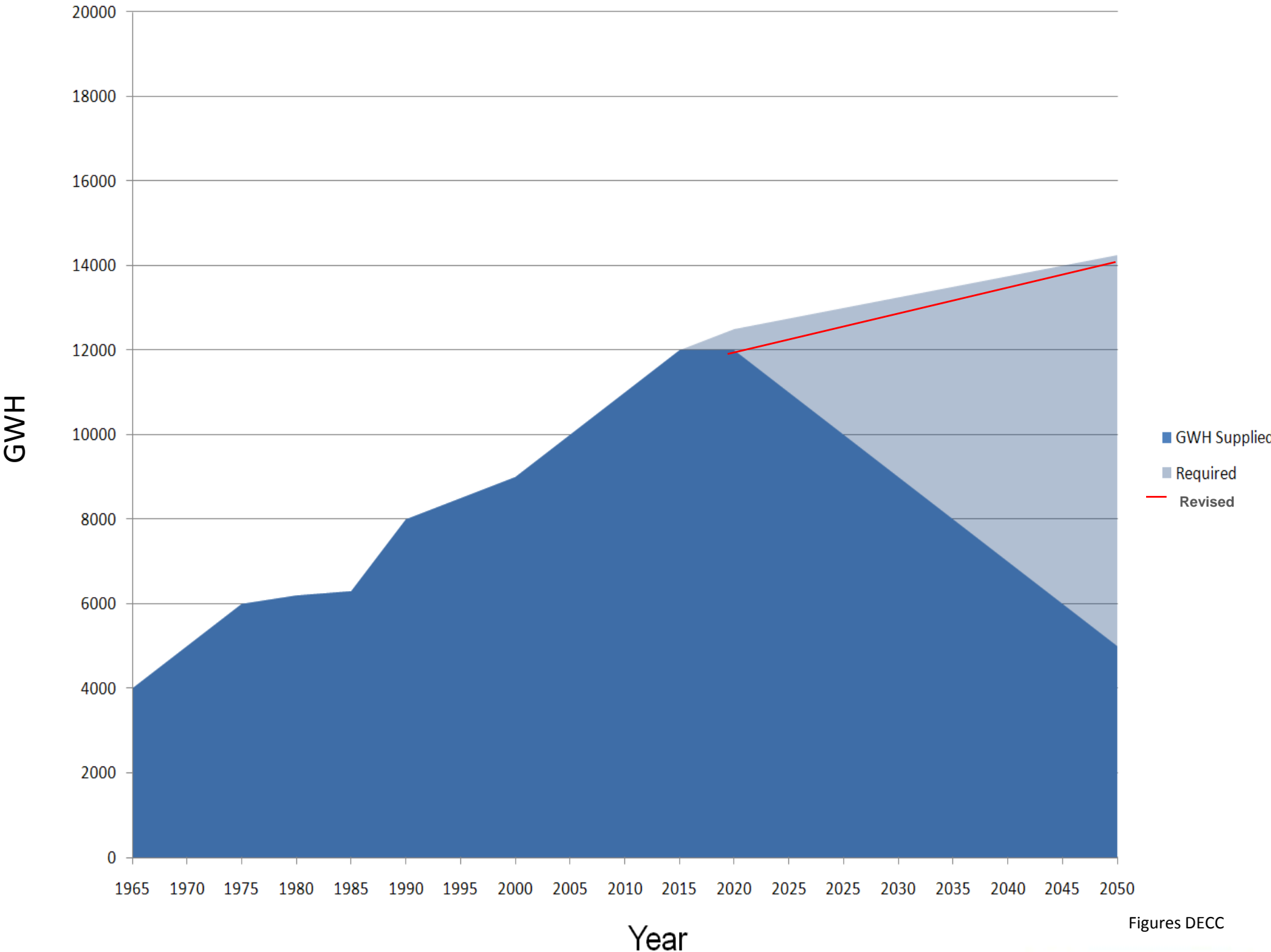


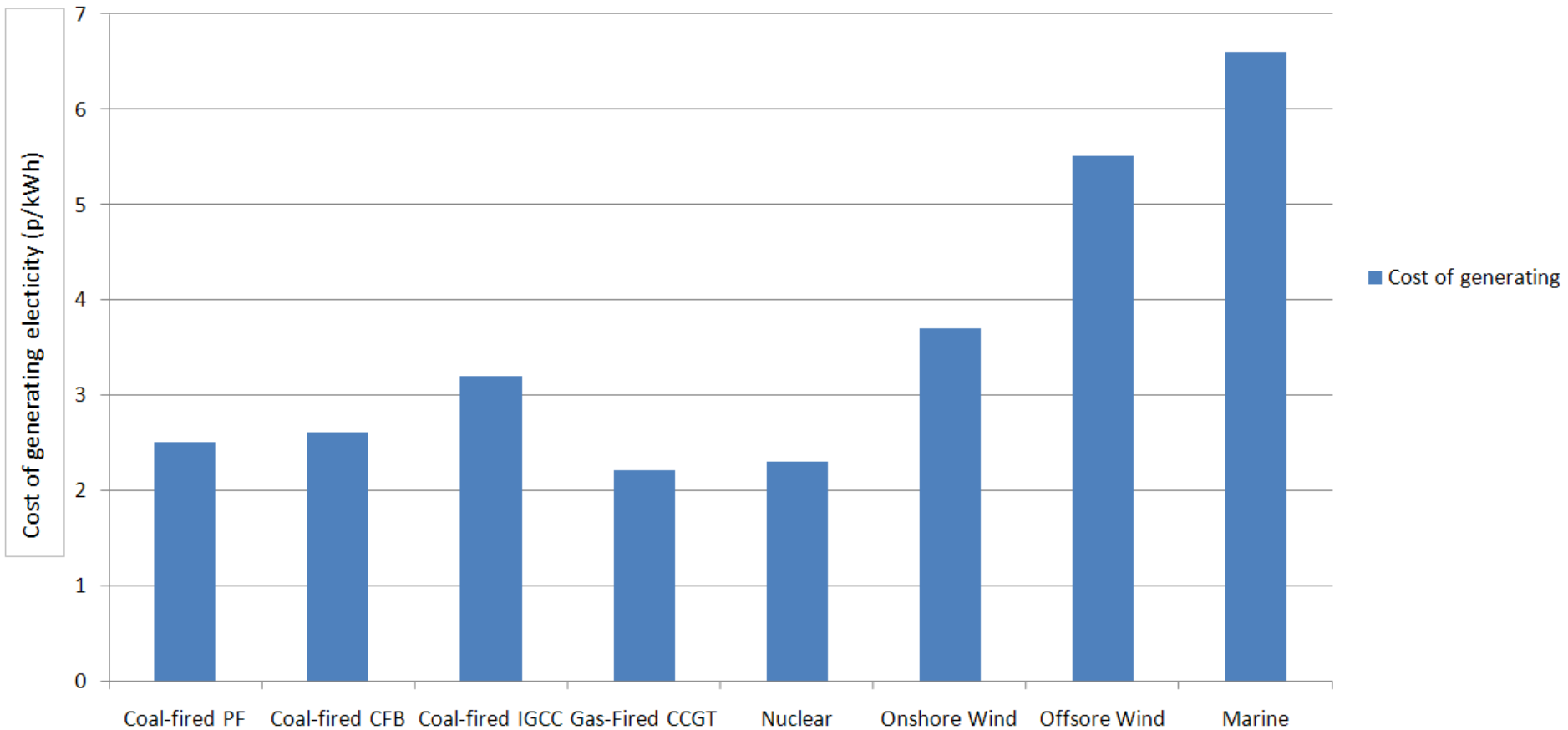
# Who will keep the lights on? Coal

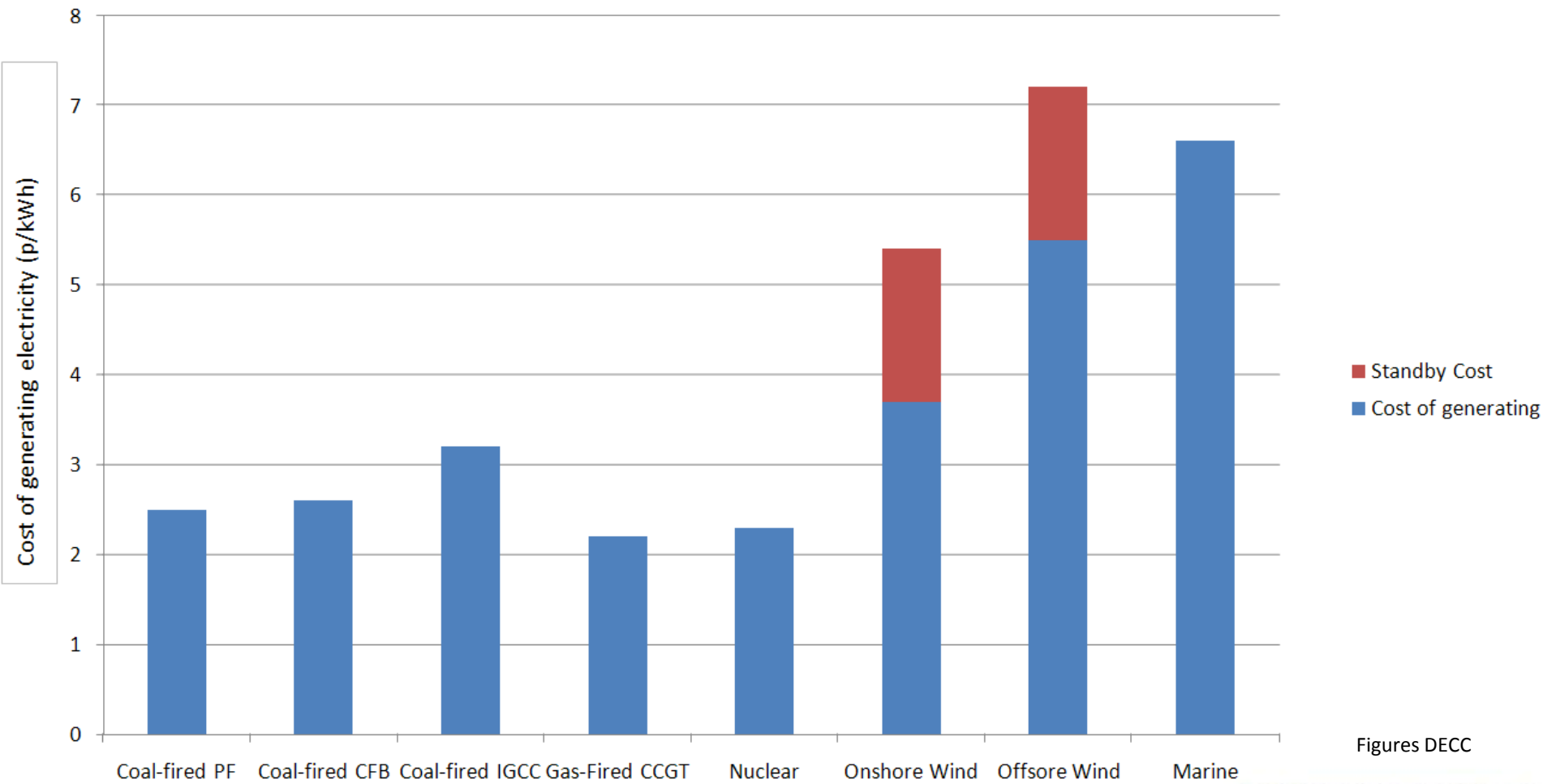
Dr. Jacob Roberts



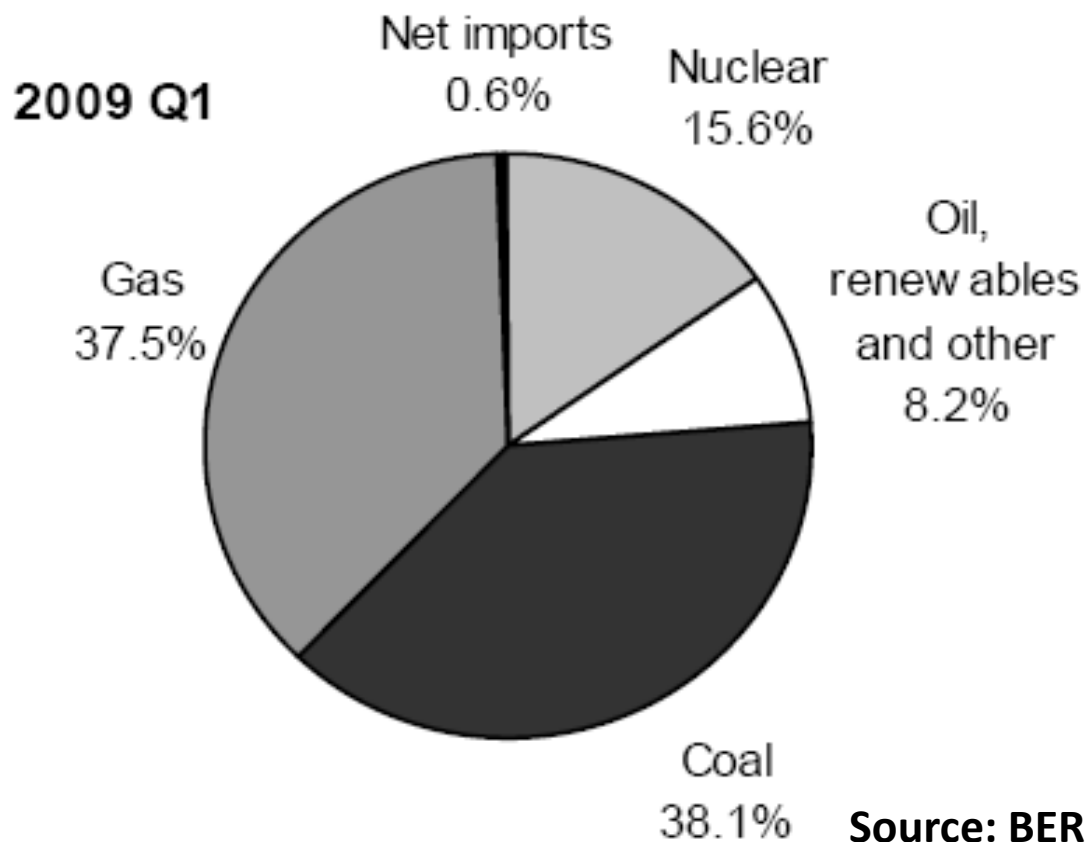
Figures DECC

# Cost of generation





Figures DECC



**Source: BERR Energy Trends**

Last years energy trends.

- The Large Combustion Plant Directive (LCPD) is a European Union Directive that aims to reduce acidification, ground level ozone and particulates by controlling the emissions of sulphur dioxide, oxides of nitrogen and dust from large combustion plant. Large power stations in the UK must comply with the LCPD.

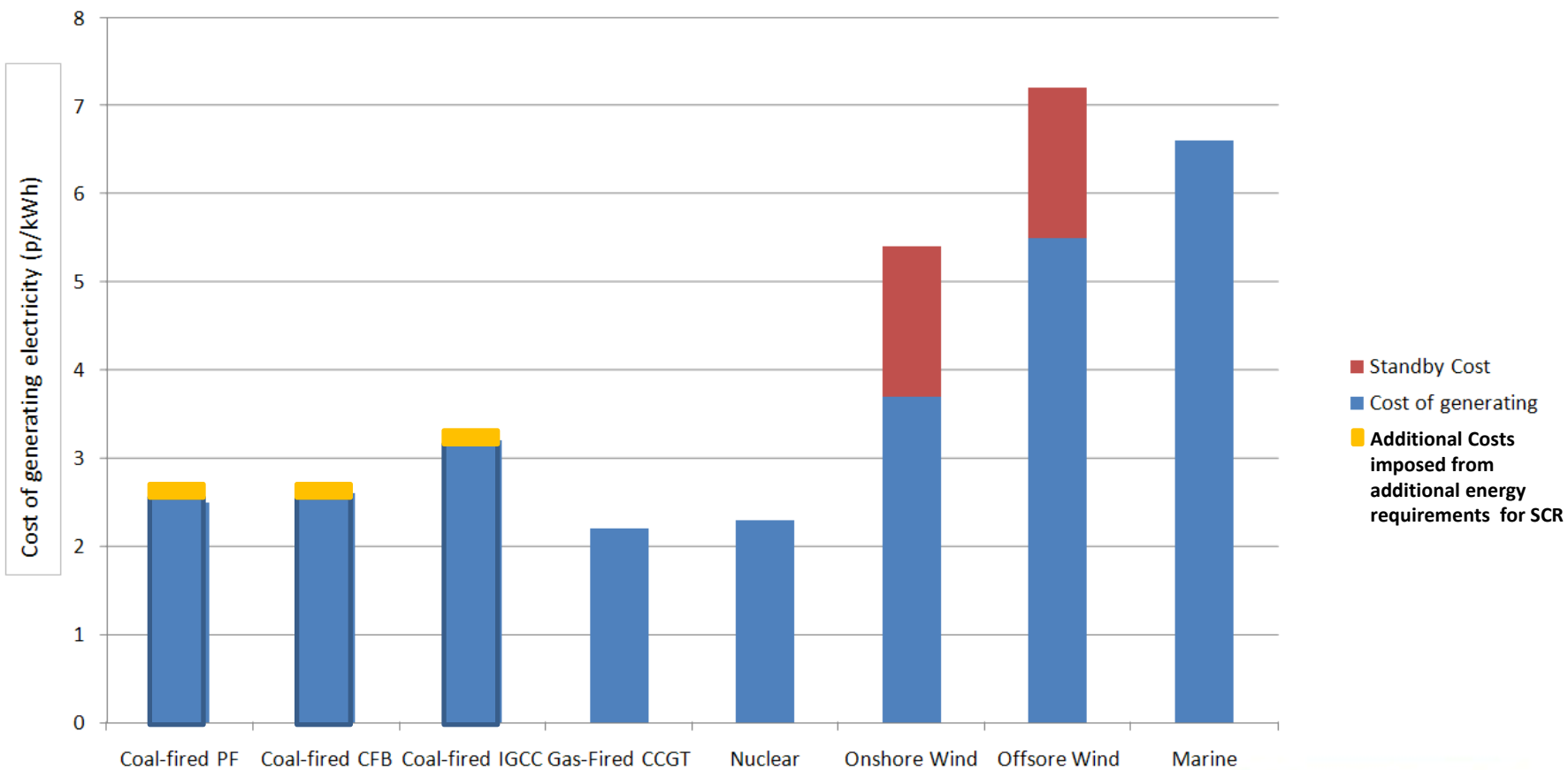
# Coal stations closing, loss of capacity

Installation	Operator	Opted-out capacity (MW)
Ferrybridge*	SSE	1000
Didcot A	RWE npower	2000
Tilbury*	RWE npower	1520
Kingsnorth*	E.ON	2000
Ironbridge	E.ON	1000
Cockenzie	Scottish Power	1152
<b>TOTAL</b>		<b>8672</b>

\* This capacity will be wholly or partially replaced by new coal-fired generation

Installation	Operator	Opted-in capacity (MW)
Drax	Drax Power	3960
Eggborough	British Energy	2000
Cottam	EDF Energy	2000
Ferrybridge	SSE	1000
Fiddler's Ferry	SSE	2000
Ratcliffe	E.ON UK	2000
Rugeley	International Power	1000
West Burton	EDF Energy	2000
Longannet	Scottish Power	2304
Aberthaw	RWE npower	1500
Kilroot	AES	520
Uskmouth	Uskmouth Power	393
<b>TOTAL</b>		<b>20677</b>





- So what is going to replace Coal? GAS?
  - The price of gas can only go up.
  - UK's own supplies of gas are depleting.

**Over reliance on gas makes for poor fuel security**

Whilst other nations can exploit their oil shale deposits the demand for gas will only increase. Cheap glut prices seen at present represent Russian overproduction in a depressed market.

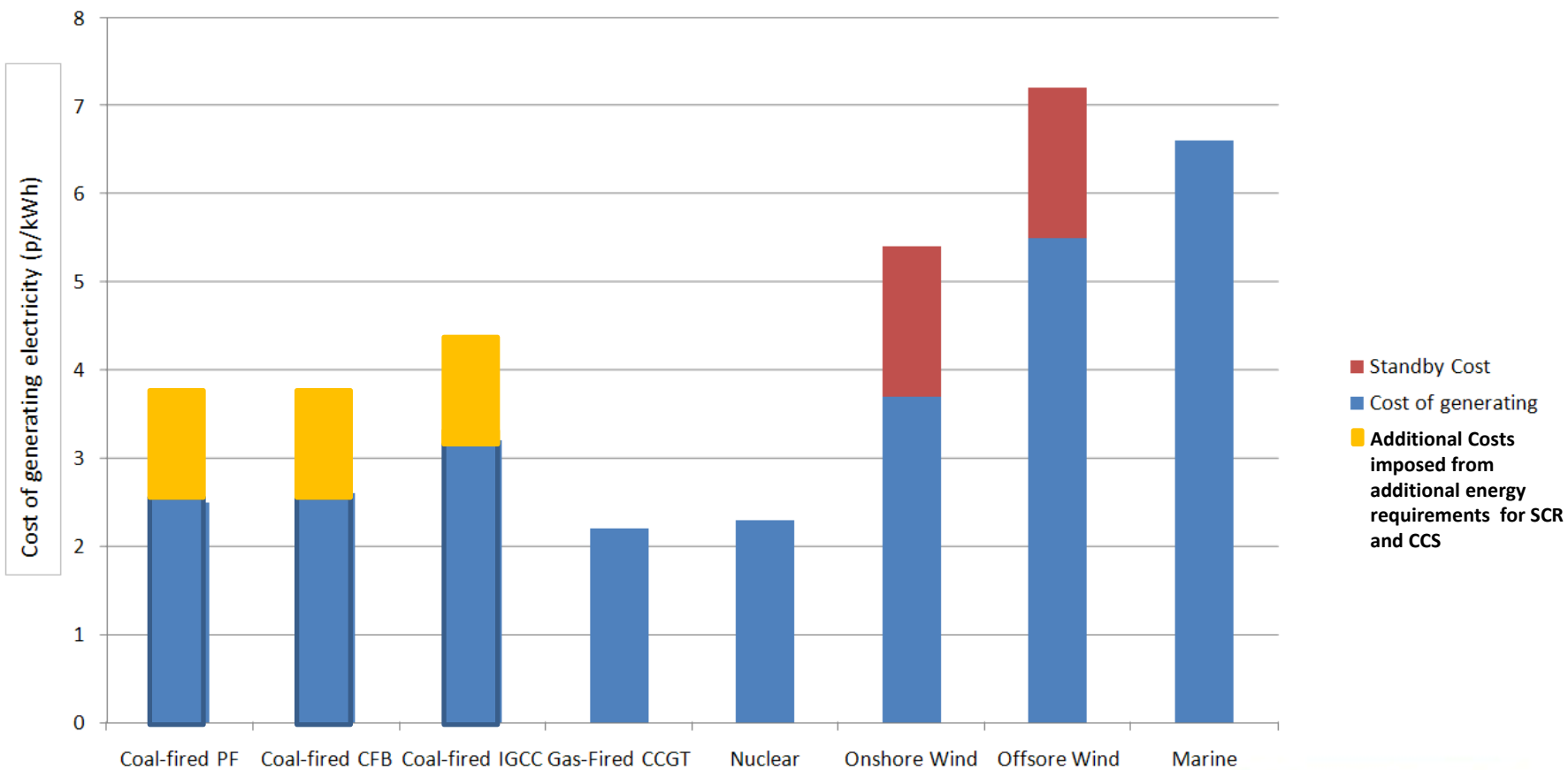
- How much of a problem is CO<sub>2</sub>?
  - The science is a debatable issue controlled by climate “scientists” to secure funding. True problem is obfuscated in the political debate.
  - CO<sub>2</sub> production from coal fired power stations in the United Kingdom is a tiny proportion to man made CO<sub>2</sub> world wide. Other sectors such as shipping and aviation are escaping censure.
  - If CO<sub>2</sub> is a significant problem then carbon capture of coal plants should be implemented to bring them into line with Gas plants not 100% CO<sub>2</sub> capture.

## But CO<sub>2</sub> related global warming is a fact and only crazies or self interested people disagree.

- Patrick Michaels, University of Virginia. Past President of the American Association of State Climatologists and former program Chair for the Committee on Applied Climatology for the American Meteorological Society. Contributing Author and Reviewer of U.N. Intergovernmental Panel on Climate Change (IPCC).
- John Christy, Professor of Atmospheric Science and Director of the Earth System Science Center, University of Alabama, in Huntsville. Alabama State Climatologist. NASA Medal for Exceptional Scientific Achievement and American Meteorological Society Special Award. Fellow in the American Meteorological Society.
- Henk Tennekes, former research director of the Royal Dutch Meteorological Society.
- Aksel Winn-Nielsen, former director of the U.N.'s World Meteorological Organization.
- Dick Morgan, Researcher in Climatology, University of Exeter, United Kingdom and former Advisor to the World Meteorological Organization.
- Dr. Oliver W. Frauenfeld, Research Scientist at the Cooperative Institute for Research in Environmental Sciences Division of Cryospheric and Polar Processes, University of Colorado. Contributing Author to the IPCC Working Group 1 Fourth Assessment Report.
- Roy Spencer, Principal Research Scientist, University of Alabama Huntsville. Former Senior Scientist for Climate Studies at NASA's Marshall Space Flight Center. Recipient of NASA's Medal for Exceptional Scientific Achievement, American Meteorological Society's Special Award.
- Robert Davis, Associate Professor of Climatology, University of Virginia. Member of EPA Global Change Research Strategy, and the NOAA Data Management Advisory Panel. Contributed to the 1995 Report of the IPCC. Past Chair of the American Meteorological Society's Committee on Biometeorology and Aermeteorology.
- Robert Balling, Jr. Professor, Department of Geography and former Director of the Office of Climatology, Arizona State University. Climate Consultant to the United Nations Environment Program, The World Climate Program, World Meteorological Organization, UNESCO, and the IPCC.
- William M. Grey, Colorado State University Emeritus Professor of Atmospheric Science at Colorado State University, and head of the Tropical Meteorology Project at Colorado State Universities' Department of Atmospheric Sciences.
- Boris Winterhalter, Professor of Marine Geology, University of Helsinki, and former Marine Researcher at the Geological Survey of Finland.
- Igor Polyakov, Professor at the Institute of Marine Science, University of Alaska.

## Carbon Capture

- Dealt with by other speakers.
- Additional parasitic efficiency loss for station.
- Will make the profitability of some stations questionable.



## Parasitic Efficiency losses.

- SOX -> FGD -> 2-4%
- NOX -> SCR or alternatives -> 2-5%
- CO2 -> CCS -> Possibly 10-15% (maybe higher)
- Each of the solutions to meet the requirements costs the power suppliers money, but also reduces the efficiency of the overall process.

## How do we make coal viable

### **Efficiency improvements**

- PF balancing
- Mill improvements
- Burner improvements

### **New Plant**

- New Supercritical boilers produce far less emissions overall.



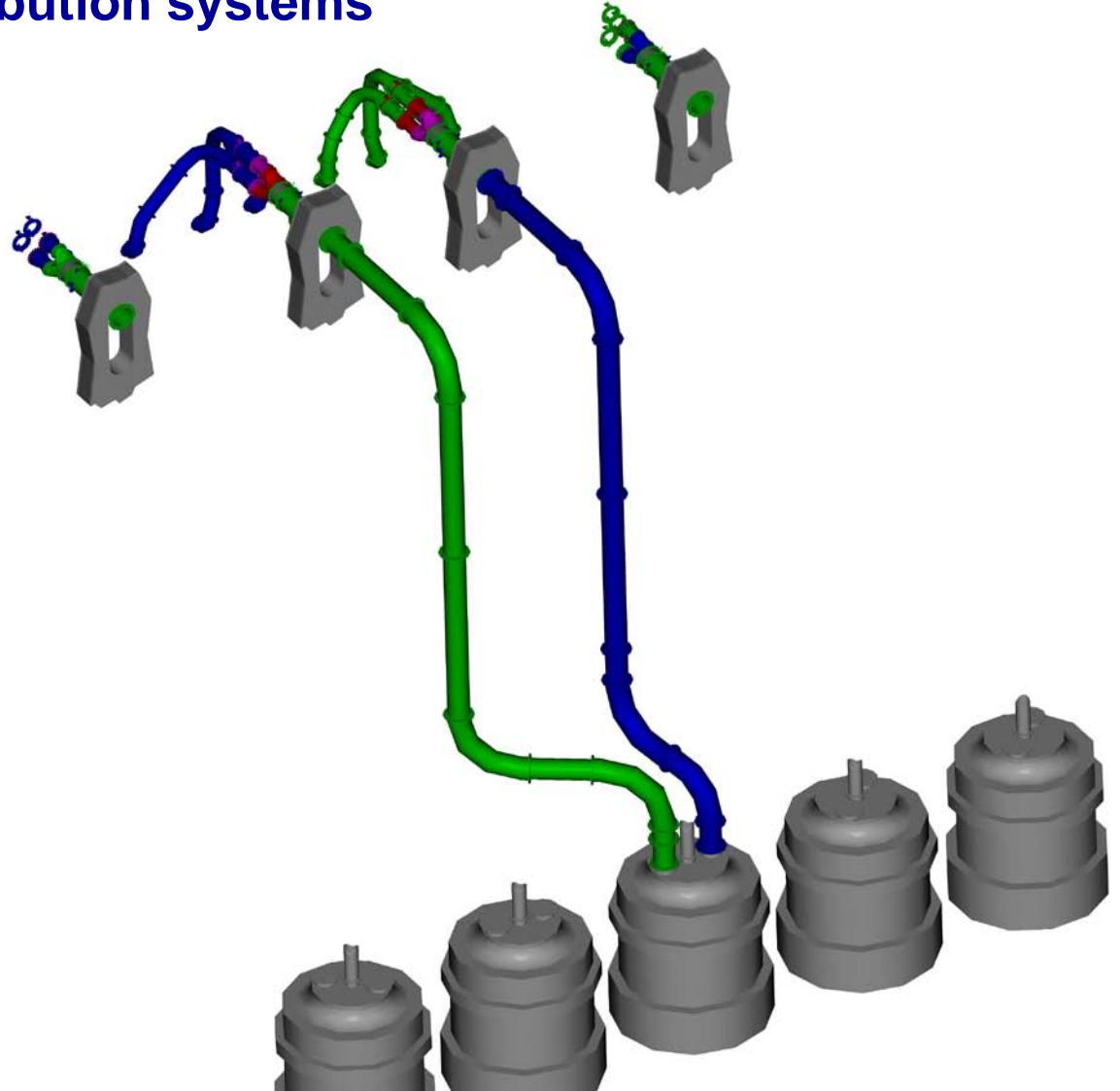
- **Aren't they as efficient as they are going to get?**
- Short Answer: NO.
- Thermal to electric (30-31% efficient on average)
- The drive towards lower NOX and SOX has created situations where poor fuel balance is now an issue.
- Shifting priorities at stations have meant that often suitable technologies have been removed to meet new priorities

- **What is combustion optimisation?**
- Improving the combustion stoichiometry
- Making the coal burn better and transferring more of the heat to the steam tubes at the walls.



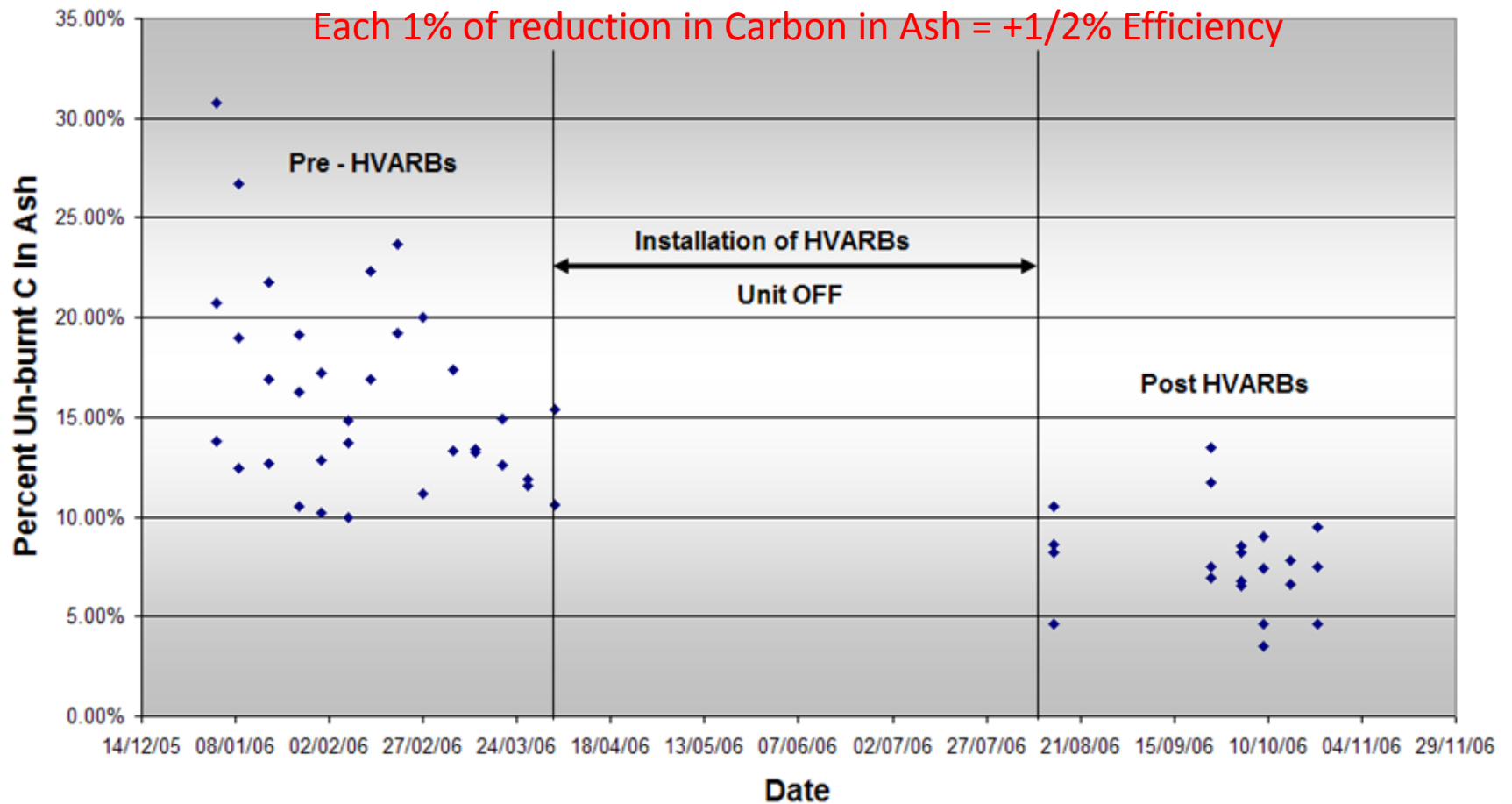
Enhancing Performance

# Boiler Set of Fuel distribution systems



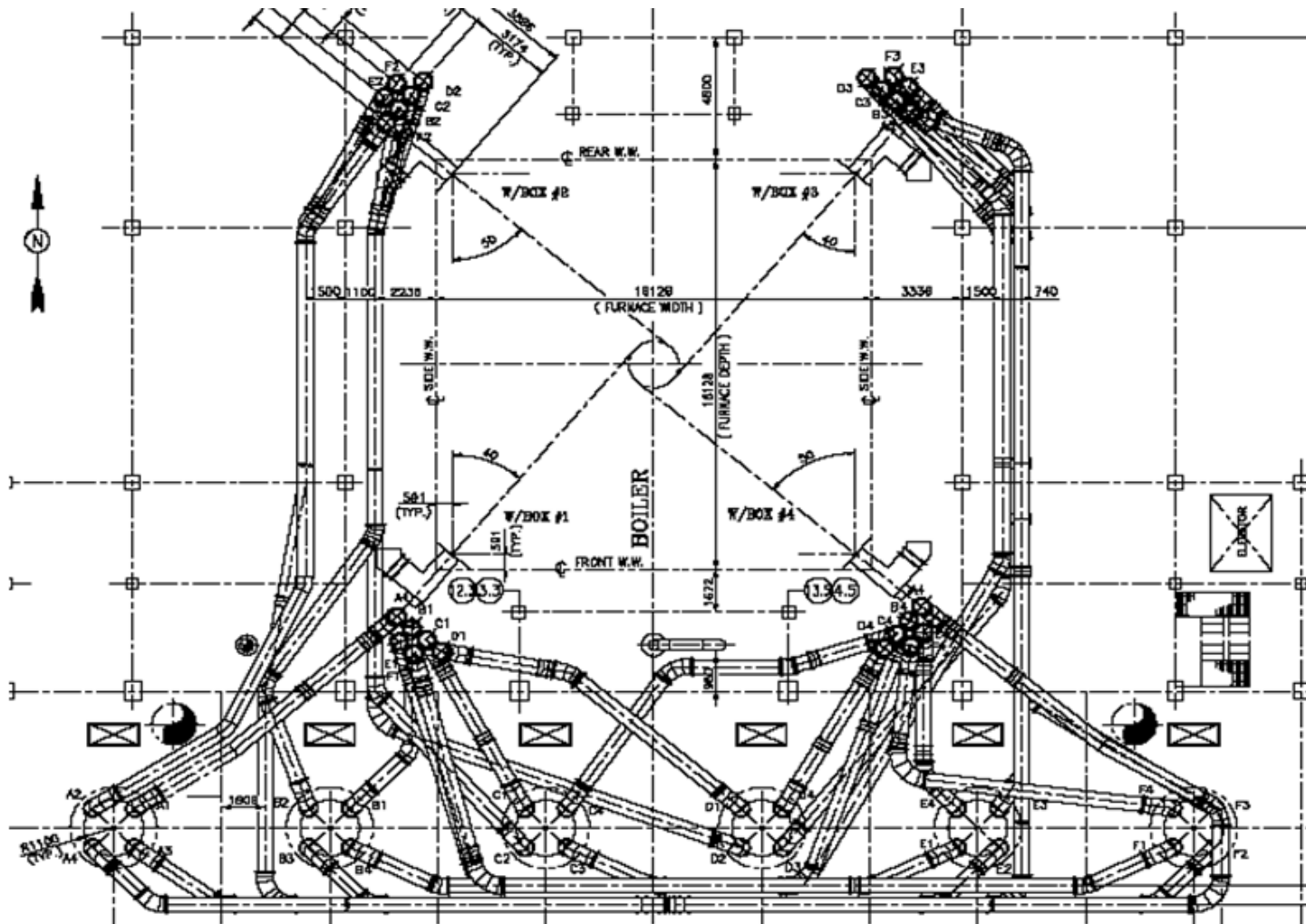
## PF Control-Gate Technology

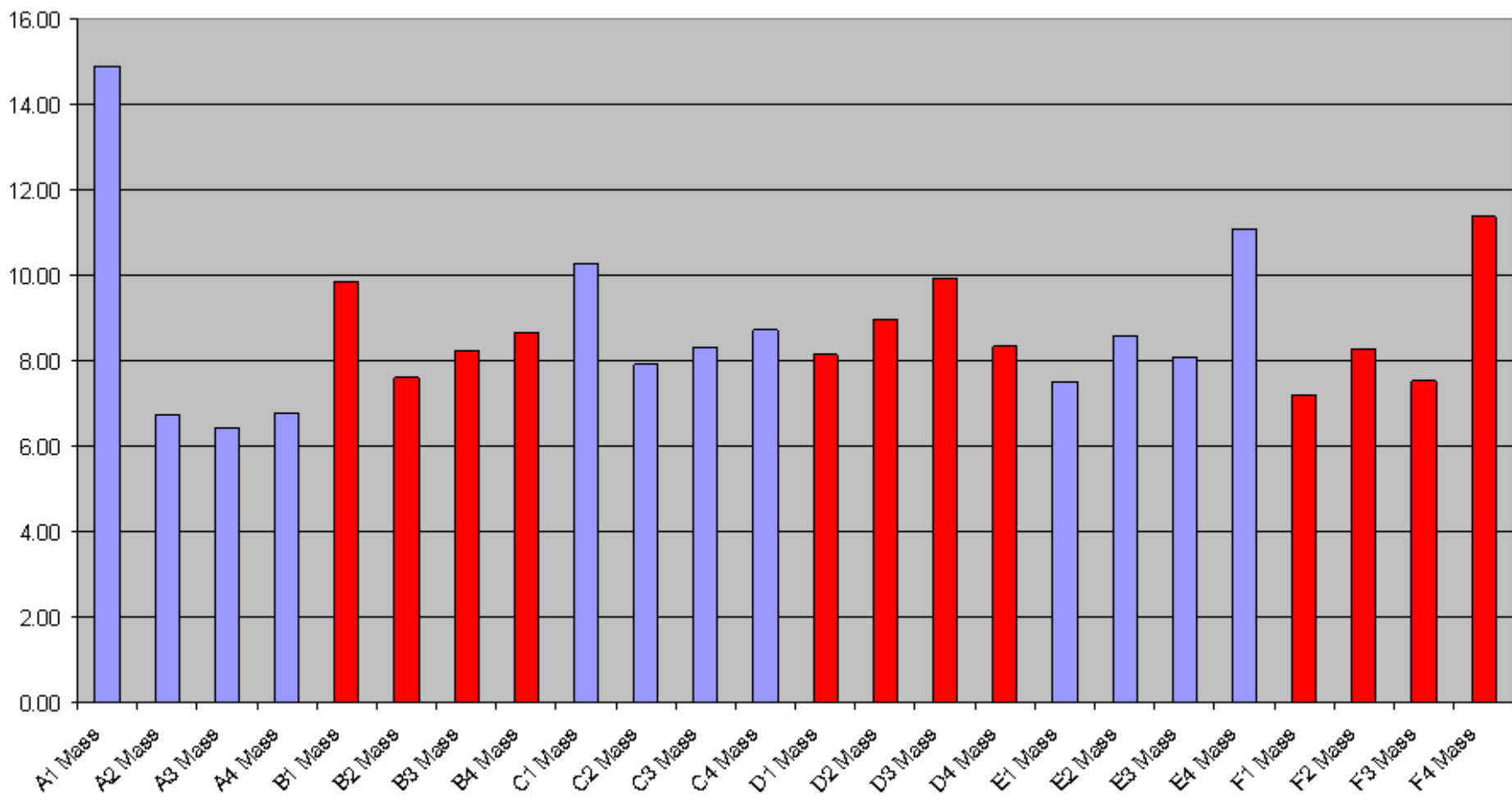




- Surely this is distribution problem is only with splitters or older stations?

## 2007 – Doosan boiler – South Korea







- Conclusions

- The United Kingdom needs to take a good look at how it utilises its UK Fleet of majority foreign owned power stations.
- Requirements for efficiency as opposed to just the sticking plasters of various scrubbing plants could be a more effective energy balance.