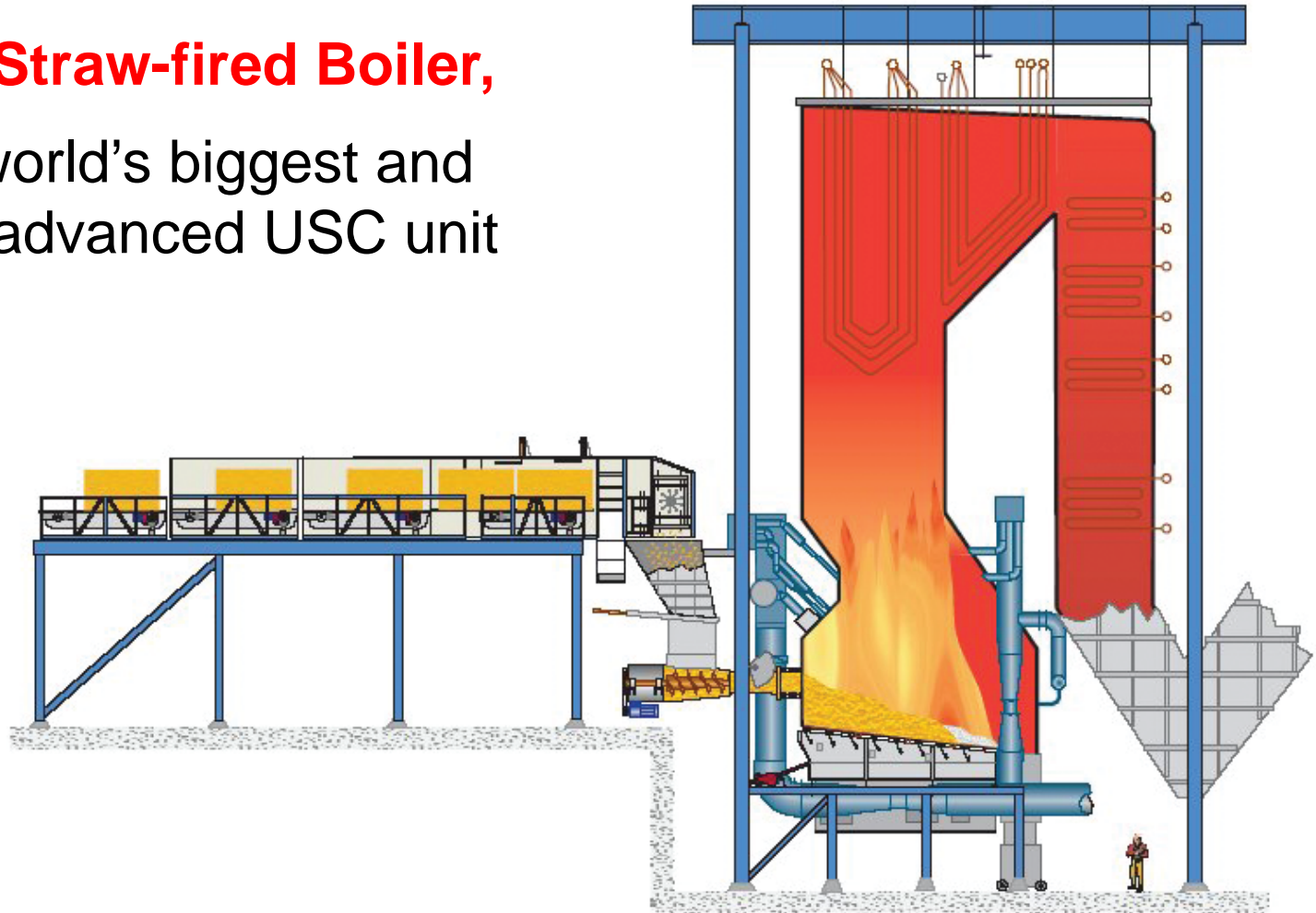
Highest in the World
with solid-fuel-fired plants,
like coal and biomass.

*The extremely high thermal efficiency
is partly determined by extremely
low **cooling water** temperature of **10° C**
as shown in following graph.*

If an identical plant would be constructed for example in Thailand or Malaysia, where the cooling water temperature is 30°C, electrical efficiency would be only 45% instead of 48%.

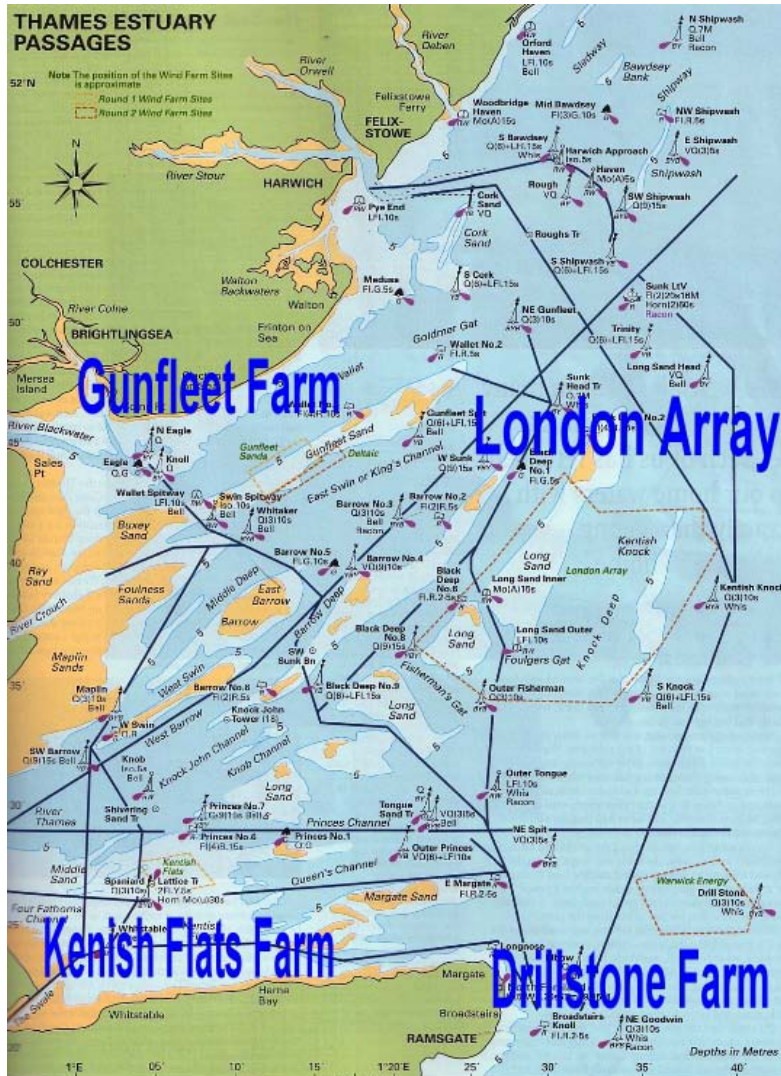


USC Straw-fired Boiler,
the world's biggest and
most advanced USC unit



London Array Wind Farm 1000 MW

Location



The London Array Wind Farm, the biggest wind-farm ever built, will be located more than 20km from the Kent and Essex coasts in the outer Thames Estuary.

The Farm will occupy an area of up to around 245 sq km on and between two sandbanks, Long Sand and Kentish Knock, in water up to 23 metres deep. The site is bounded to the west by Black Deep, the main approach to the Port of London, and to the south by the approaches to Fisherman's Gat. The water depth increases fairly rapidly to the east of the site, into an area used by shipping.



Configuration

The turbines will be arranged in rows and columns aligned according to the prevailing south-westerly wind.

Key advantages offered by this site are:

- High wind speeds
- Low water depth
- Proximity of nearby ports for construction, operation and maintenance
- Minimum interference with established shipping channels
- Suitable ground conditions
- Suitable grid connection
- Proximity of power demand (South East England has the highest demand for electricity in the UK).

Offshore Substation

Array cabling will connect groups of turbines and **offshore substations**, which will step up the voltage to reduce losses before feeding the power to shore. Up to six undersea export cables will connect the offshore transformers and the shore.





Onshore Substation

The wind farm will be connected by undersea cables to a proposed new **onshore substation** at Cleve Hill, on the North Kent coast. From the substation, the electricity would be fed into the existing 400kV transmission network.



Time Schedule

Up to 341 turbines, will be installed through a four year period.

The wind farm will be constructed in two phases with Phase 1 erecting 175 turbines. Onshore construction has already started in July 2009.

Offshore construction will start in early 2011.

Generation is expected to start before the end of 2011 and phase one completed in 2012.

Full planned capacity is up to 1,000 MW of electricity.



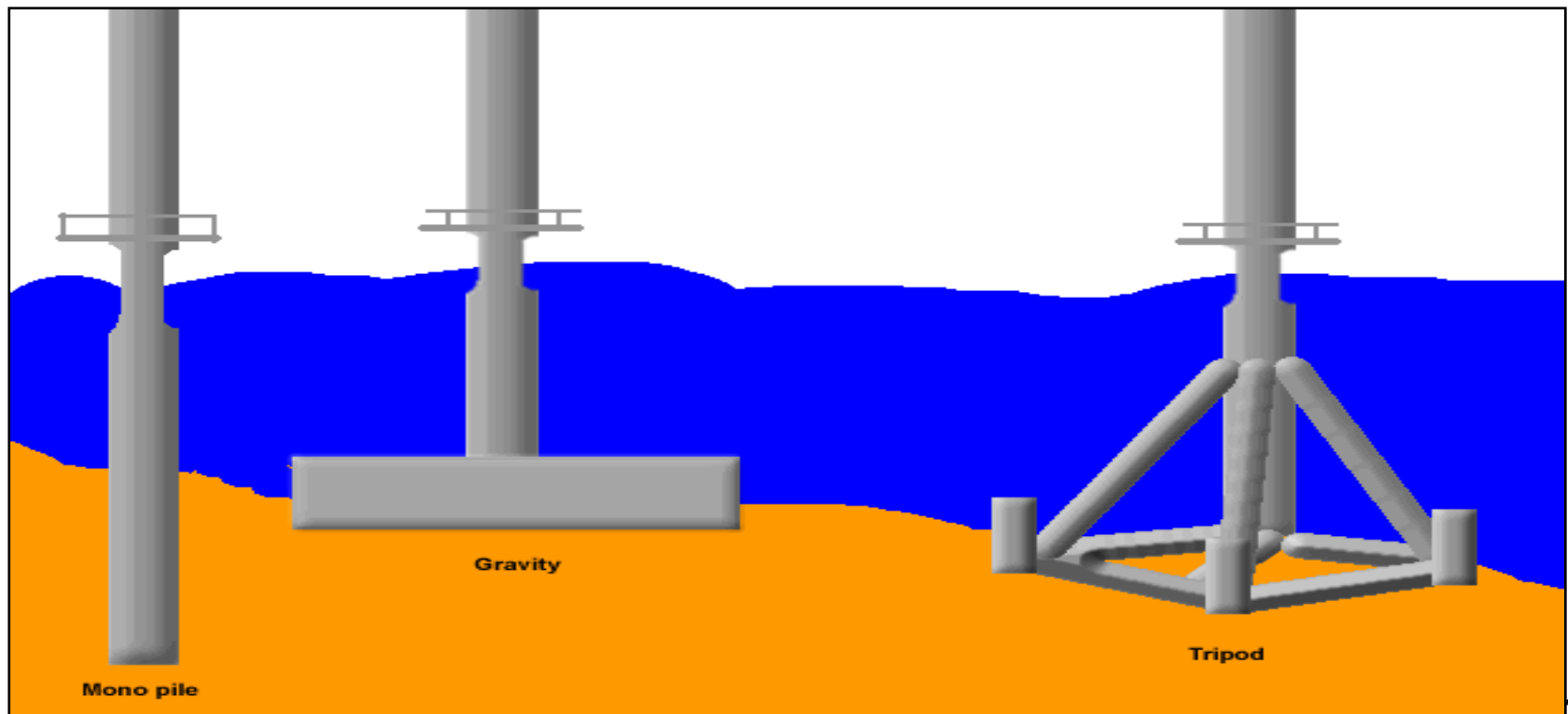
Measuring & Monitoring

In September 2004, a wind monitoring mast was installed in the south-west corner of the London Array wind farm site.

Measuring equipment is installed to record wind speed and direction, and the data is transmitted back to shore for processing and analysis.

Foundation types

- Steel monopile (left)- a hollow diameter steel cylinder driven into the seabed
- Gravity base (middle)- a concrete/steel structure sitting on seabed
- Tripod foundation (right) – three legs pinned to the seabed.



Turbines

The Turbines will range between 3MW and 7MW. The hub heights will be between 85m and 100m above sea level, and the total turbine height will not be greater than 175m. The turbines will have three blades.



They will typically begin generating electricity at a minimum wind speed of 3m/s, with full power being achieved from 13m/s. For safety reasons they will begin to shut down at wind speeds greater than 25m/s.

***Waste-to-Energy
Water Treatment Plant
Psyttalia, Greece
Biggest in Europe***



Location

Waste Water Treatment Plant (WWTP) Psyttalia is situated on the island of Psyttalia in the distance of 2 kilometers south of the Athens suburb of Keratsini, in the Saronic Gulf. It replaces the ancient island-prison of Psyttalia. The island location was chosen because Athens, a city of almost 5 million people, is so densely populated that there was simply no room on the mainland.

Site The Plant is self-sufficient concerning power, and heat thanks to a biogas system. The plant replaces the ancient island-prison of Psyttalia. It is self-sufficient concerning power, thanks to a biogas system.



WWTP



The WWTP is the main wastewater treatment facility in the greater Athens area, serving a population of over 3 million people. It is owned by **the Water Corporation of Athens**. The average wastewater inflow to the Psyttalia WWTP is 760,000 m³/day (design capacity is 1 Mill m³/day). The Plant has been built in two stages: Stage A works have been in operation since 1994, and stage B works have recently been under trial operation. The Greek Ministry for the Environment, Regional Planning and Public Works was responsible for the construction of both stages.



Sludge Dewatering

The sludge from the sewage treatment system is dewatered and then fed to four drum drying lines. The plant is designed for the treatment of approximately 350,000 tons of sewage sludge per year. The final product, granulate of 90% dryness, is used as high-energy fuel (LHV 11-13 MJ/t). Heating of the plant is almost exclusively done with off-heat from a gas-turbine and the biogas produced in the sewage system.



Figure 05

Energy consumption accounts for some 95%
of the operational costs of aeration units.

Biogas Cogeneration The biogas that is produced in the digesters is directed to the gas-holders, and after being cleaned in the scrubber, it is being compressed in three compressors and subsequently dewatered.

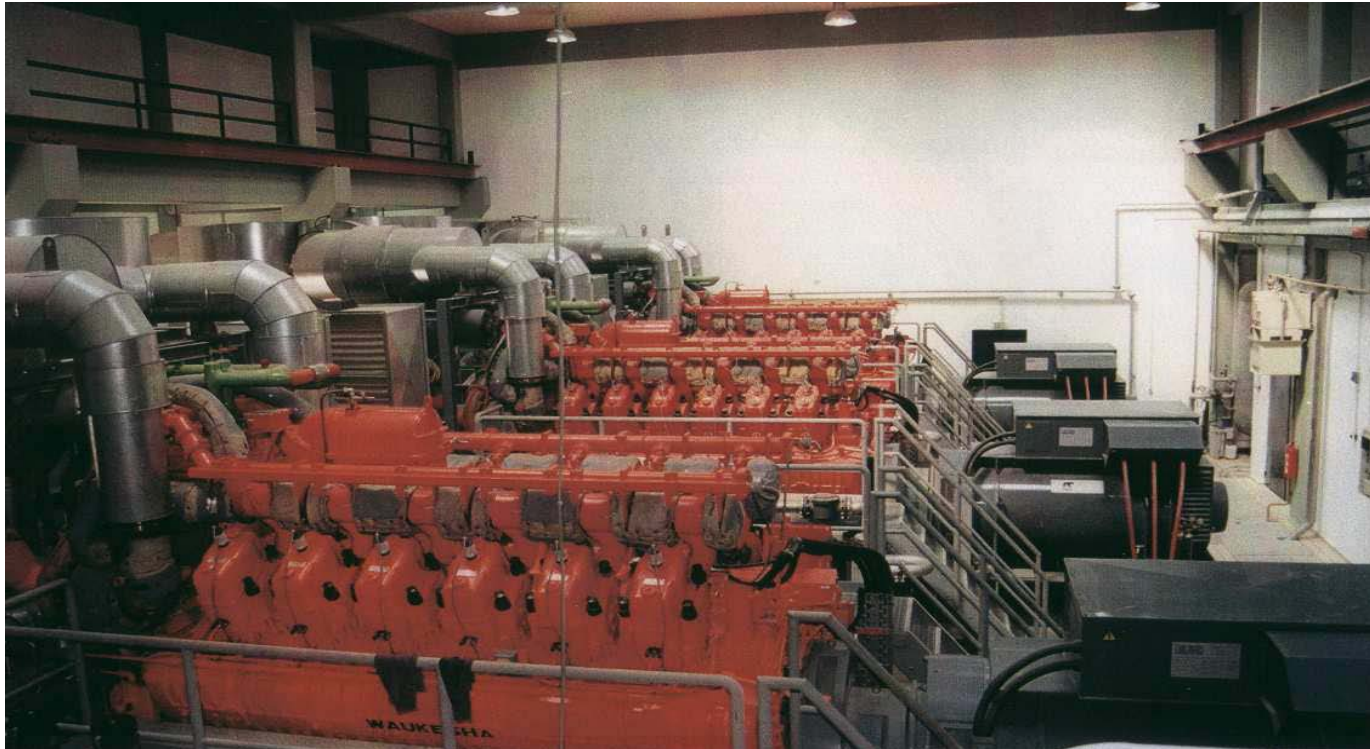


Biogas is utilized as the fuel in the Cogeneration Unit (CHP01), which has been operating since October 2001.

It consists of three internal-combustion engines, capable of producing 7 MWe and 10 MWt heat

Gas Engines CHP Plant

In 2001 CHP 01 Plant was commissioned and the biogas exploitation started. The biogas is produced via anaerobic digestion and fuels 3 gas engines, 2.5 MW^e each. The annual production of heat is 86 GWh and production of electricity is 65 GWh to saturate Psyttalia WWTP facilities and partly export to the Greek power grid. Heat produced is used internally to heat the digesters.



The additional biogas production through the operation of the Stage B works is utilized by CHP02 Unit (see Figure 08)

Gas Turbine-based Cogeneration Plant

Left: Siemens SGT-400 Gas Turbine Generator set makes possible to operate the complete WWTP in independent island mode.

Right: Gas Turbine with Dry Low NOX burners.



Some Interesting Projects in Slovakia





Combined Cycle Power Malzenice, to be commissioned in 2012
Highest thermal efficiency in Europe (59% plus)



Combined Cycle Power Plant Bratislava, the biggest in Slovakia



Hydro-electric Plant Gabčíkovo, South-West Slovakia,
Capacity 720 MW, the biggest on the river Danube



Aquacity

Slovakia's Green Water Park Resort

Poprad, Slovakia. a resort that has photocells built in to the glass walls of the complex. The cells generate enough power to operate pool center, a solar-powered, geothermal swimming-pool complex .

Park uses the resources of wind, water and sun, saving up to 30,000 kg of CO₂ per day. The resort generates 80% of their electrical requirement and gets their water from geothermal water, drilled from a vast subterranean lake.

Since 2004, a 2.64 MW wind park Cerová and 0.5 MW Ostrý Vrch wind power plant have been in operation. 2MW wind park Skalité at



SET@W Bangkok, February 2010



Since 2004, a 2.64 MW **wind park Cerová** has been in operation. 2MW **wind park Skalité** at Čadca is planned for commissioning soon. Before 2010, under present conditions, generating wind power potential of 100 GWh is projected.