Future Plant Portfolio

Cost Comparison

04-Oct-2007

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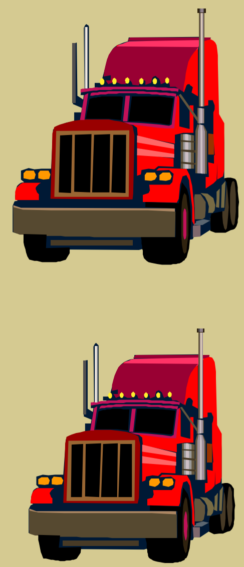
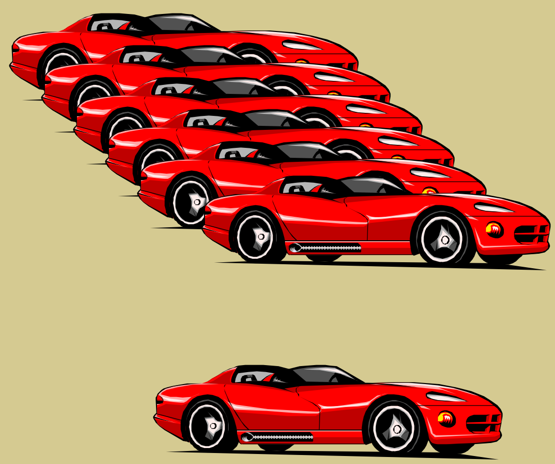
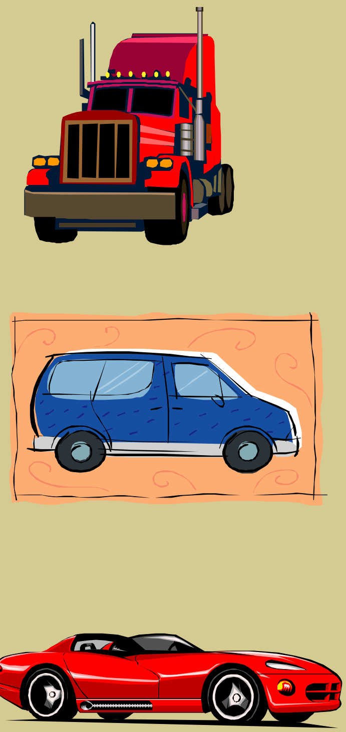
Balanced systems?

Transport fleet for retail/wholesale drinks co.







Lowest cost per unit weight transported

Shortest transport time

Systems which satisfy multiple objectives by providing a **range** of functionality.

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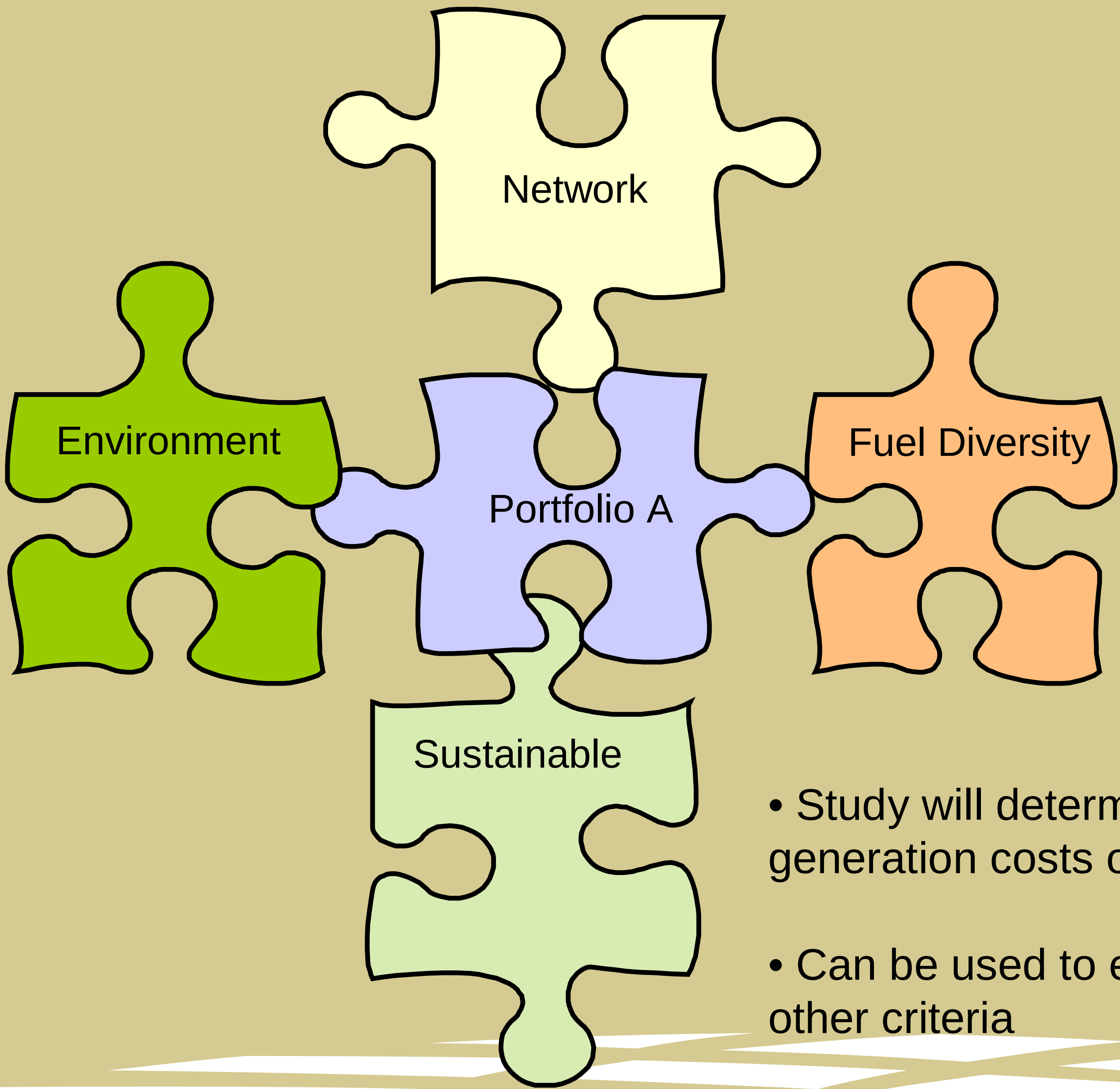
What are we doing?

- Assuming demand growth and generation closures
  - evaluate the costs associated with a number of potential portfolio expansion options.
- Initially this study will look at RoI portfolio expansion
  - prior to commissioning of the East West interconnector

Study objectives

- Provide fiscal information related to meeting customer demand
  - Capital
  - Fuel
  - O&M
  - CO_2

- Options can be compared on this basis



- Study will determine the relative generation costs of Portfolio A
- Can be used to evaluate fit with other criteria

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Disclaimer

- A reasonable set of assumptions made on capital cost, fuel prices etc. to inform debate
  - Not ‘the’ definitive list
- Generator revenue and profit not examined
  - the focus is on total system cost evaluation.

The candidates

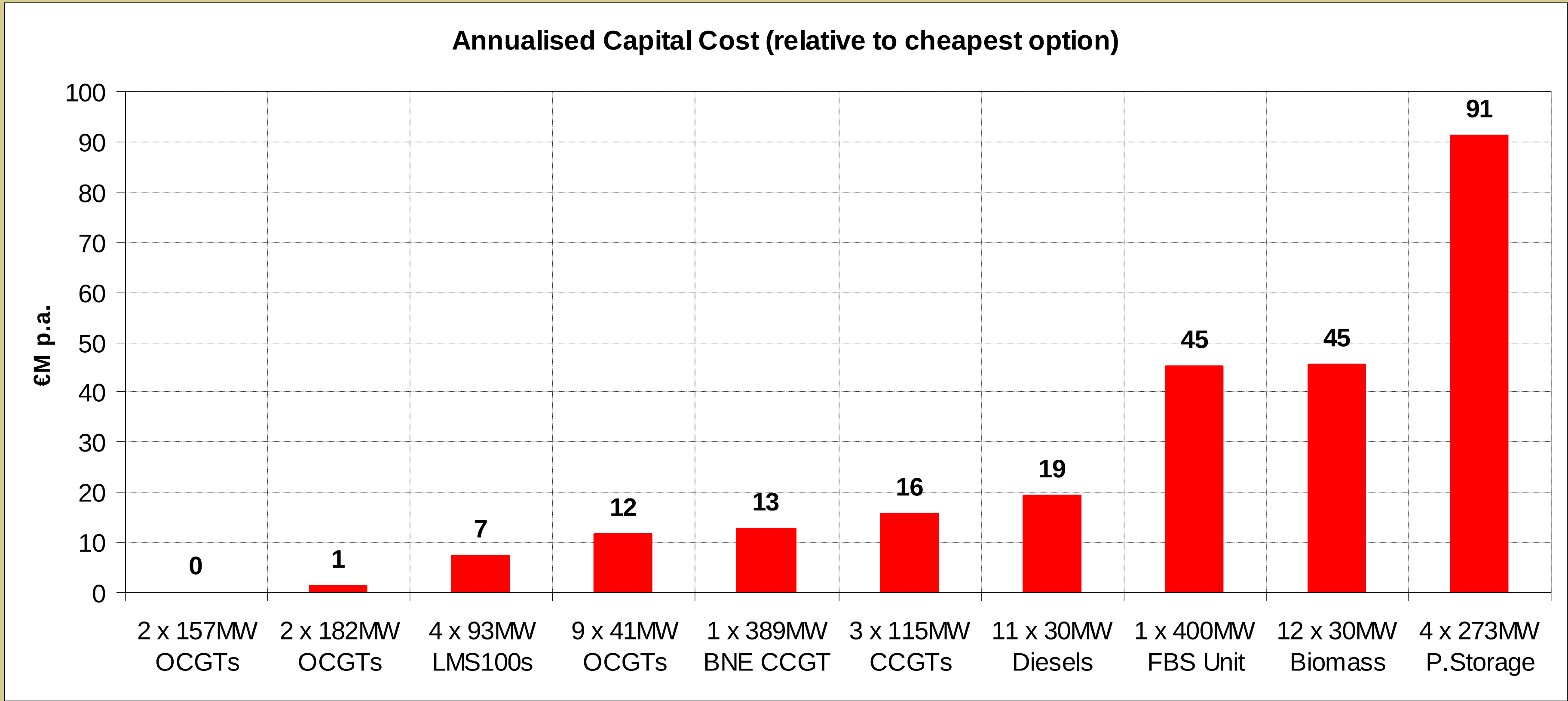
Different types of new plant will be considered:

- OCGTs
- CCGTs
- Coal-burning plant
- Diesel unit
- Biomass
- Pumped-storage

The Details

Plant Additions	MW	η at MCR (%)	Avail. (%)
11 x 30 MW Diesel units	330	46.1	96.0
4 x 93 MW LMS100 units	372	43.3	94.2
1 x 400 MW Fluidised Bed Steam	400	42.5	87.6
1 x 389 MW CCGT (BNE)	389	54.7	92.3
3 x 115 MW CCGTs	345	53.1	92.3
9 x 41 MW OCGTs	369	39.0	94.2
2 x 182 MW OCGTs	364	33.3	94.2
2 x 157 MW OCGTs	314	33.5	92.3
4 x 273 MW P.S. units	1092	76.0	93.3
12 x 30 MW grate-based biomass units	360	28.0	87.6

Annualised Capital Cost (relative to the cheapest option)



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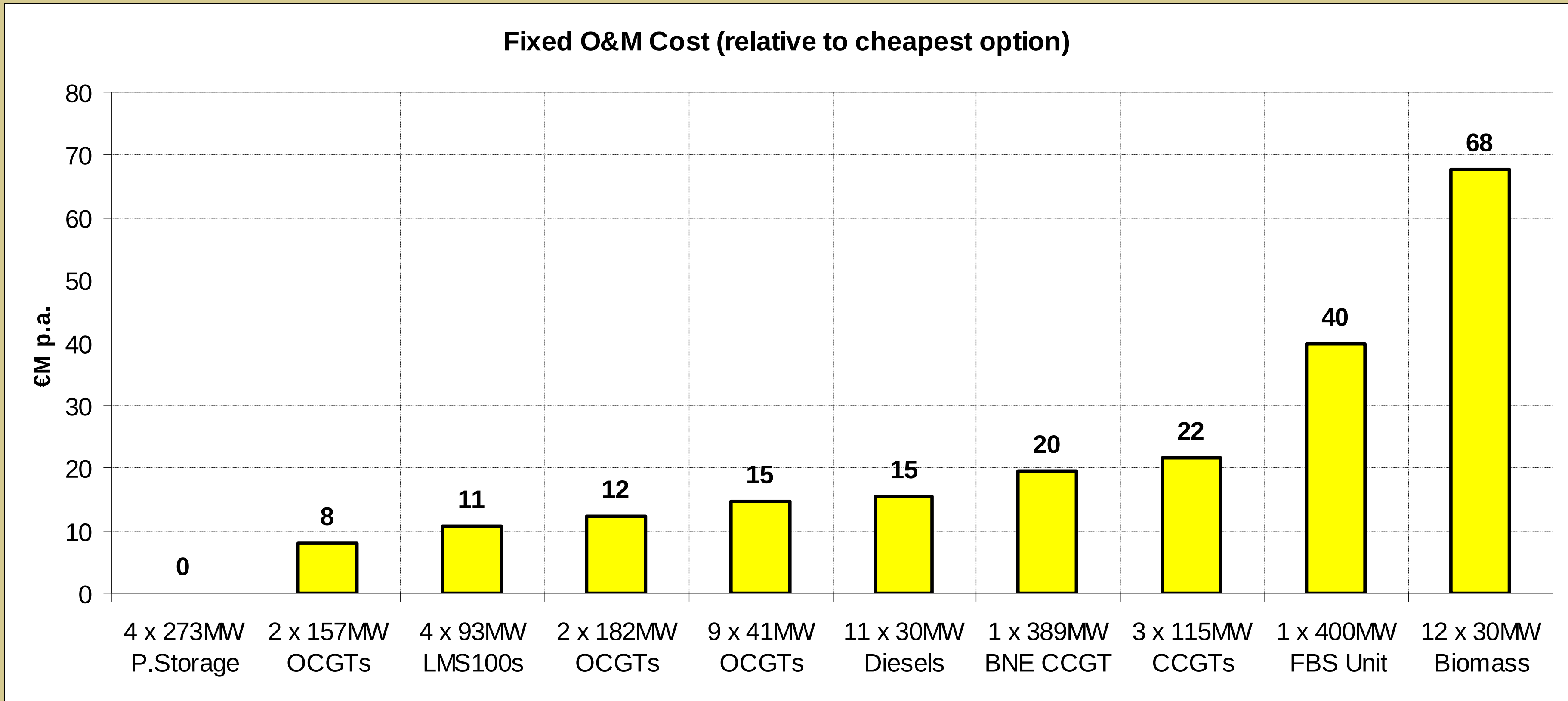
Fixed O&M Cost
(relative to the cheapest option)



Simulation Studies

Simulation studies were carried out using PROMOD

– All-Island generation dispatch
– Allowing for 1300 MW plant closure
– 2 x 430 MW new CCGTs commissioned
– Including 3100 MW of wind.

The two principal results of interest were:

– Total system fuel cost;
– CO_2 Volume.

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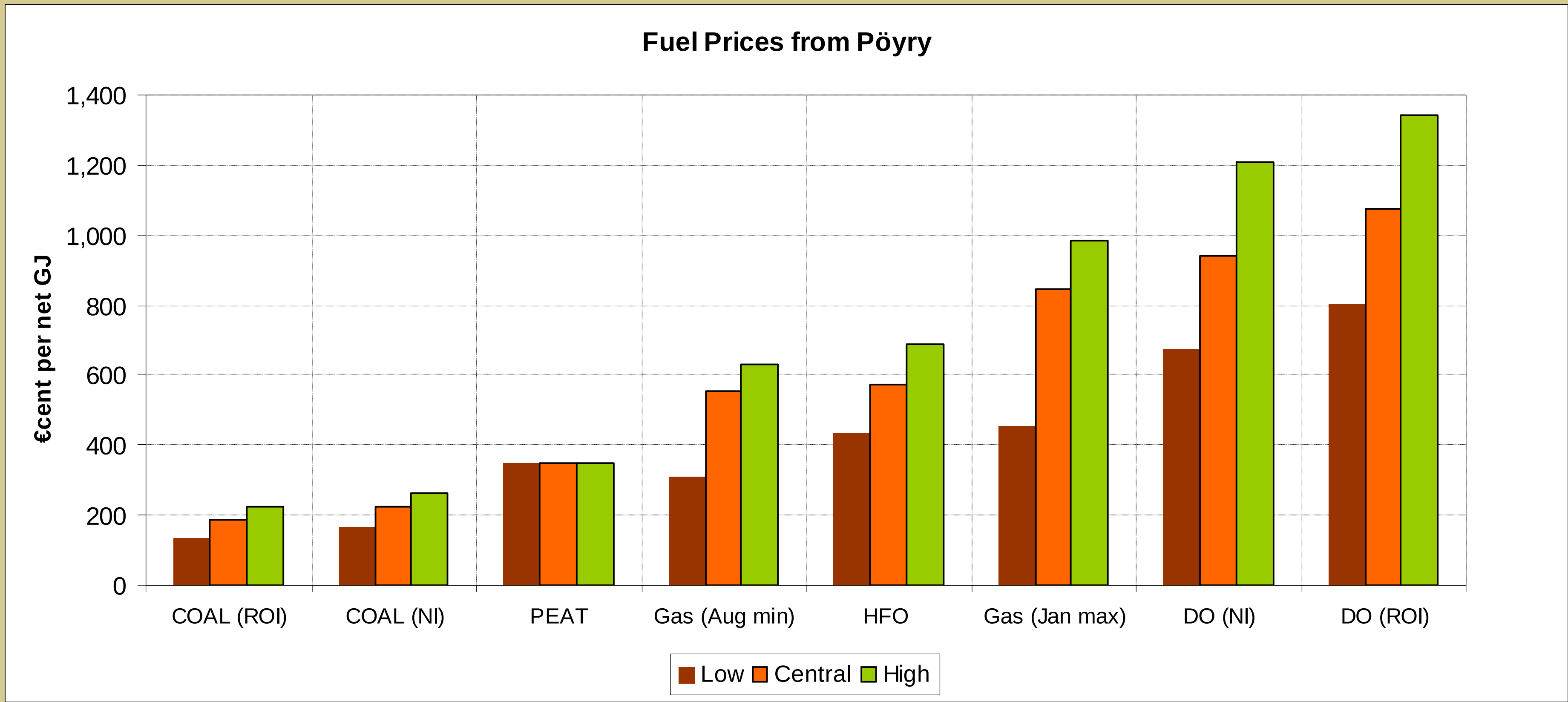
Fuel Prices (Central scenario)

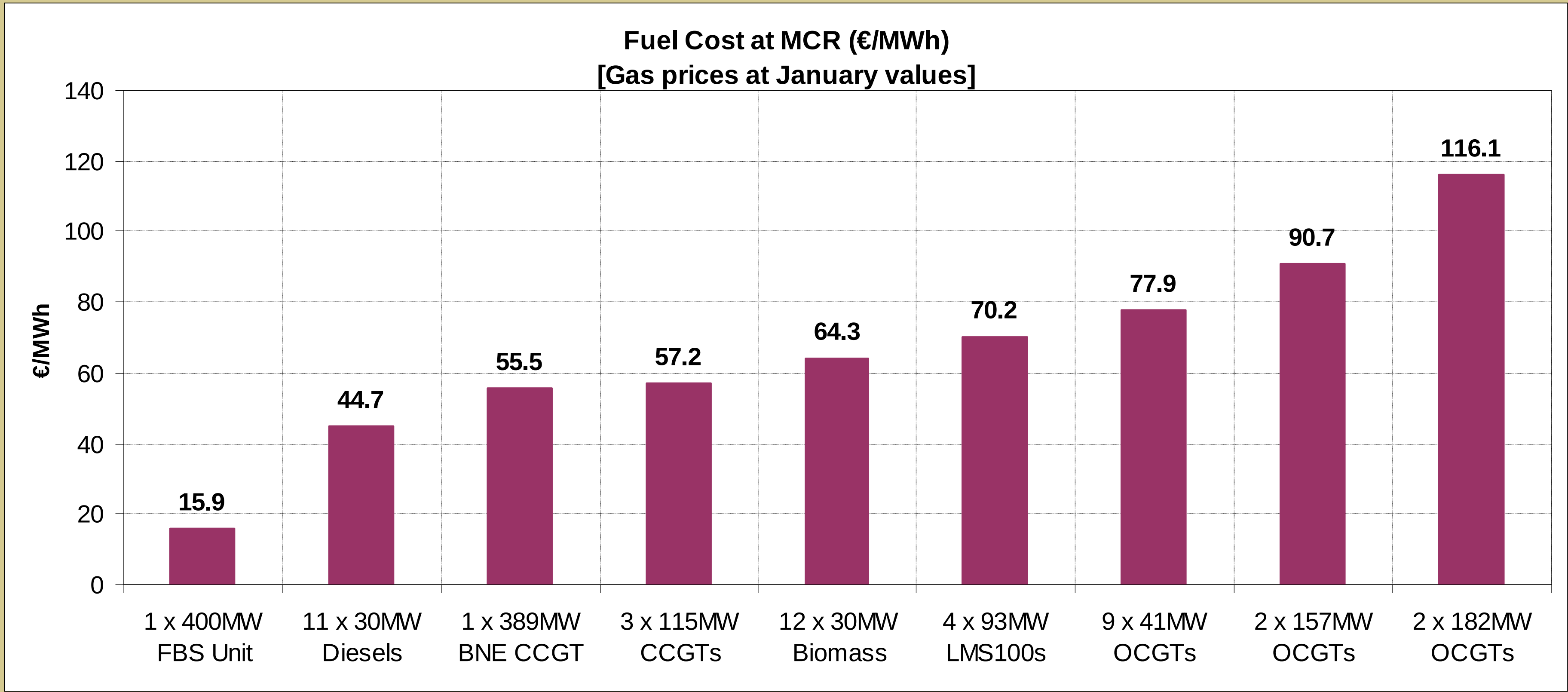
Fuel	Price (€cent / net GJ)
Coal [RoI, NI]	188, 223
Gas	Min to Max: 553 (Aug) to 844 (Jan)
Heavy Fuel Oil	573
Distillate Oil [RoI, NI]	1074, 943
Peat	349
Miscanthus	500

Gas prices expressed in €cent / gross therm: 52.6 (Aug) to 80.2 (Jan)

Fuel Prices from Pöyry (All scenarios)

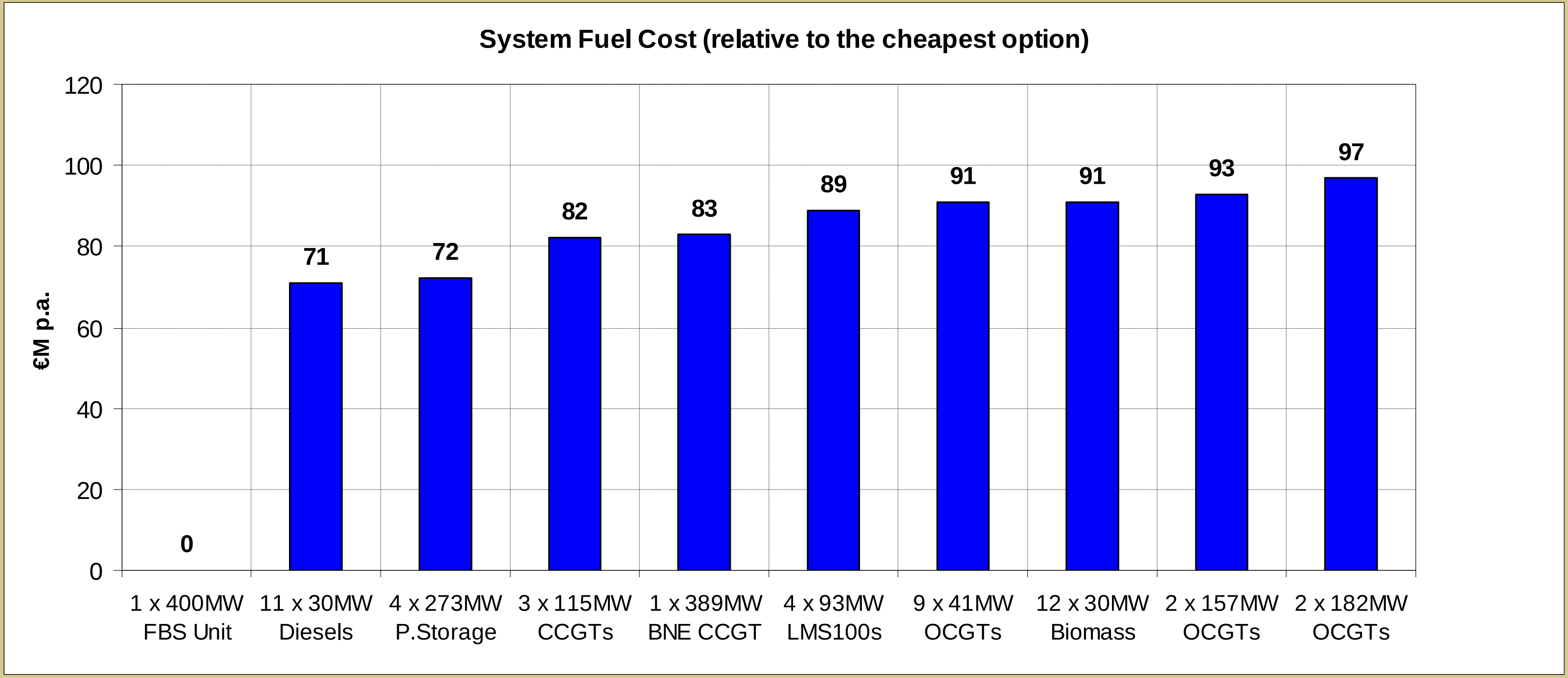


Fuel Cost at MCR (€/MWh)
[Central scenario; Gas prices at January values]



System Fuel Cost (relative to the cheapest option)

[Central fuel price scenario]



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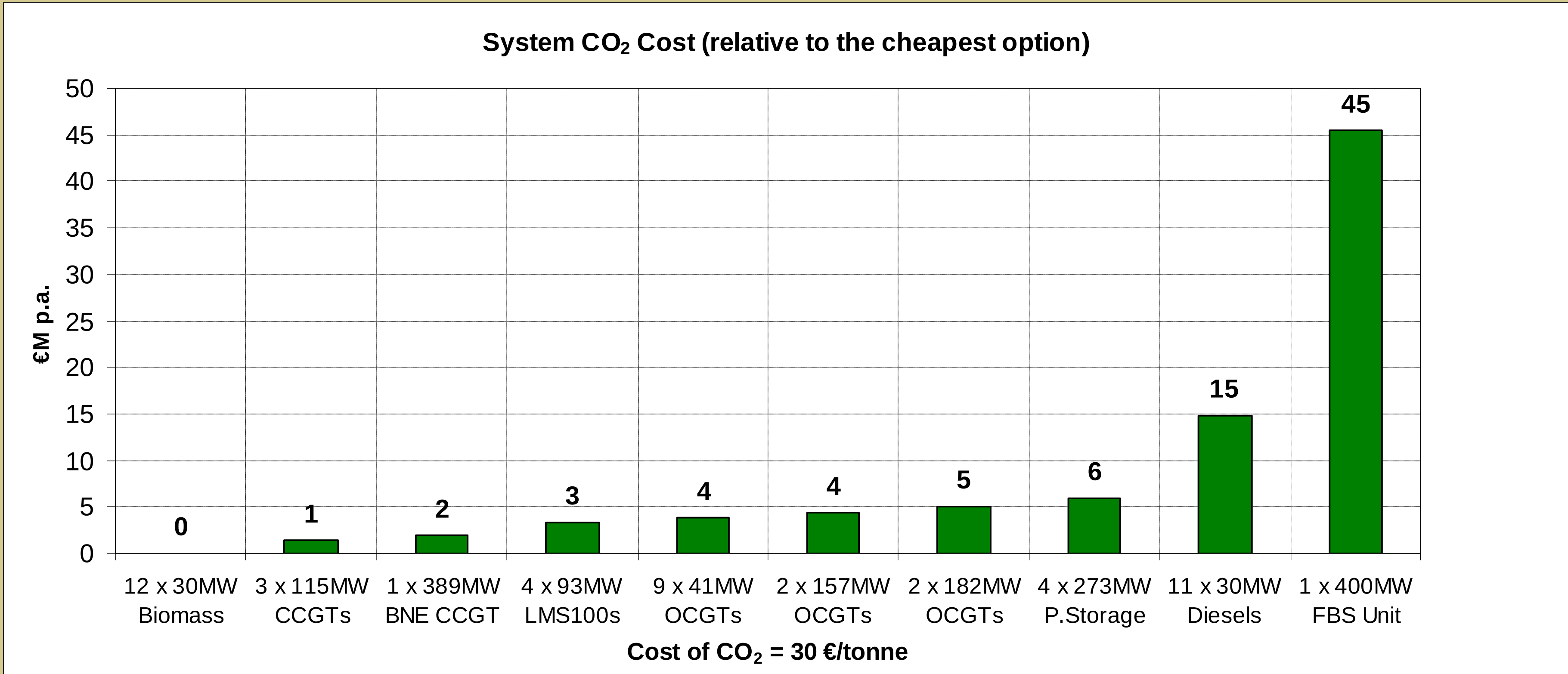
System CO_2 Cost (relative to the cheapest option)



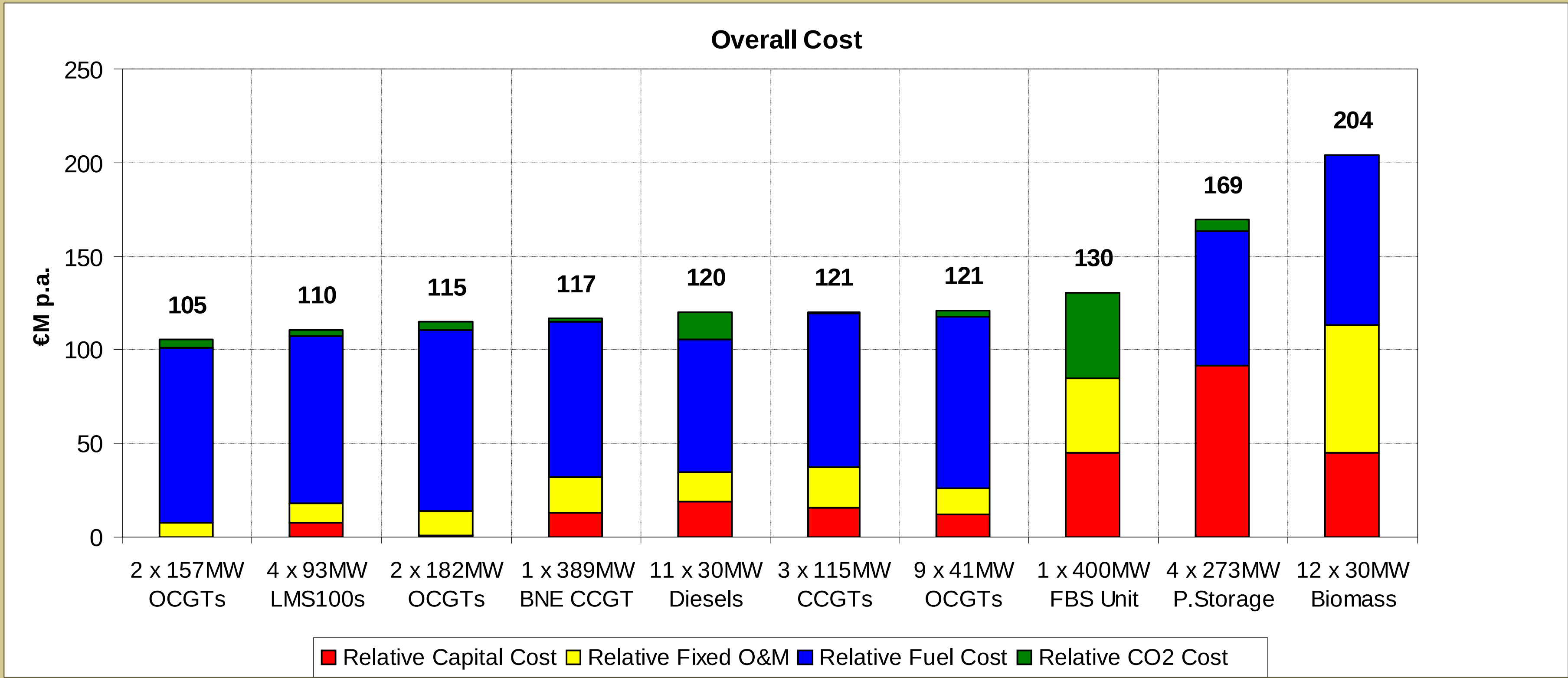
* Cost of CO_2 credits assumed to be 30 € / tonne.

Overall Cost

The overall cost was calculated by adding the four components:

- Annualised Capital Cost (relative to cheapest);
- Annual Fixed O&M cost (relative to cheapest);
- Annual system fuel cost (relative to cheapest);
- Annual CO_2 cost (relative to cheapest).

Overall Cost (Base Case)



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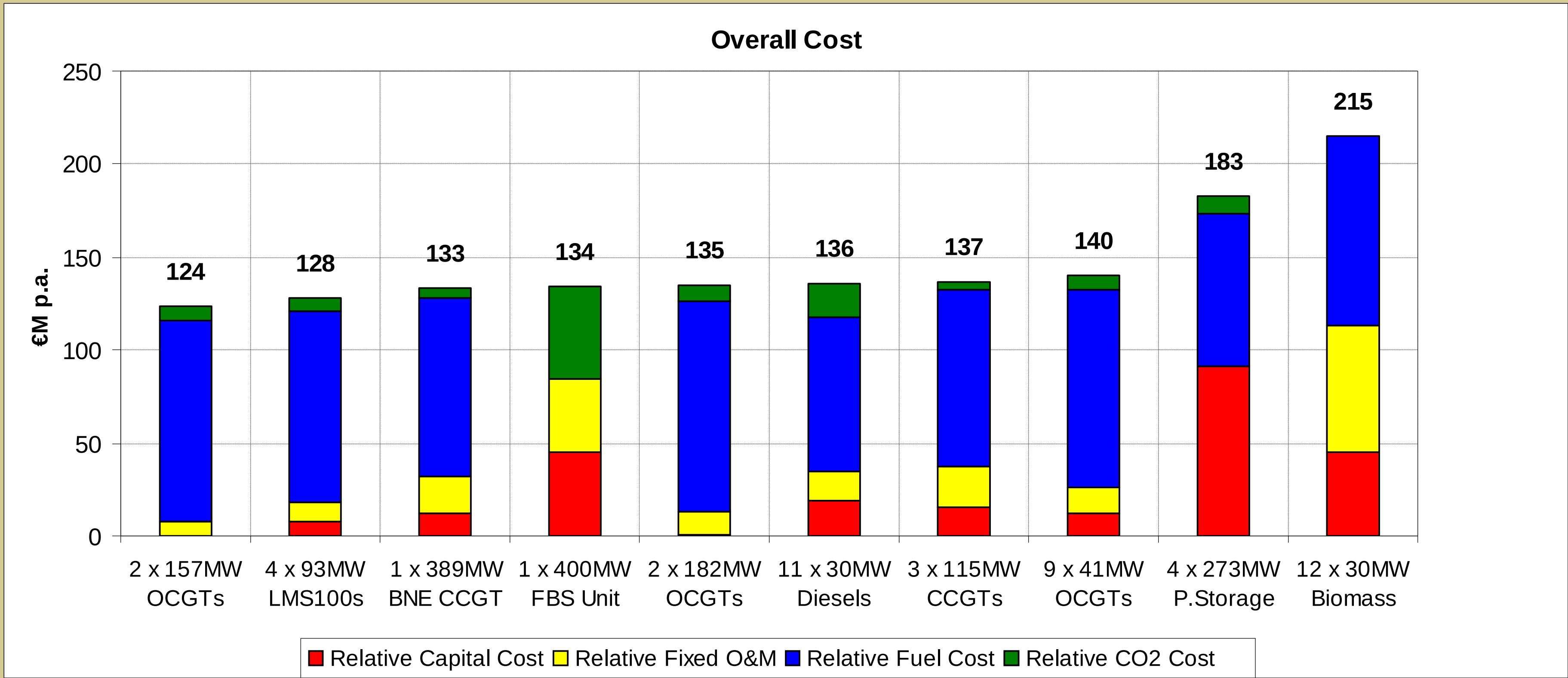
Sensitivity Studies

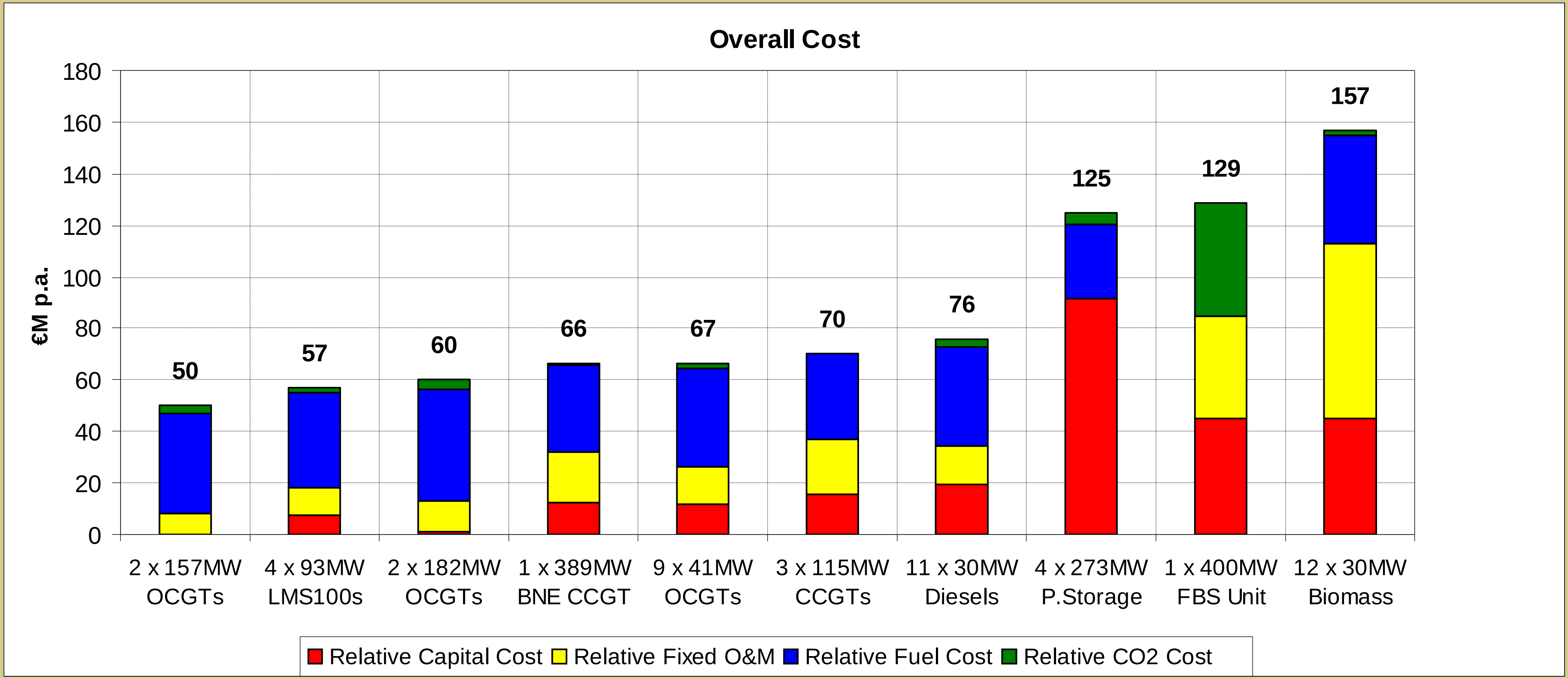
The following sensitivity studies were carried out:

1. High fuel price scenario;
2. Low fuel price scenario;
3. Increased CO_2 cost (from 30 to 100 €/tonne)
4. Higher capacity requirement

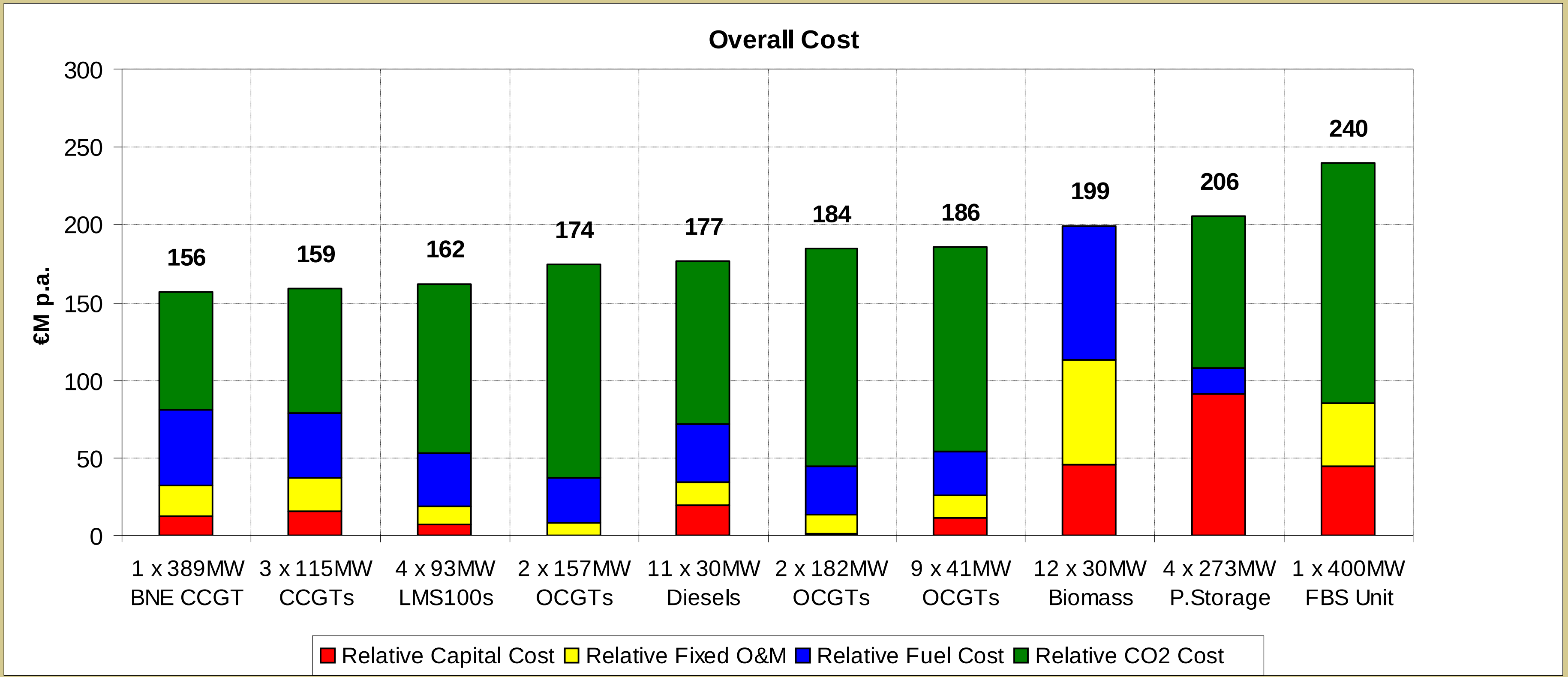
1. High Fuel Price Scenario



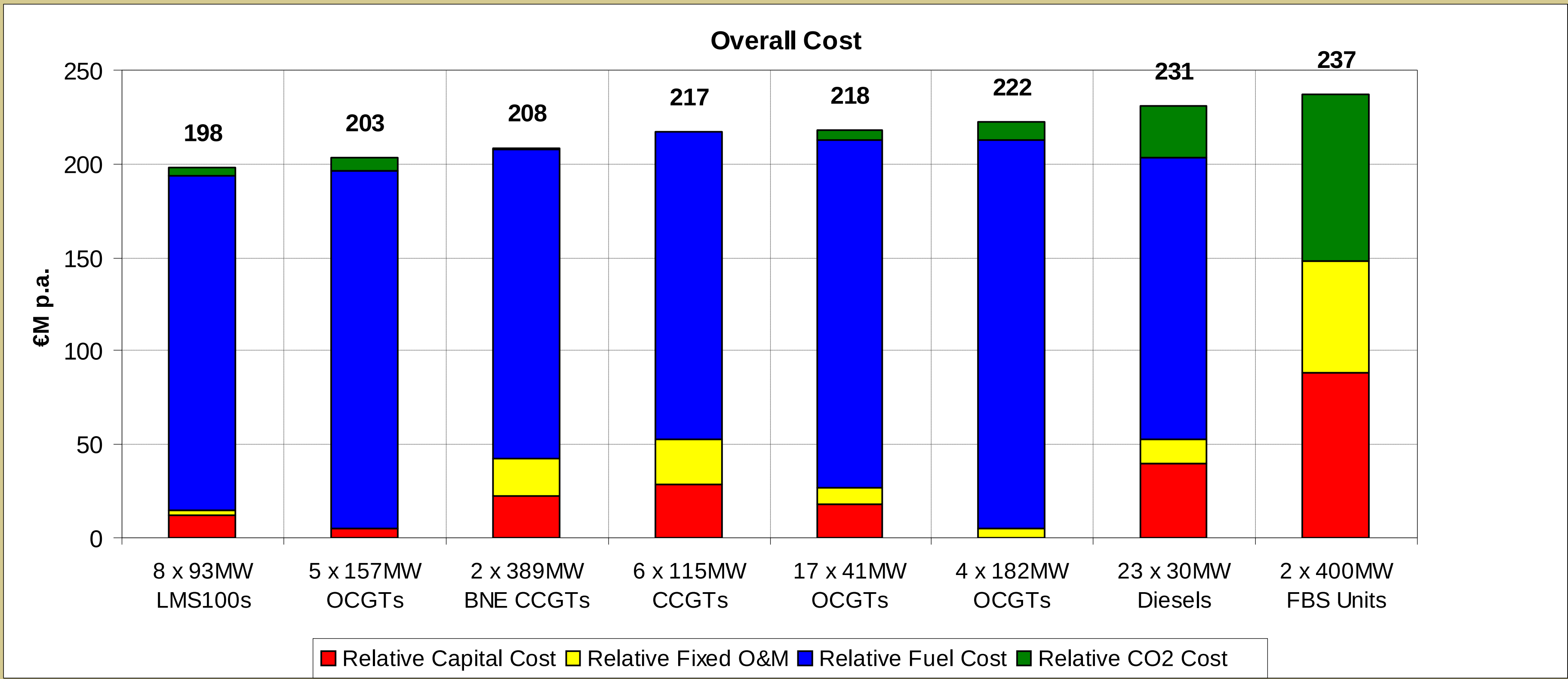
2. Low Fuel Price Scenario



3. CO2 Cost = 100 €/tonne



4. Higher Capacity Requirement



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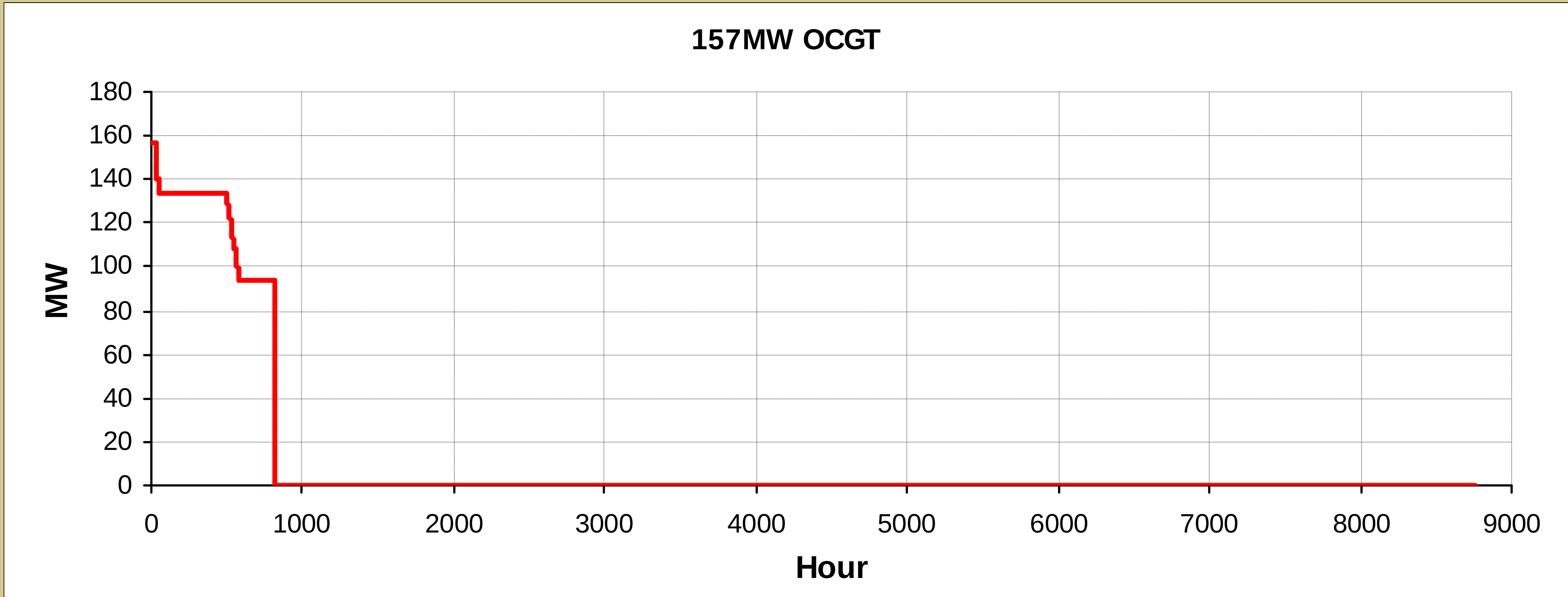
Summary of Results
(1 = cheapest, … 10 = most expensive)

Candidate Plant	Central Fuel Prices	High Fuel Prices	Low Fuel Prices	CO_2 = 100 €/tonne (rather than 30)	Higher Capacity
157MW OCGTs	1	1	1	4	2
93MW LMS100 OCGTs	2	2	2	3	1
389MW BNE CCGT	4	3	4	1	3
182MW OCGTs	3	5	3	6	6
115MW CCGTs	6	7	6	2	4
30MW Diesel Units	5	6	7	5	7
41MW OCGTs	7	8	5	7	5
400MW Coal FBS Unit	8	4	9	10	8
1092MW pumped storage	9	9	8	9	
30MW Grate-based Biomass Units	10	10	10	8	

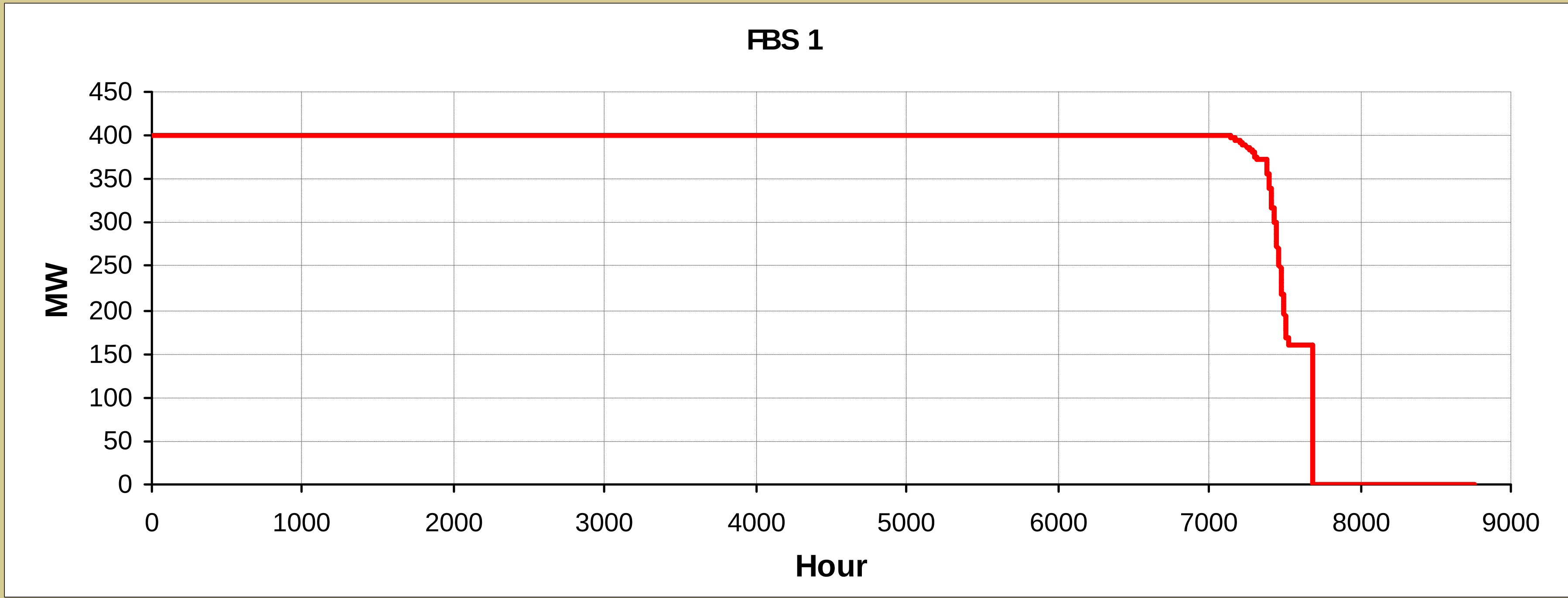
Example running regimes

Annual Duration Curve for 157 MW OCGT



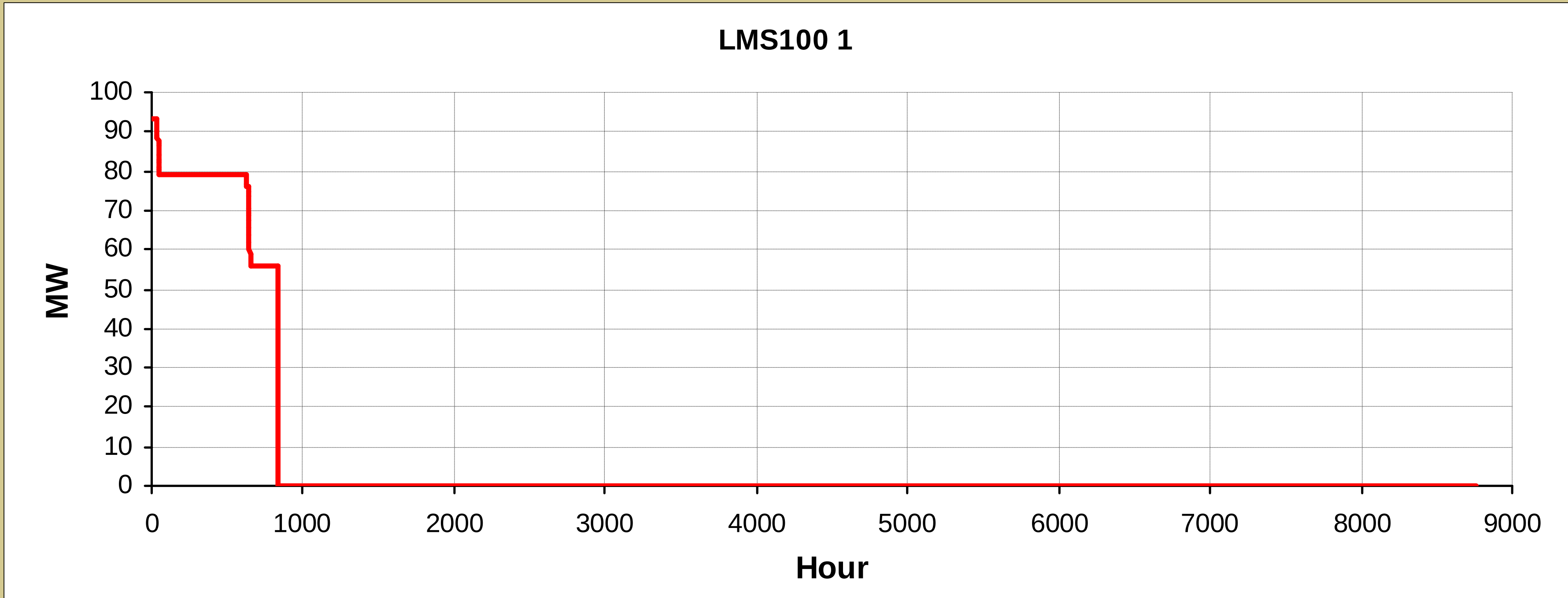
Generator	157 MW OCGT burning gas. Min load = 94.2 MW (60% of max).
Capacity Factor	7%
Run Hours	814 (9% of the time)
Running Load Factor	77%
Startups	136 p.a. (1 startup every 2.7 days on average).
Onload Duration	Average of 6.0 hours from startup to shutdown.

Annual Duration Curve for Fluidised Bed Steam unit



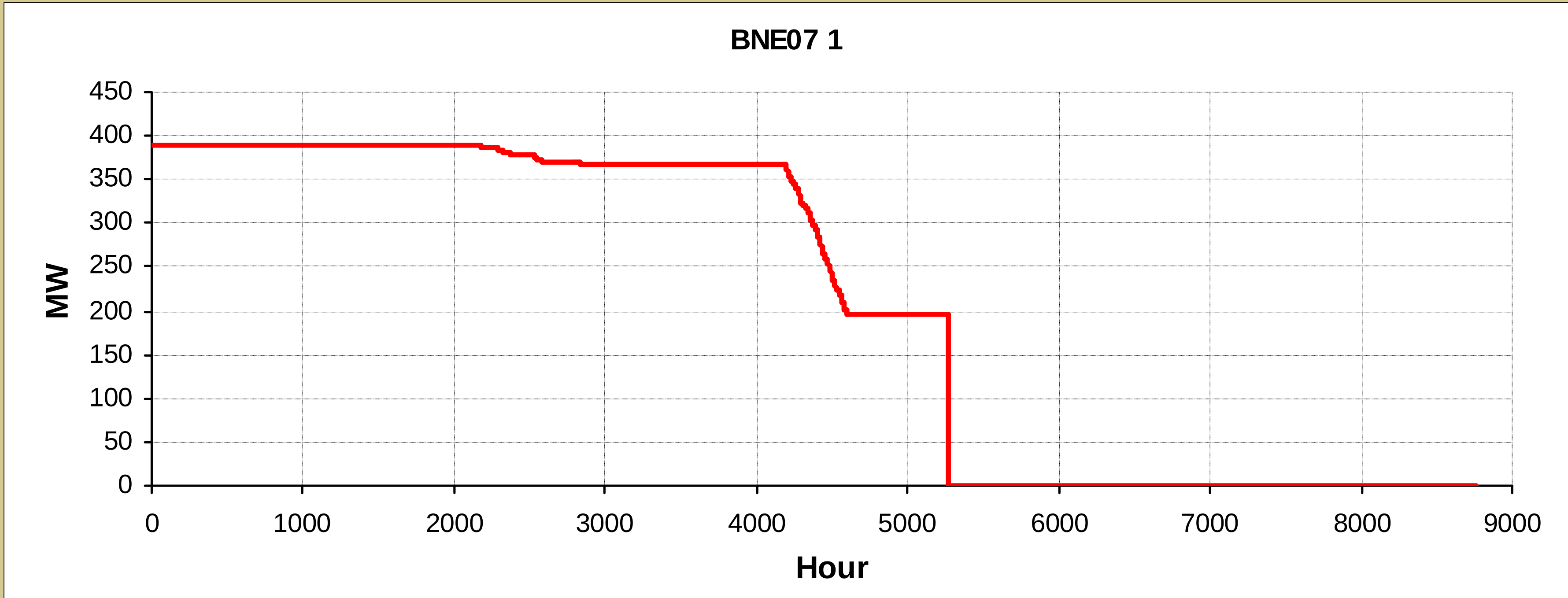
Generator	400 MW Fluidised Bed Steam unit burning coal. Min load = 160.0 MW (40% of max).
Capacity Factor	86%
Run Hours	7,679 (88% of the time)
Running Load Factor	98%
Startups	13 p.a. (1 startup every 28 days on average).
Onload Duration	Average of 25 days from startup to shutdown.

Annual Duration Curve for LMS100 OCGT



Generator	93 MW LMS100 OCGT burning gas. Min load = 55.8 MW (60% of max).
Capacity Factor	8%
Run Hours	835 (10% of the time)
Running Load Factor	80%
Startups	101 p.a. (1 startup every 3.6 days on average).
Onload Duration	Average of 8 hours from startup to shutdown.

Annual Duration Curve for BNE CCGT



Generator	389 MW BNE CCGT burning gas. Min load = 195 MW (50% of max).
Capacity Factor	54%
Run Hours	5,274 (60% of the time)
Running Load Factor	90%
Startups	295 p.a. (1 startup every 1.2 days on average).
Onload Duration	Average of 18 hours from startup to shutdown.

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Ref: CndPt118

Conclusions

- 'Horses for courses' – considering different scenarios leads to various least cost solutions
  - Many technologies provide comparable economic solutions
- Some technology types regularly appear in the winning enclosure
- The system can be operated securely under each scenario considered
- Provides information for informed and in-depth debate

End of Main Presentation

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