Flattening Power Factor 2009

A Report to the SEM Committee by SEMO on behalf of EirGrid and SONI

Document History

Version	Date	Author	Comment
1.0	26/08/2008	EirGrid and SONI	

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1 INTRODUCTION

1.1 Purpose

In line with M.30 of T&SC 4.3, the System Operators, EirGrid and SONI, herein propose a value for the Flattening Power Factor (FPF) for 2009. The introduction of the FPF into the Loss Of Load Probability Table (LOLP Curve) calculation has the objective of reducing the volatility in the Capacity Payments Mechanism (CPM). Choosing an appropriate value for the FPF is a matter of striking an appropriate balance between retaining sufficient volatility to signal the need for availability in times of low margin and avoiding excessive volatility that would render the mechanism highly unpredictable.

Section M.30 of the T&SC 4.3 states that it is the responsibility of the System Operators (SOs) to propose a value for the FPF to the RAs. Explicitly, it states:

"With respect to the Loss of Load Probability Table, the System Operators shall make a report to the Regulatory Authorities at least four months before the start of the Year proposing a value for the Flattening Power Factor (FPFy) for Year y which shall be in the range $0 < FPFy \leq 1$. The Market Operator shall publish the approved value of this parameter within 5 Working Days of receipt of the Regulatory Authorities' determination or two months prior to the first Capacity Period of the Year, whichever is the later. The System Operators may propose revisions to the value of the Flattening Power Factor (FPFy) during the Year and, subject to the approval of the Regulatory Authorities, the Market Operator shall publish such revised value not less than thirty 30 days prior to the first Capacity Period for which such revised value is to be applied".

1.2 Audience

This document will be published for consultation.

1.3 Scope

This document sets out the principles by which the FPF will be chosen for 2009. It further details analysis carried out by the SOs in determining whether the current FPF for 2008 is appropriate for 2009. It includes a discussion of the case for two FPFs. Finally, it proposes the value for 2009.

1.4 Document Structure

Following this introduction, the remainder of this document is structured as follows:

- **Section 2 – Rationale** outlines the guiding principles for choosing the FPF for 2009 ;
- **Section 3 – Review** briefly goes through the components of the capacity payment relevant to the choice of the FPF;
- **Section 4 - Analysis** analyses the historical market outcomes for the first six months of 2008; and
- **Section 5 – Conclusion** sets out the proposed value for the FPF for 2009 and any other recommendations.

2 RATIONALE

EirGrid and SONI in their role as SOs[1] in the Republic of Ireland and Northern Ireland respectively ensure the safe, secure, reliable, economic and efficient development, maintenance and operation of the high voltage transmission systems in RoI and NI respectively. These objectives will be at the core of this paper.

The aim of the T&SC[2] is to facilitate the achievement of the following objectives:

- to facilitate the efficient discharge by the Market Operator of the obligations imposed upon it by its Market Operator Licences;
- to facilitate the efficient, economic and coordinated operation, administration and development of the Single Electricity Market in a financially secure manner;
- to facilitate the participation of electricity undertakings engaged in the generation, supply or sale of electricity in the trading arrangements under the Single Electricity Market;
- to promote competition in the single electricity wholesale market on the island of Ireland;
- to provide transparency in the operation of the Single Electricity Market;
- to ensure no undue discrimination between persons who are parties to the Code; and
- to promote the short-term and long-term interests of consumers of electricity on the island of Ireland with respect to price, quality, reliability, and security of supply of electricity.

These objectives will also be considered as part of this report. In addition, the CPM should strike a balance between the following design objectives[3]:

- capacity adequacy and system reliability
- efficient price signals for long term investments
- price stability
- susceptibility to gaming
- fairness
- simplicity

Each of these objectives will be reviewed before recommending a value for the FPF for 2009 to ensure that all aspects and impacts of the choice of FPF are considered.

[1] EirGrid and SONI are also the market operator through the joint venture, SEMO.
[2] TSC v4.3, clause 1.3
[3] http://www.allislandproject.org/GetAttachment.aspx?id=dee78878-ff15-4cd4-ad6c-5f522dd86366

3 REVIEW

Prior to the analysis of historical CPM outcomes, it may be useful to briefly discuss the structure of the capacity payment.

3.1 Overview of CPM

Unlike the capacity payment mechanisms in other markets, e.g. the former England & Wales Pool, the annual amount available for capacity payments is fixed prior to the commencement of the year in question. The indicative Annual Capacity Payment Sum for 2009 is €594,676,800[4].

As this is a significant amount, it is imperative that the mechanism through which it is distributed is efficient and achieves the objectives set out in its design (see Sec. 2). This annual amount is recovered from supplier units in the pool on a per MWh basis. The annual pot is further split into 12 monthly demand-weighted pots. These monthly pots are in turn split into three components - a Fixed, a Variable and an Ex-post payment, at a ratio of 30:40:30.

The Fixed payments are linked to relative vales of Forecast Demand. Variable and Ex-post payments are linked to the margin via a LOLP curve. The margin is the difference between eligible availability and demand in any one period. The LOLP curve is used as a relationship between the margin and the security of the system. It is used to weight capacity payments in each trading period and is calculated annually[5]. Fig. 3.1 shows how the LOLP curve[6] is used to calculate an Output LOLP value (OLOLP) based on an input margin. The FPF, the parameter being considered in this paper, is used to 'flatten' the LOLP curve by raising every value on the LOLP Curve to the power of FPF ($0 < FPF \leq 1$). This has the effect of lowering the volatility of capacity payments.

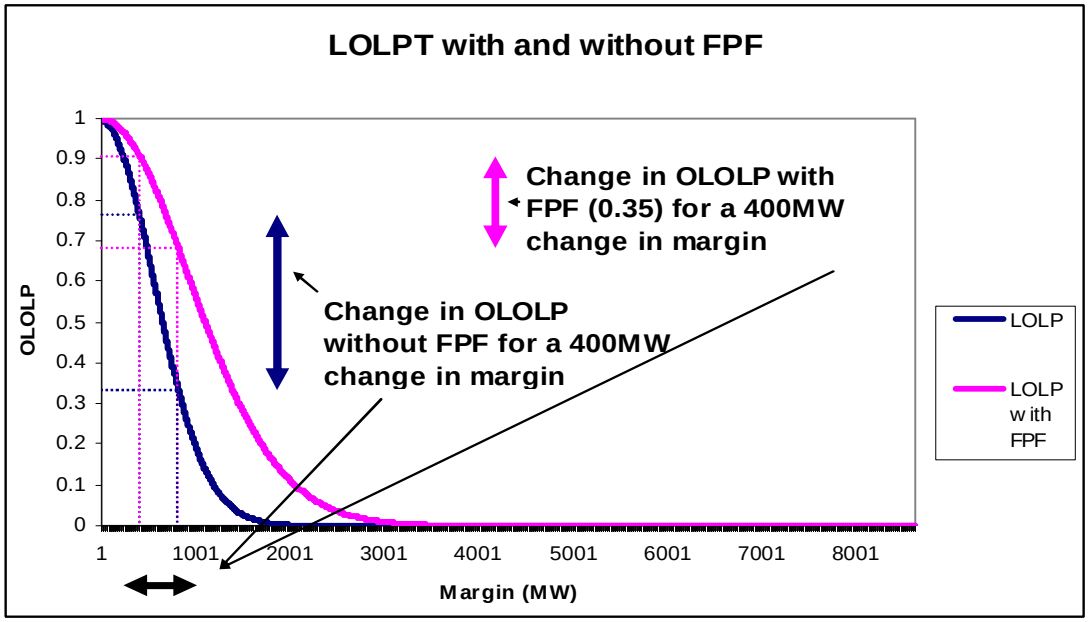


Fig. 3.1. – LOLP Curve with and without FPF

[4] http://www.allislandproject.org/en/capacity-payments-consultation.aspx?article=c992e67e-9ab7-4150-9729-de5edc8deb2c

[5] Unless >50MW unit registers or deregisters whereby it is recalculated within year.

[6] The LOLP curve is, in fact, a discrete lookup table and is not a continuous function as the word 'curve' implies. However, the use of the word 'curve' allows various adjectives, such as 'flat' and 'steep' to be used.

3.2 Difference between Variable and Ex-post payments

What distinguishes the Variable payment from the Ex-post payment (besides the fact that the Variable pot is larger) is that the portion of the monthly Variable pot available in each trading period is based on a *forecast* of the margin whereas the Ex-post weightings are based on the *actual* margin. Put another way, the Variable payment is calculated prior to the capacity period[7] whereas the Ex-post payment is calculated after the capacity period.

The foreknowledge of the Variable payments and lack of it for the Ex-post payments coupled with the relative size of the monthly pots make the Variable payment a more certain and attractive revenue stream than the Ex-post payment.

The forecast margin, however, on which the Variable payments is based has a sizeable inherent error. This is due to the unpredictability of discrete forced outage events and the variable nature of wind and demand a month in advance. An important consideration in the choice of an appropriate value for FPF is this inherent error in the forecast margin. Too volatile a payment may encourage greater availability at times when there is no real need for greater availability or may place little incentive in trading periods where, on the day, there is a real need for greater availability.

The actual margin, on which the Ex-post payments is based is a much better reflection of the security of the system in a particular trading period than the forecast margin. In the Ex-post payment generator units are rewarded for being available at times when the system *actually* most required their capacity. Another important consideration in the choice of an appropriate value for FPF is ensuring that periods of relatively low Ex-post margin are rewarded disproportionately. The Ex-post payment should retain sufficient risk and volatility to incentivise greater availability and value capacity appropriately in periods of real system need.

[7] This is not strictly true. There are factors of the calculation which are not known in advance viz. Capacity Payments Generation Price Factor and Capacity Payment Price Factor. However, these factors have a relatively minor effect on the level of payment.

4 ANALYSIS

The analysis to determine an appropriate FPF for 2009 is based on historical CPM data from 01/01/2008 to 30/06/2008. The period from "Go Live" 01/11/2007 to 31/12/2007 has not been considered as it was felt that, as the market was settling down in this period, any trends exhibited would not be representative of how the market would normally run. While ideally the analysis would be based on a full year's data, as the market is only in its first year, only six full months of data was available when this analysis commenced.

The FPF is chosen primarily based on the desire is to keep some volatility in the payments to signal the need for availability during periods of system stress, but at the same time provide a predictable stream of payments over the course of the month. To achieve this objective for 2007/2008, following analysis of the effect of the FPF on the distribution of both Variable and Ex-post payments, the SOs recommended that the value initially suggested by the RAs of 0.35 be adopted for 2007/2008.

4.1 Capacity Adequacy and System Reliability

Fig. 4.1 below is a scatter graph of Ex-post Capacity Payments Generation Price (ECGP) and the Variable Capacity Payments Generation Price (VCPGP) in every period from 1st Jan 2008 to 30th Jun 2008 as a function of the total Eligible Availability (EA) less the total Forecast Unit Availability (FUA) of conventional units (i.e. not wind, energy limited, pumped storage or interconnector units). This aims to illustrate whether the high capacity prices lead to changes in availability of conventional units.

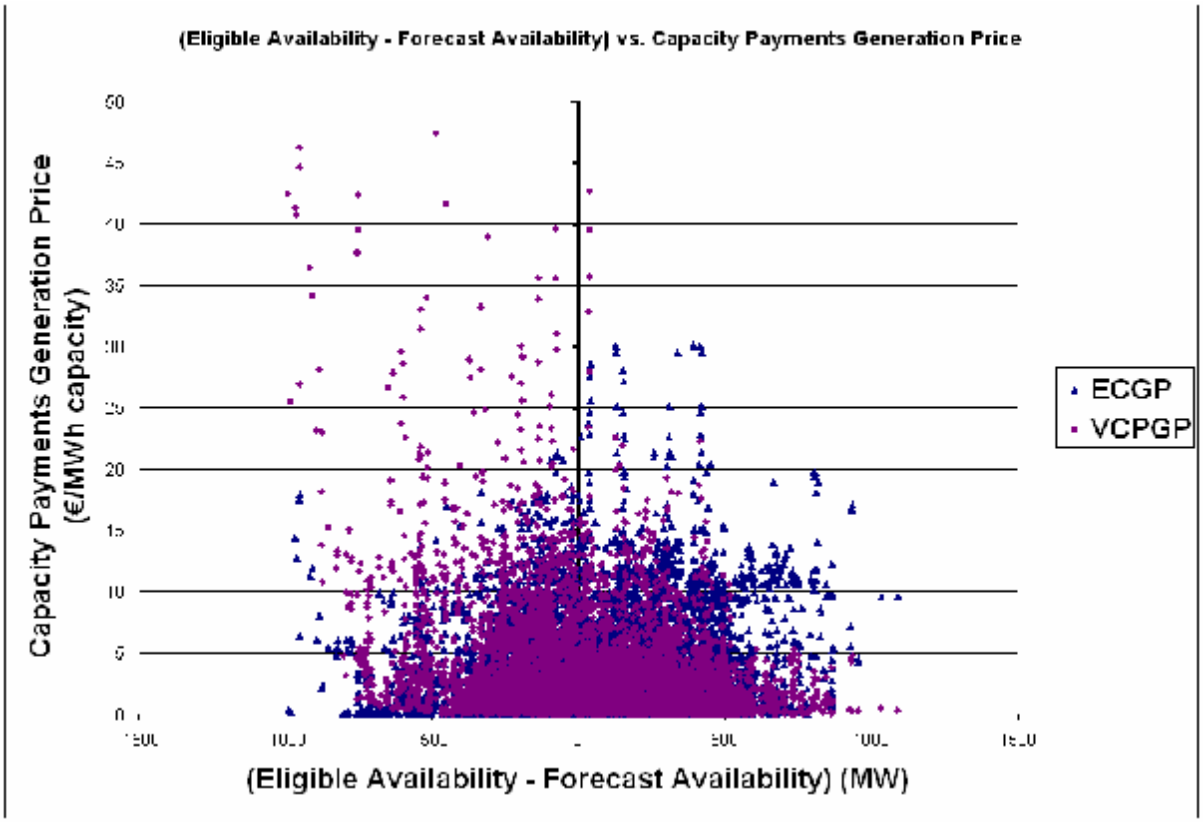


Fig. 4.1 – Scatter Graph of ECGP and VCPGP as a function of (EA-FUA)

The results indicate that trading periods with high VCPGP, whose main factor, the Variable Capacity Payment Weighting Factor (VCPWF), is know during the capacity period, coincide with periods where generator availability is *lower* than the forecast. This implies that even

though there are large payments available in some periods known to generator units in advance, the availability in these trading periods is almost always less than expected.

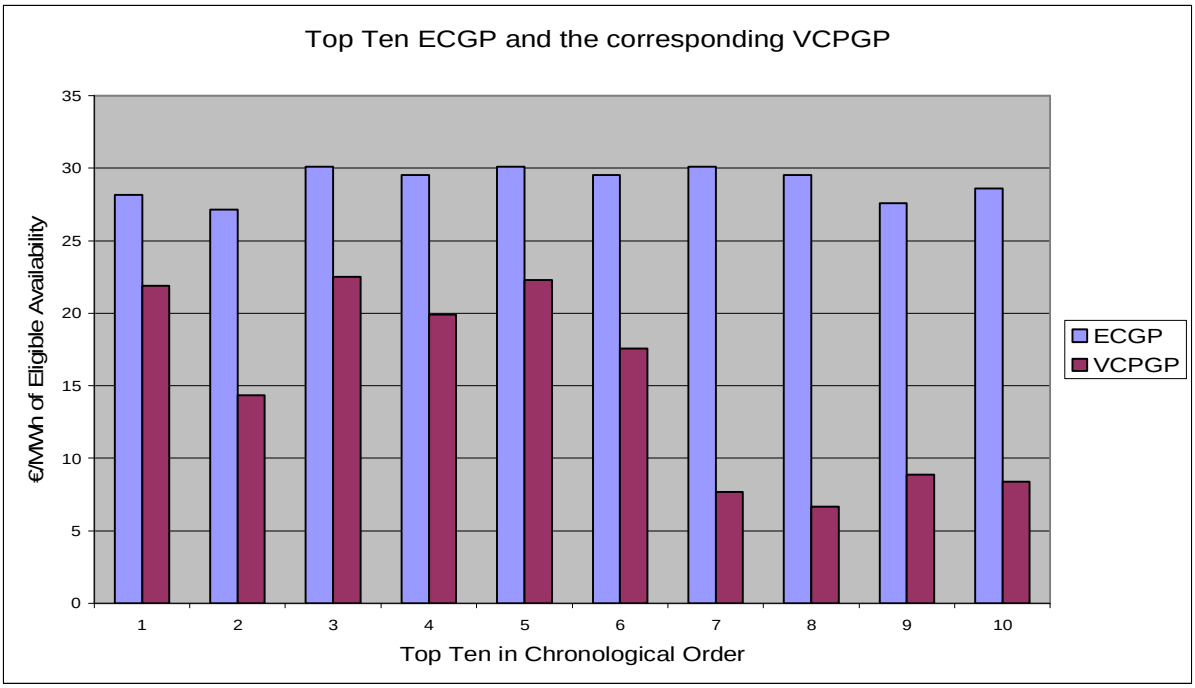
In addition, trading periods with high ECGP, whose main factor, the Ex-post Capacity Payments Weighting Factor (ECPWF), is not known with certainty during the capacity period, coincide with periods where generator availability is *higher* than the forecast.

These trends *appear* positive from a system operation perspective, as they imply that units are responding to the Ex-post signal and are not focussing solely on trading periods with higher Variable payments. However, due to the complex interrelationships between the many components of the capacity payment and the limited amount of data, it is difficult to isolate individual aspects of the mechanism or behavioural responses to them.

The following example may illustrate. There was a 5% increase in RoI in the EA of conventional units over their FUA in the 6 months examined. It would be easy to conclude that this 5% was due to the incentives of the CPM. However, if we look at changes to monthly 52-week rolling average availability in RoI[8], we notice that average availability is still poor and there has been little movement between the 77% figure in Jan-2008 and the 78% figure in Jul-2008. It is more likely that the 5% difference is due to a relatively short time period examined and to the limitations of probabilistic approach to forecasting unit availability on a small system.

It is the view of the System Operators that the link to the Ex-post margin is being overly damped and that there is insufficient incentive for generators to invest appropriately to improve their availability.

On the other hand, high Variable payments (based on a forecast margin with a large inherent error) are being paid to generators in trading periods where there is not an appreciable scarcity. Fig. 4.2a and 4.2b illustrate the lack of correlation between the top ten Variable and Ex-post capacity payment prices between Jan and Jun 2008.



[8] http://www.eirgrid.com/EirgridPortal/default.aspx?tabid=Availability Reports&TreeLinkModID=1451&TreeLinkItemID=348

Fig. 4.2a – Top Ten ECGP and the corresponding VCPGP

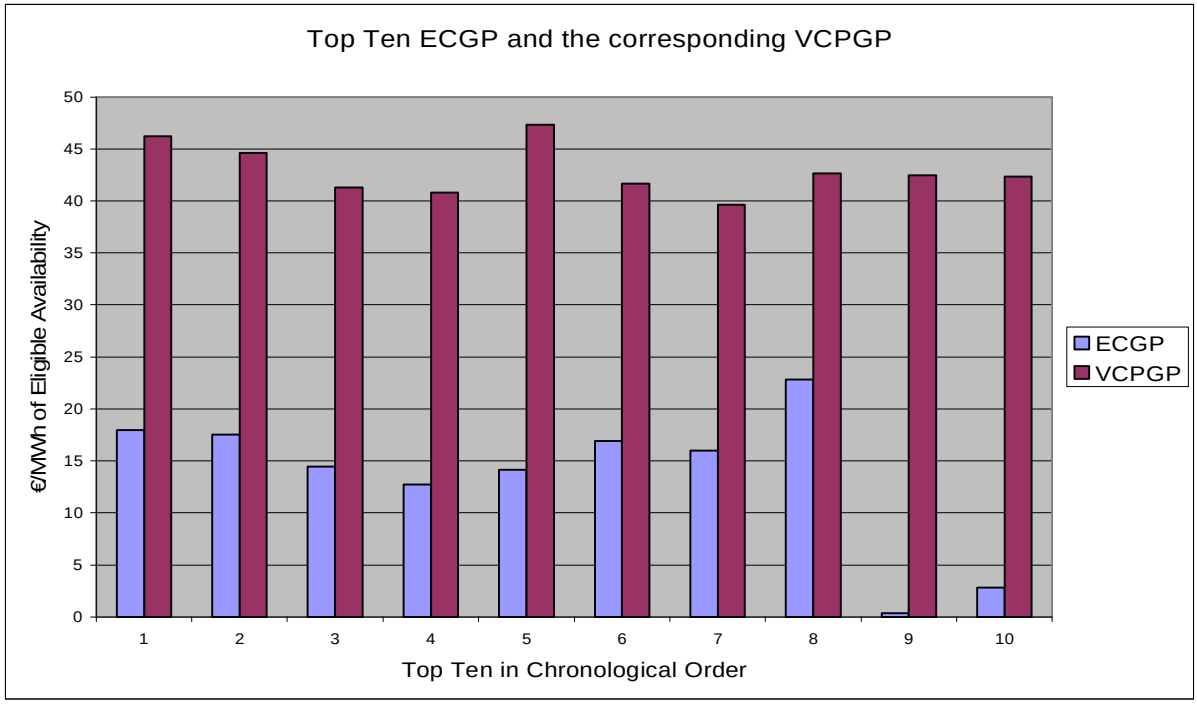


Fig. 4.2b – Top Ten VCPGP and the corresponding ECGP

The SOs believe that volatility in the Ex-post payments should be increased to signal the need for increased availability in times of real system need whereas volatility in the Variable payments should be decreased to take into account the inherent error in the forecast margin.

However, with a single FPF, decreasing the volatility in the Variable payment and increasing the volatility in the Ex-post payment is not possible. A higher FPF closer to the actual LOLP curve would introduce the necessary risk in the Ex-post payment *but at the expense of creating higher more volatile payments in the Variable payment.* A low FPF will dampen the Variable payment (to take into account the error in the forecast) *but at the expense of incentivising greater availability through the Ex-post payment.*

The SOs favour the introduction of a second FPF. One FPF would apply to the LOLP Curve used for the Variable payments and the other FPF would apply to LOLP Curve used for the Ex-post payment. This would enable the tuning of the Variable and Ex-post payments to reflect their individual characteristics. This, in our view, would ensure stable Variable payments that are linked to the margin but also take into account the inherent error in the forecast of the margin. It would also ensure better Ex-post signal that would incentivise better availability in times where this availability is really required.

***The System Operators invite the views of the Market Participants and the Regulatory Authorities on the introduction of a second FPF to the CPM*.**

4.2 Efficient Price Signals for Long Term Investments

From an investor's perspective the CPM is a very important component of revenue from SEM. While units may earn revenue above their Variable costs through infra-marginal rent, ancillary services payments and carbon allowances, a large proportion of a unit's capital and fixed costs are recovered through the CPM.

Inter-year revenue stability is more likely to be of more concern to investors i.e. the level of expected revenue from the CPM over the lifetime of the investment. This is discussed in the recent consultation by the Regulatory Authorities[9] and is not considered further here. However, in terms of intra-year revenue, the choice of FPF will benefit some plant over others and this would be a consideration by any investor.

Based on how different unit types are treated in the CPM, Table 4.1 outlines how different levels of intra year payment volatility might affect the revenues of these unit types. The unit types considered are based on their eligible availability profiles. A *New Thermal Unit* is a large CCGT, peat or coal unit (>100MW) with high availability (>90%). An *Old Thermal Unit* is an older gas, peat or coal unit with a low availability (<80%). A *Wind Unit* has variable availability. Both a *Hydro Unit* and a *Pumped Storage Unit* are energy limited but their availability is optimised to maximise revenue from the CPM. An *OCGT Unit* is a smaller unit with very high availability (>95%).

Relative Benefits of Different Levels of Volatility in the CPM by Plant Type			
Unit Type	Lower Volatility	Medium Volatility	Higher Volatility
New Thermal Unit	Higher	Higher	Medium
Old Thermal Unit	Higher	Medium	Lower
Wind Unit	Higher	Medium	Lower
Hydro Unit	Lower	Medium	Higher
Pumped Storage Unit	Lower	Medium	Higher
OCGT Unit	Medium	Higher	Higher

Table 4.1 – Effect of intra-year CPM Volatility

An OCGT Unit, a Hydro Unit and a Pumped Storage Unit may benefit more from payments with higher volatility. This is due to the fact that the OCGT Unit has very high availability and the Energy Limited and Pumped Storage Units' availabilities are optimised for times of high capacity payments. A New Thermal Unit may benefit less than they would in the Lower and Medium Volatility Cases. An Old Thermal Unit is most likely to lose out in the Higher Volatility Case due to their lower availability. A Wind Unit, while it might benefit less directly from for the Higher Volatility Case, might benefit in the long run from the investment in units that have characteristics complimentary to the Wind Unit[10].

The opposite is true for the Lower Volatility Case.

All units fair well in the Medium Volatility Case. However, New Thermal Units and OCGTs would be likely to fair better than other units due to their higher availabilities.

The System Operators believe that it would only be appropriate to increase or decrease the volatility in the Variable and Ex-post payments if there are two FPFs. That way any increase in volatility in the Ex-post payment can be balanced by a decrease in the volatility of the Variable payments.

Where there is only one FPF, we believe that the current FPF of 0.35 provides an adequate balance between the objectives considered in this paper. Changing the single

[9] http://www.allislandproject.org/en/capacity-payments-consultation.aspx?article=c992e67e-9ab7-4150-9729-de5edc8deb2c

[10] "The installation of complementary, i.e. flexibly dispatchable plant must be effectively incentivised so as to maintain adequate levels of system security". (All Island Grid Study , WS4, Conclusions, Jan 2008)

FPF will only result in the tradeoffs discussed in Sec. 4.1 that will inevitably result in a further dampening of the Ex-post signal.

4.3 Susceptibility to Gaming

Trying to manipulate capacity payments by withdrawing available generation with the intention of artificially creating a capacity shortage has been illustrated previously to be a redundant strategy[11]. Efforts to withdraw enough plant to elevate the ECPG by an amount such that a participant sees a net capacity payment revenue gain from the remaining available portfolio has been show to lead to in almost every case to a net loss of revenue. This study referred to was carried out prior to the application of an FPF. It is assumed here that any FPF<1 would make even more remote the possibility of profitably gaming the CPM. Therefore, we may conclude that the choice of FPF has no appreciable effect on a participants ability to game the CPM.

4.4 Price stability

An important characteristic of the CPM is price stability. The Annual Capacity Sum governs what is paid out through the CPM. Monthly values are fixed and it is guaranteed that these amounts will be paid out.

The only consideration of relevance when determining the FPF is the volatility of payments. The volatility of the payments should be such that sufficient risk is retained to incentivise better availability. However, overly unpredictable payments would send a damaging signal that SEM is not a stable investment environment.

Graphed below, in Fig. 4.3a and 4.3b are histograms of the VCPGP and the ECGP. It can be easily seen that both distributions are relatively smooth and the frequency of high prices is low indicating a low volatility. The standard deviations of both sets of prices are of the same order of magnitude as their mean.

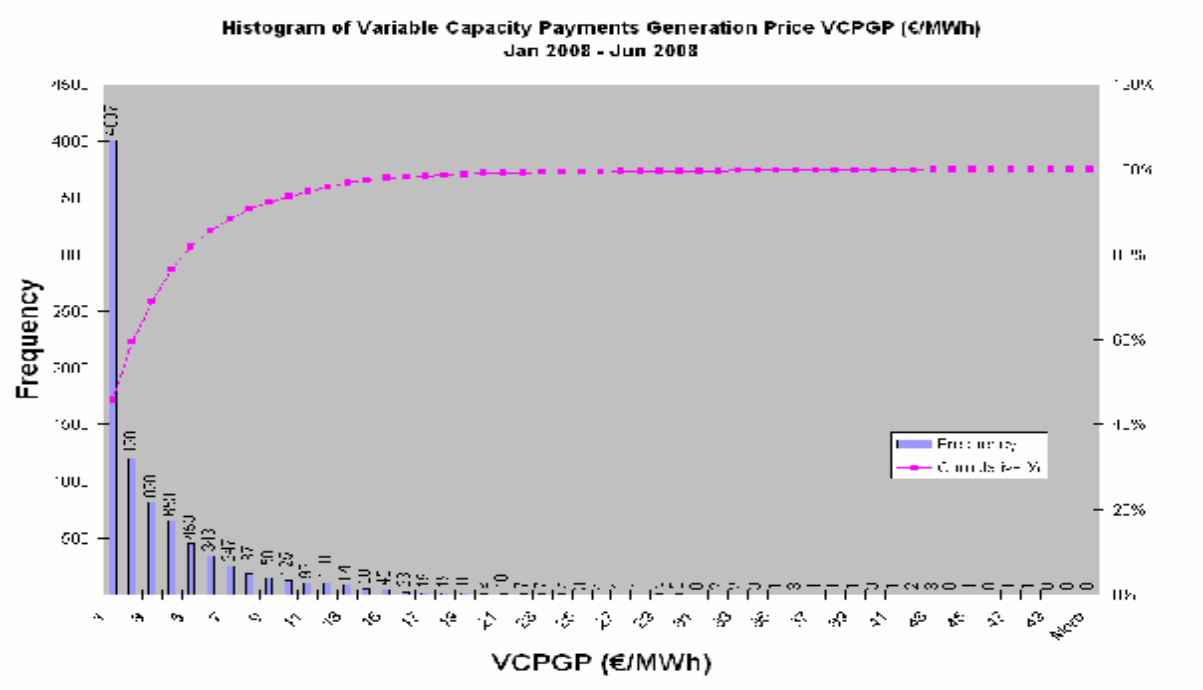


Fig. 4.3a – Histogram of Variable Capacity Payments Generation Price

[11] AIP-SEM-231-06

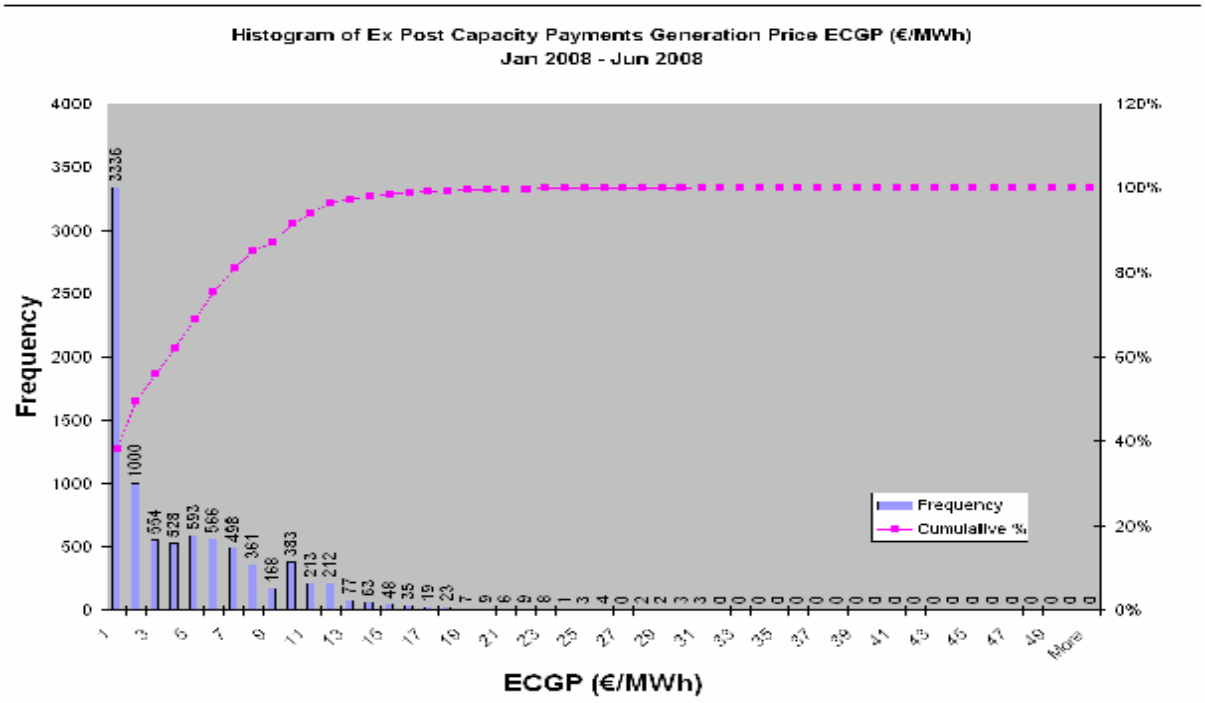


Fig. 4.3b – Histogram of the Ex-Post Capacity Payments Generation Price

4.5 Simplicity

A FPF of 0.35 does not overly complicate the CPM.

4.6 Fairness

The only way in which the FPF affects the fairness of the CPM is through the investment signals dealt with in Sec. 4.2.

5 CONCLUSION

Choosing an appropriate value for the FPF is a matter of striking an appropriate balance between retaining sufficient volatility to signal the need for availability in times of low margin and avoiding excessive volatility that would render the mechanism highly unpredictable.

Using of 6 months of data from Jan 2008 to Jun 2008 inclusive, we have considered all the aspects of the design objectives of the CPM. It is our view that 6 months data is not a lot of data and any conclusions drawn from it should reflect this. However, based on the data we have, we see no issues with the current FPF of 0.35 in the areas of susceptibility to gaming, price stability, simplicity or fairness.

In relation to capacity adequacy, system reliability and investment signals, there may scope for improving the mechanism. It is the System Operators' view that one FPF is inadequate for the Variable and Ex-post payments. Two FPFs, in our view, would enable the creation of two LOLP curves: on one hand, a 'flatter' curve for stable Variable payments that retain the link to the margin but incorporate the error inherent in a forecast of the margin; on the other hand, a steeper curve closer to the actual LOLP curve that introduces the appropriate level of risk to the Ex-post payment that drives the necessary investment in availability. These objectives are not fully realisable with one FPF.

We welcome the views of the Market Participants and the Regulatory Authorities on the introduction of a second FPF.

In the meantime, the System Operators propose that the FPF of 0.35 is retained for 2009.