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An Coimisiún um Rialáil Fuinnimh

# Industry forum

Margadh Aibhléise na hÉireann

CityWest Hotel

3rd December 2003

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# AGENDA
## Keelin O'Brien

| | Item | Time |
|---|---|---|
| 1 | Registration | 9:00 – 9:30 |
| 2 | Welcome and introduction | 9:30 – 9:45 |
| 3 | FTRs paper overview and questions | 9:45 – 11:00 |
| | Break | 11:00 – 11:30 |
| 4 | Co-optimisation paper overview and discussion | 11:30 – 1:00 |
| | Lunch | 1:00 – 2:00 |
| 5 | Modelled scenarios | 2:00 – 3:30 |
| 6 | Update on project progress and organisation | 3:30 – 4:00 |

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# AGENDA
## John George, PA Consulting

- Welcome and introduction
- FTR paper overview
- Co-optimised reserves
- Modelled scenarios
- Project organisation & progress

# Agenda

This session will cover FTRs:

- Purpose
- Administration
- Form
- Funding
- Revenue adequacy
- Treatment of losses
- Allocation
- Examples

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# What is an FTR?

Problem:

- LMP leave participants exposed to differences in LMPs ("basis risk")
- New market may affect some physical transmission access rights (if any)

Solution:

- Financial Transmission Rights
  - Tradable financial instrument
  - Support energy CfD
  - Hedge spot price between LMPs at two nodes
    - UWSMP can be regarded as a node
  - Paid out each trading interval (half hour) based on FTR holding irrespective of dispatch quantity
  - Partial solution to physical transmission rights

FTRs hedge locational price volatility in the same way that CfDs hedge inter-temporal price volatility

# Who administers FTRs?

FTRs are supported by the MAE and have prudential implications on the market.

Regulatory oversight

- CER

FTR Administrator

- SMO

Licensed FTR holders

- MAE participants (need to be bound to the market rules)

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# What do FTR look like?

Point-to-point

- Hedge any pair of LMPs or an LMP and the UWSMP (uniform wholesale buy price)
- Defined in a direction – ***from*** node A ***to*** node B

Two-way hedges

- “Obligations” – like swap contract
- In any half-hour could be a right to receive a payout or an obligation to make one

Limited term

- Basic term: 3 months up to 12 months ahead
- Longer term under certain circumstances

# How are FTRs funded?

Primary financial backing from the energy market settlement surplus

- Sufficient funding when FTR quantities are determined so as to be "revenue adequate"

Secondary funding (when FTR allocation in revenue inadequate) can be from:

- ESB Networks through TUoS
- Energy price uplift

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# What is a revenue adequate set of FTRs?

Settlement surplus:

> *Σ(LMP x energy withdrawal quantity at withdrawal node) - Σ(LMP x energy injection quantities at injection node).*

FTR payout for each FTR is:

> *(LMP x FTR withdrawal quantity at withdrawal node) - (LMP x FTR injection quantities at injection node)*

A set of FTRs is revenue adequate in any trading interval if

- The settlement surplus in that interval is no less than than the (total) FTR payout
- The set of FTR injection and withdrawal quantities are feasible to the energy network in that interval

Revenue inadequacy occurs if the network is too constrained for the allocation of FTRs – eg network outage

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# How is Revenue Adequacy Assured?

Under normal circumstances

- FTR allocation is constrained by ensuring it is feasible to energy network
- So use transmission network to test the feasibility of FTR allocation
  - eg FTR auction is constrained by a transmission network similar to energy network
- But: FTR network is a long-term version of energy network
  - Issue: how to ensure FTR network is a good representation of expected energy network

Under a contingency – eg transmission forced outage

- Energy network may be more constrained than the FTR network and too many FTRs have been allocated
- Settlement surplus may be inadequate to cover FTR payout

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# What about losses?

LMP price difference is:

*(LMP at withdrawal node) - (LMP at injection node)*

Settlement surplus is:

*(LMP x energy withdrawal quantity at withdrawal node) - (LMP x energy injection quantities at injection node)*

These differ because of the losses inherent in the difference between the injection quantity and the withdrawal quantity.

LMP price difference has:

- Congestion rental – included in settlement surplus.
- Loss rental – included in settlement surplus
- Cost of losses – not included in settlement surplus

FTRs can payout for either:

- Full LMP price difference – but this is more than the settlement surplus so is revenue inadequate on their own
- Congestion rental plus loss rental - this corresponds to settlement surplus so is revenue adequate

# What are loss-based FTRs?

Allowing for losses leads to the specification of several FTR instruments:

- "Balanced FTR"
  - Injection and withdrawal quantities are the same
  - Pays out based on full LMP price difference
  - Is revenue inadequate
  - Not sufficient on their own for a feasible allocation
- "Unbalanced FTR"
  - Injection and withdrawal quantities different
  - Payout adjusted for quantity difference
  - May be either fixed unbalanced or flexible unbalanced (variations in the unbalanced quantity offered via incs and decs)
  - Revenue adequate
  - May allow a full feasible set of FTRs if sufficient flexibility offered
- "Spot FTR"
  - Only an injection or withdrawal quantity at a node
  - Buys or sells loss quantities
  - Equivalent to a forward energy contract
  - Assist the full liquidity of the FTR allocation

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# Will the FTRs be Firm?

Firmness is the degree of certainty of payout

- Desirable that FTRs should be firm

In the MAE liability for LMP “basis risk” is already limited by

- VoLL – limits how large an LMP can go (can sometimes exceed VoLL)
- Rules for administered price regime – limits duration of market exposure to a contingency
- UWSMP – limits basis risk spread but a also increases spread of the effect of a contingency

Firmness achieved by

- Revenue adequacy of FTR allocation
- (Possibly) obligation on ESB Networks for outages through Performance Based Regulation and TUoS
- Uplift payment in energy market

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# How are FTRs Acquired?

Grandparenting: Allocation to “make good” any major impacts of change in trading arrangements – possible circumstances

- Extinguishing of physical transmission rights
- Supporting vesting any contracts
- But note:
  - FTRs confer both an asset and liability
  - Someone is disadvantaged by handouts of FTRs

Residual Capacity:

- Regular auctions of unallocated FTR capacity

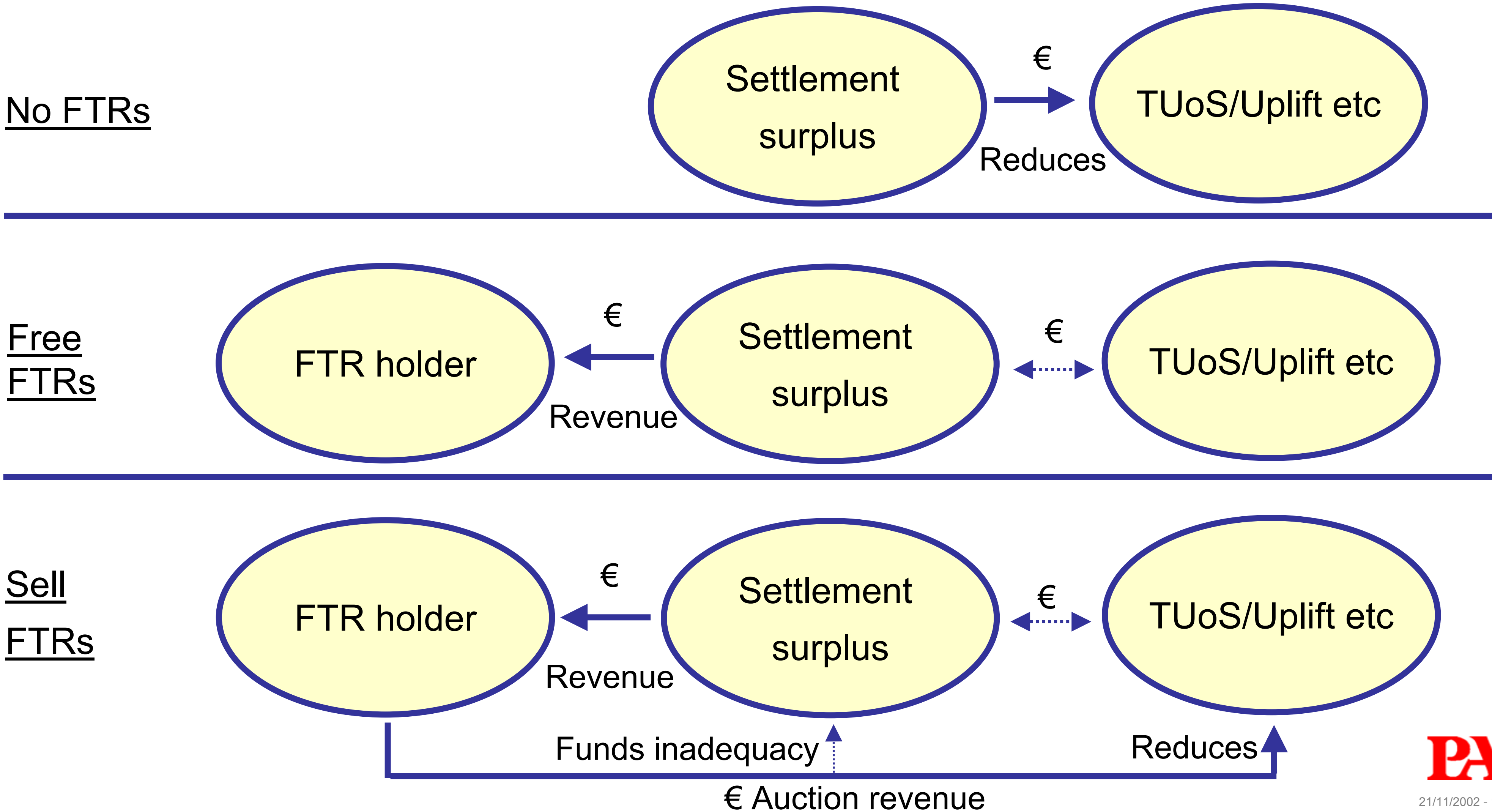
Secondary trading:

- Trading in SMO run residual capacity auctions
- Bilateral trading among licensed participants

Imposed:

- Control of locational market power

# Allocation of settlement surplus



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# Auction Design

Quarterly auction for 4 quarters in advance – rolling horizon

Multi-round auction

- Similar in concept to pre-dispatch energy markets
- Used for ensuring liquidity and competitive pricing
- Suggested up to 5 rounds daily for 1 week

Buying and selling (previously allocated) FTRs based on offers

Fundamental FTR instrument: loss adjusted FTR

Auction price is a “market clearing price” based on maximising auction revenue value

(Possibly prices subject to auction reserve price)

Allocation constrained to be feasible by DC load-flow transmission network

FTR prices set by FTR auction nodal prices using formula:

*(Price x quantity at withdrawal node) - (Price x quantity at injection node)*

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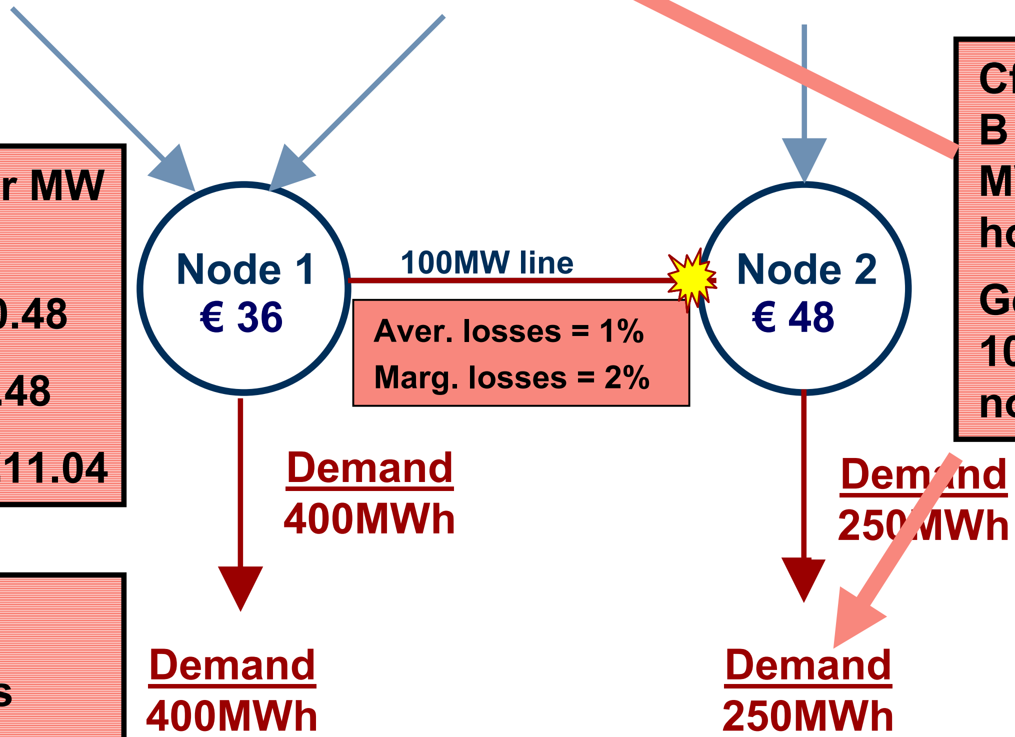
# EXAMPLE: *Two Node Transmission System – Quadratic losses and congested line*

**Generator A**
Capacity:300MWh at € 30
Generation: 300MWh

**Generator B**
Capacity:300MWh at € 36
Generation: 200MWh

**Generator C**
Capacity:500MWh at € 480
Generation: 151MWh




CfD between Generator B and Load 2 for 250 MW at € 40 / MW per hour at node 2

Gen B has an FTR for 100 MW from node 1 to node 2

Nodal price difference per MW = € 12

Cost of loss per MW = € 0.48

Loss rental per MW = € 0.48

Congestion rent / MW = €11.04

Settlement surplus =

((400*36)+(250*48)) minus

((500*36)+(151*48))= € 1152

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# Settlement of Dispatch, CfD and FTR (Balanced FTR)

| | Quantity (MW) | Price (€ /MW) per hour | Generator B Revenue (€) | Load 2 Revenue (€) |
|---|---|---|---|---|
| Gen B Dispatch | 200 | € 36 | € 7200 | |
| Load 2 Dispatch | - 250 | € 48 | | - € 12000 |
| Gen B CfD | 250 | € 40 - € 48 | - € 2000 | |
| Load 2 CfD | 250 | € 48 - € 40 | | € 2000 |
| Gen B FTR | 100 | € 48 - € 36 | € 1200 | |
| Total | | | € 6400 | - € 10000 |

Note: the FTR is revenue inadequate: SS = € 1152, FTR = € 1200

## Settlement of Dispatch, CfD and FTR (Unbalanced FTR)

| | Quantity (MW) | Price (€ /MW) per hour | Generator B Revenue (€) | Load 2 Revenue (€) |
|---|---|---|---|---|
| Gen B Dispatch | 200 | € 36 | € 7200 | |
| Load 2 Dispatch | - 250 | € 48 | | - € 12000 |
| Gen B CfD | 250 | € 40 - € 48 | - € 2000 | |
| Load 2 CfD | 250 | € 48 - € 40 | | € 2000 |
| Gen B FTR: (100) at node 1 and (99) at node 2 | 100 inj.<br>99 with. | Return =<br>(€48*99)– (€36*100) | € 1152 | |
| Total | | | € 6352 | € 10000 |

Note: the FTR is revenue adequate: S.S. = € 1152, FTR = € 1152

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# AGENDA

## Alasdair Turner and John George, PA Consulting

Welcome and introduction

FTR paper overview

Co-optimised reserves

Modelled scenarios

Project organisation & progress

# Agenda

Why co-optimise energy and reserve?

What classes of reserve can be co-optimised?

What is the price for reserve?

How should the offer price for reserves be set?

What is a reserve provider paid for?

How much is the price for reserve likely to be?

Who pays for reserve?

# Why co-optimise energy and reserves?

Co-optimising energy and reserve ensures that:

- Generators offer reserves where they are able to do so
- Demand offers interruptible load where they can do so
- The lowest total cost of providing energy and reserve is achieved
- The correct (marginal) prices for energy and reserve are found, so that generators are
  - neither out of pocket for providing reserves
  - nor make profits at the expense of others

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# Which classes of reserve can be co-optimised?

In theory all reserve classes can be co-optimised as is the case in other countries.

In Ireland it is proposed to co-optimise:

- Load following reserve
- All classes of operating reserve

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# What is the price for reserve?

The (marginal) price for reserve is

- The cost of an extra unit of reserve

which is

- The opportunity cost of backing off a generation unit to provide that reserve plus its offer to provide that reserve

Just as in the energy market most providers are infra-marginal, the marginal price paid represents more than their offer and opportunity cost.

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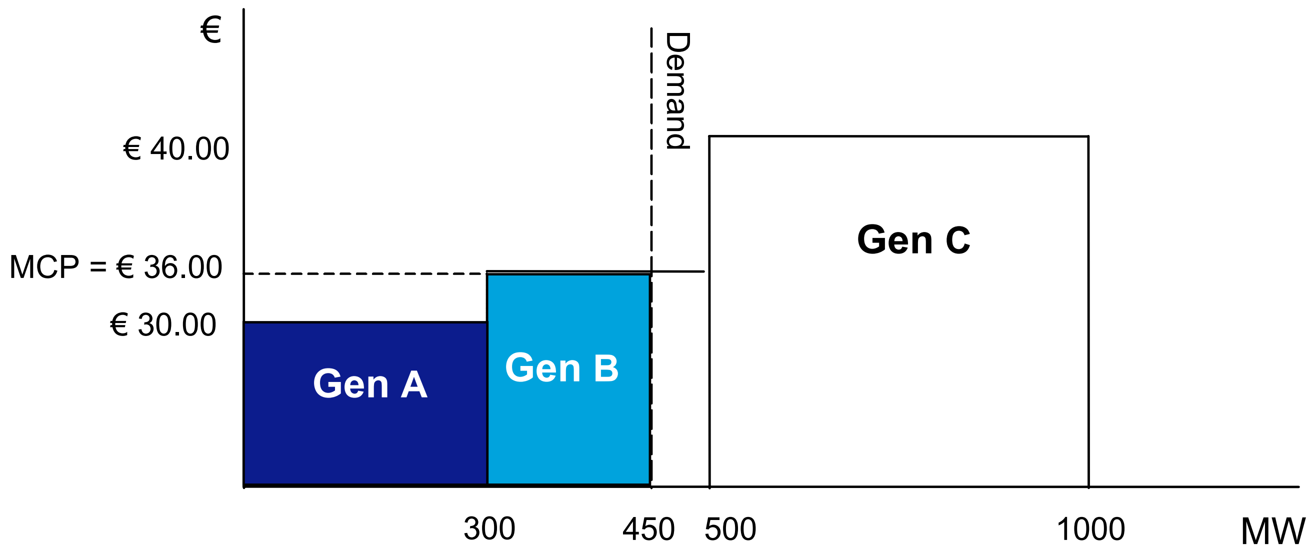
# How is the price for reserves calculated?

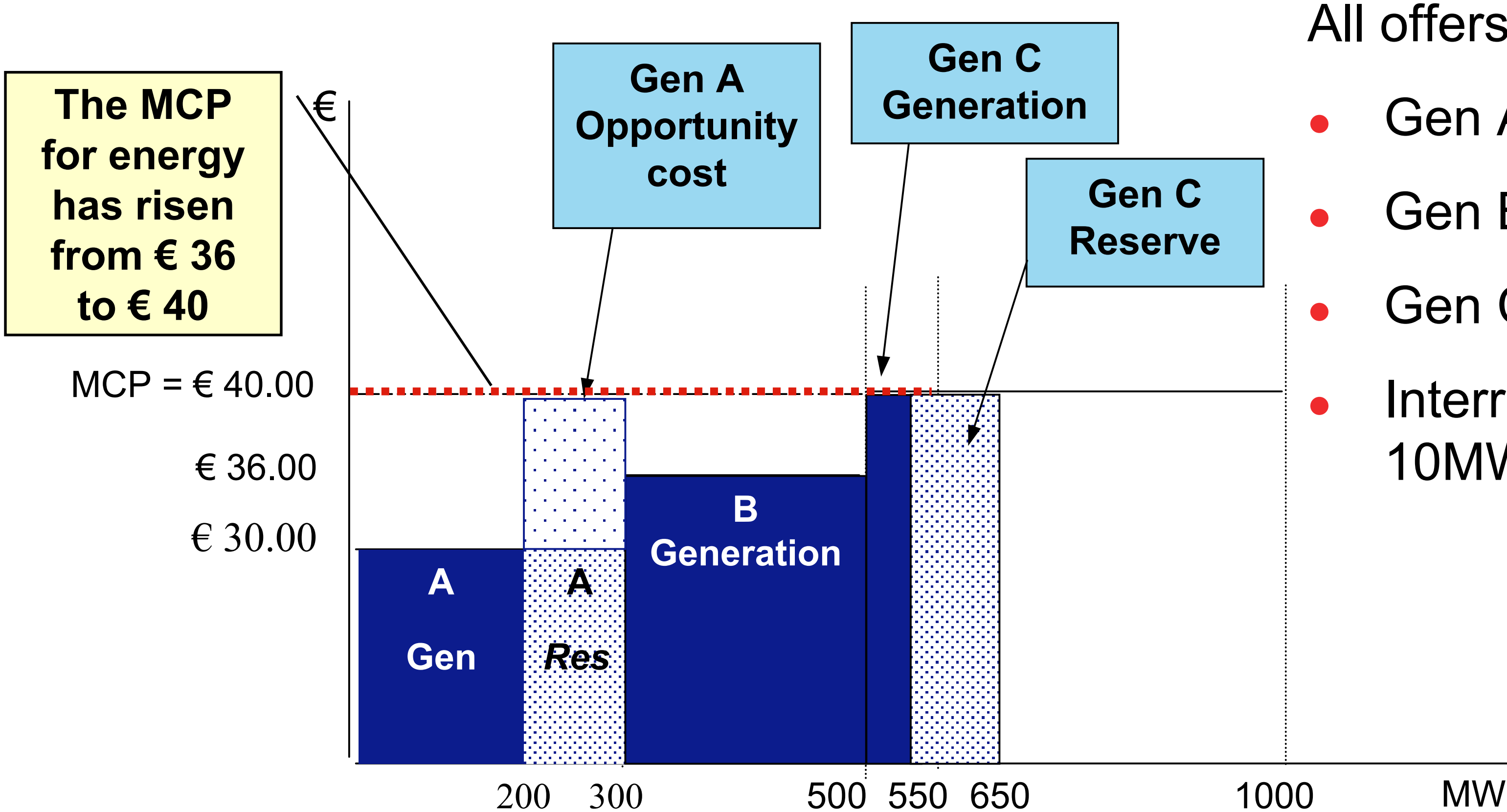
First assume that no reserves are required and there are three generation units

- Gen A offers 300 MW at €30/MWh for energy
- Gen B offers 200 MW at €36/MWh for energy
- Gen C offers 500 MW at €40/MWh for energy

The market clears with a demand of 450 MWh



# Reserves are now included and the reserve requirement is 210MW




All offers are 0 €/MW

- Gen A offers 150 MW
- Gen B offers none
- Gen C offers 100MW
- Interruptible load offers 10MW

The spot price for reserve is the sum of the marginal reserve unit's reserve market bid (€0/MW) and the same unit's opportunity cost of energy backed-off (€10/MW)

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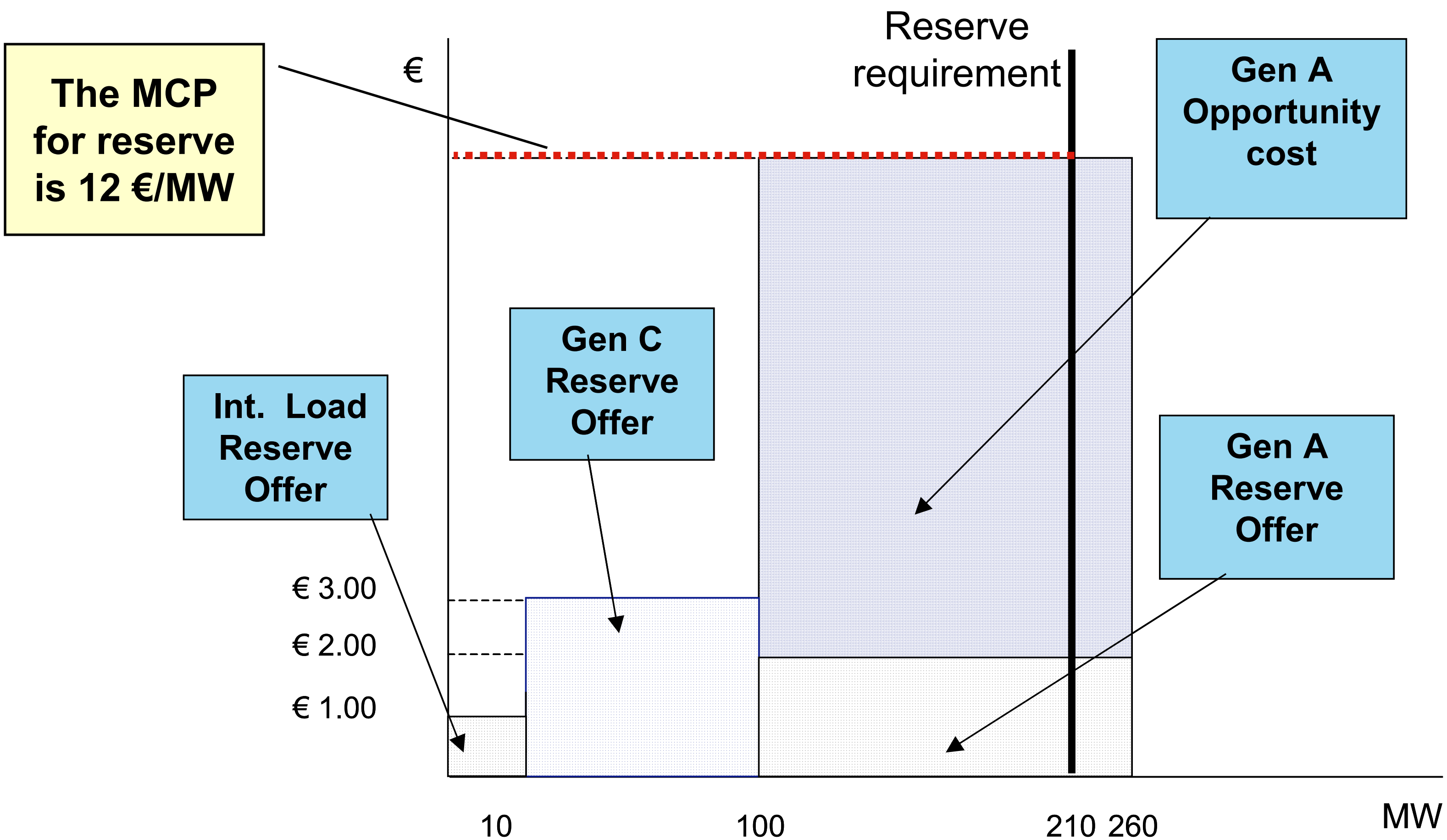
# Reserves are now offered at various prices

New offers for reserve are

- Interruptible load offers 10MW at €1.00/MW
- Gen A offers 150 MW at €2.00/MW
- Gen B offers no reserve
- Gen C offers 100 MW at €3.00/MW

The market clears with a demand of 450 MWh and a reserve requirement of 210MW

# Now the co-optimised reserve market clears at ...




The spot price for reserve is the sum of the marginal reserve unit's reserve market bid and the same unit's opportunity cost of energy backed-off.

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**Although there are many permutations, in all cases the Market Clearing Engine is attempting to find the lowest total cost of providing all the required products.**

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# How should I set my offer price for reserves?

The offer price for reserves might include:

- The variable operating costs associated with providing reserves (generation units)
- The averaged expected cost of lost production due to the load being interrupted (interruptible load)
- The averaged cost of any facilities required to allow reserves to be offered (both generation units and interruptible loads), particularly important for providers who expect to be on the margin

The offer price for reserves should **not** include:

- An estimate of the opportunity cost of being backed off generation when providing reserves, except if the energy offer price had a premium above SRMC to cover standing costs, etc.

# What is a reserve provider paid for?

Scheduled reserve providers are paid:

- In every period where no reserves are called on
  - The reserve price for each class of reserve for which they are scheduled multiplied by the MW quantity of reserve in each class which is scheduled
  - The energy price multiplied by the metered energy which they produce (will be close to that for which they were scheduled)
- In a period where reserves are called upon
  - The reserve price for each class of reserve for which they are scheduled multiplied by the MW quantity of reserve in each class which is scheduled
  - The energy price multiplied by the metered energy which they produce (will be that for which they were scheduled plus the additional energy produced from their scheduled reserves)

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# Reserve offer and price caps?

Just as in the energy market there will be an offer and price cap in the reserves markets, in the energy market the price cap is VoLL.

In the reserves markets the price cap will be lower than VoLL and is likely to be around three quarters of the energy VoLL cap.

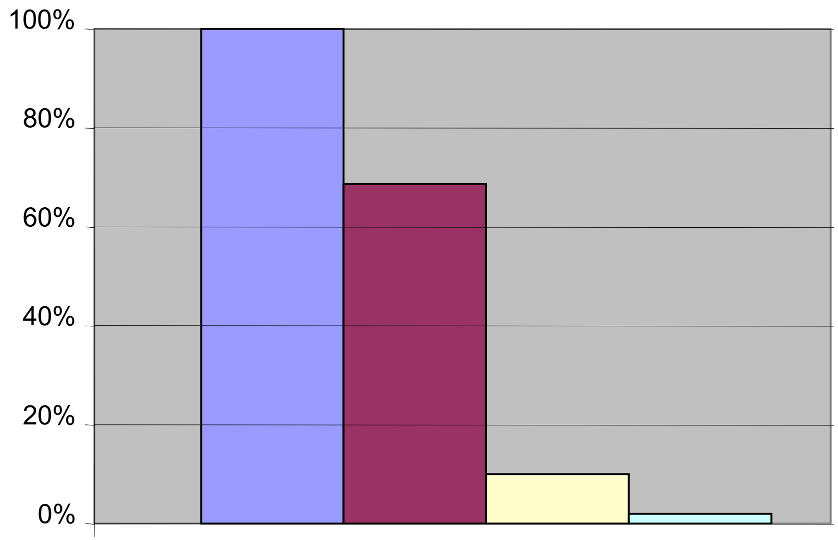
This ensures that in times of reserve shortage, if any, energy is served in preference to providing reserves.

Offer caps that may or may not be used in order to address market dominance mitigation are dealt with separately.

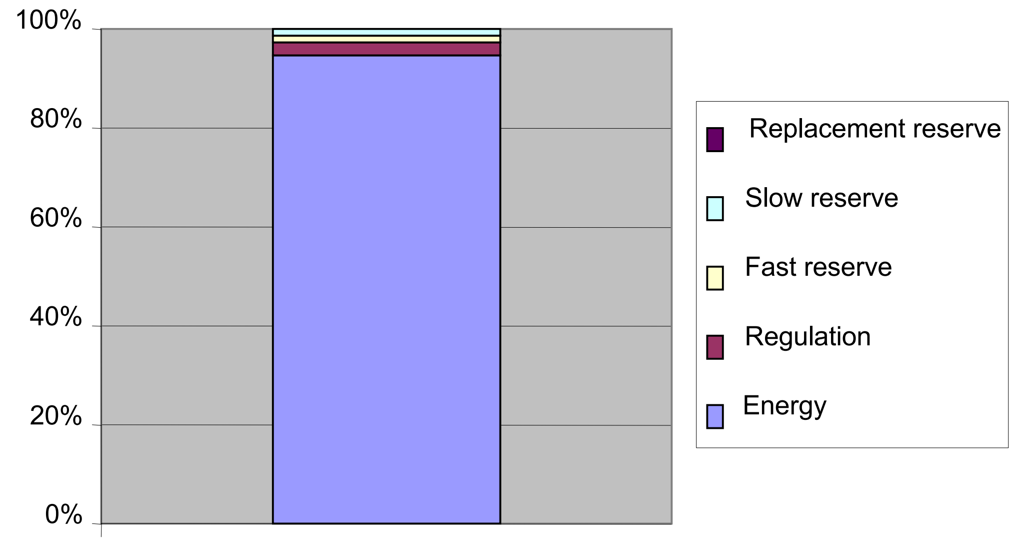
# How much are reserves prices likely to be?

## An example from Singapore

**Average price of each product as a % of energy price**




**Proportion of total costs by product**




Data is from the Singapore Electricity Market

# Who pays for reserves?

There are two possibilities:

- The *consumer* pays, because they pay in the end anyway and this prevents generators distorting their energy offers to include their reserve and regulation costs
- The *causer* pays, so that they get the correct price signals associated with their “behaviour”

The CER Consultation paper says that “the causer shall pay”

# Putting co-optimisation into practice in Ireland

At the beginning of MAE it is intended that co-optimisation will be functionally available.

However, at market start the SMO may still contract for reserves and use the co-optimisation facility to schedule the use of these contracts.

Eventually it is intended that market participants have the ability to offer their own reserves for co-optimisation.

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# AGENDA

## John George and Alasdair Turner, PA Consulting

Welcome and introduction

FTR paper overview

Co-optimised reserves

**Modelled scenarios**

Project organisation & progress

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# AGENDA

## Keelin O'Brien

- Welcome and introduction
- Co-optimised reserves
- FTR paper overview
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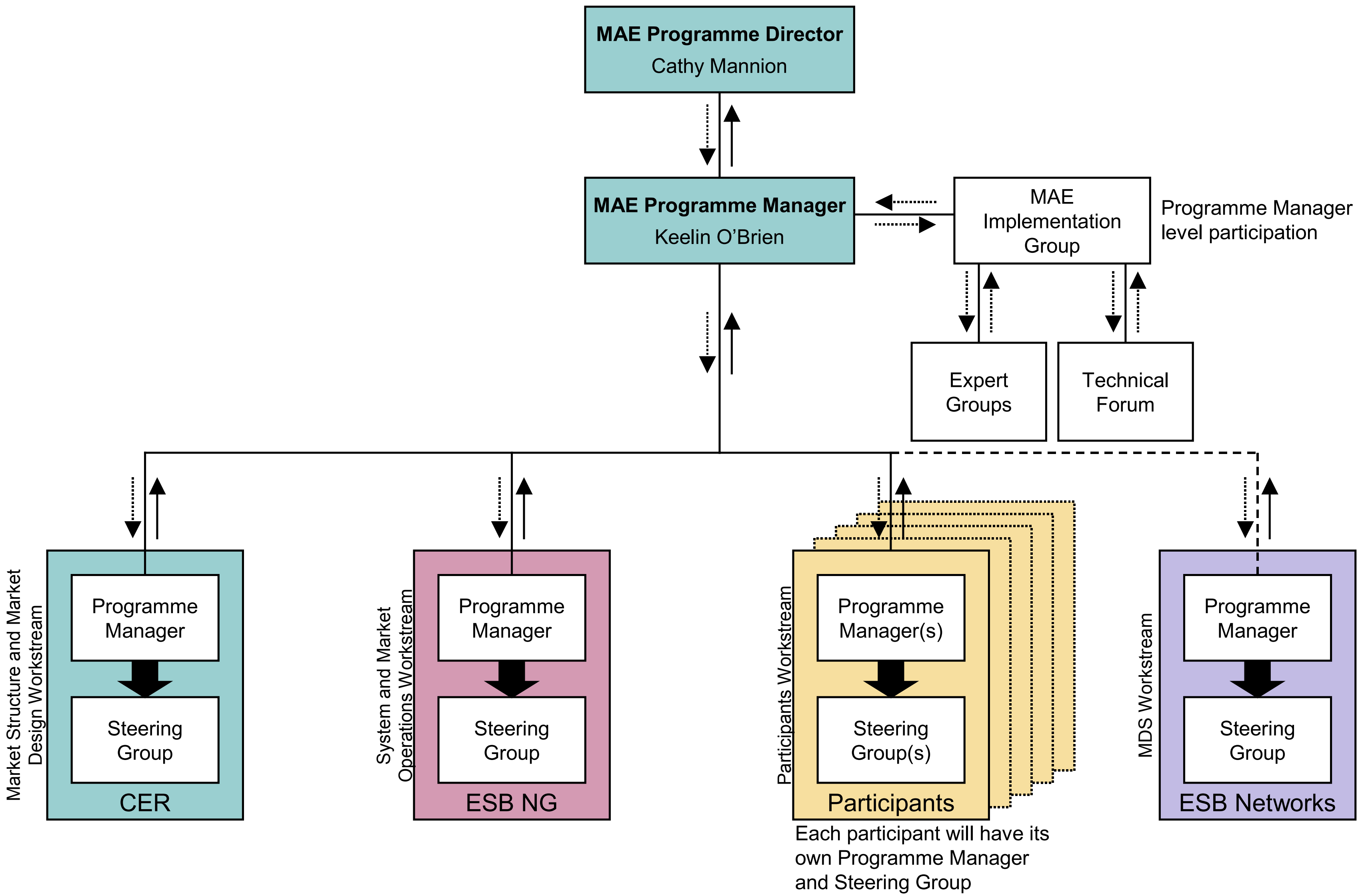
# MAE Implementation Programme

- MAE implementation by February 2006
- CER Responsible for Market Rules Decisions
- ESBNG responsible for Development of rules into code
- ESBNG purchasing systems to support MAE
- Participants systems will interface
- CER co-ordinating Implementation Programme to ensure all parties are working to same timeframe and participants will be ready when MAE opens

# Market implementation programme



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# Consultation process

The increasingly detailed and complicated issues that are involved lead CER to adopt a two-tiered consultation process.

Tier 1 – Expert Groups

- Smaller group of technical experts
- Aimed at resolving issues and ensuring best approach

Tier 2 – Public consultation

- Output from expert groups presented
- High-level summary
- Detail available to those that want it

# Expert Groups to Support Process

- Market Design Group
  - To advise and make recommendations on the detailed market rules
- Interconnector Trading
  - Technical Advice from specialist TSO/Regulator Group, will advise on rules for node selection, interconnector seams issues, reserves sharing
  - Trading expert group inlcudes suppliers trading across the interconnector
- Renewables / CHP
  - To examine issues specific to renewables and CHP
- Treatment of Reserves

The Chairperson of each expert group will be represented on the Inplementation group and will present an up-date at each meeting

# Detailed Market Design Consultation

- CER issued a detailed market design document which will be used as a basis for system specification. More details were provided on:
  - Operation of spot market
  - Pricing and Dispatch
  - Pre-dispatch projections
  - Outage Planning and Scheduling
  - Reserves and Other Ancillary Services
- Views were sought on four specific topics
  - Demand-side bidding / information/ reserves/ pumped storage
- Version 0.1 of the Market Rules being finalised
  - Other versions will incorporate the results of further consultations

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# Renewables Consultation

- Renewables / CHP / Embedded Generation Consultation Issued 10th October
- 18 responses received to renewables consultation paper
- Main Issues in Consultaton
  - Renewables dispatched on preset floor price – ensures priority dispatch
  - No floor price – may have to pay negative prices or turn down
  - Support mechanisms for renewables should be addressed outside of the market
- MAE provides many advantages for renewables
  - guaranteed market
  - No requirement for balanced schedules
  - Implicit Capacity Payment
- CER evaluating responses and these will be considered by renewables expert group

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# Interconnector Trading Principles

- Consultation issued 17th October
- Nine Responses Received
- No concensus on options for Trading across interconnector
  - Dispatch on price gives implicit capacity right
  - Further consideration needed on impact on long term capacity rights
- Further information requested
  - FTR allocation
  - Modelling needed to see impact on pricing
- Seams issues identified as very important (NI / Ireland and Moyle / NI)
- Technical Issues including Node selection, reserve sharing across border, and imbalances will be considered by the interconnector technical expert group

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# Future Consultations

CER will issue other papers on a range of topics:

- Further Consultations 2003:
  - Financial Transmission Rights (FTR) Consultation - 2nd December
  - Reserves FAQ – 28th November
  - Market Rules Version 0.1 – end December
- Consultations 2004 will include:
  - Market dominance plan
  - Fast build safety net option to address generation adequacy
  - Settlement Timetable
  - Security Cover / Liabilities
  - Other Governance Issues (MAE Rules V0.5)
  - Demand Side Participation

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# ESBNG Initial Programme Milestones

| Activity | Draft Milestone |
|---|---|
| Rules Team Mobilised | Mid February 2004 |
| PM / SI Team Mobilised | Mid February 2004 |
| Product and Infrastructure RFI's Issued | Mid March 2004 |
| Baseline Market Rules | Mid May 2004 |
| CER Approve Baseline Rules | Mid June 2004 |
| Draft Functional and Technical Specifications | Mid May 2004 |
| Baseline Specifications | End June 2004 |
| RFP's for Products Issued | Mid July 2004 |
| Vendor Proposals Recieved | End Aug 2004 |
| Vendor Contracts Awarded | October / November 2004 |

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# Estimated Timeframe for Activities

| Activity | Estimated Duration |
|---|---|
| System Configuration | 7 Months |
| On-site Product Test | 2 Months |
| On-site Integration Testing | 2 Months |
| Industry / Market Trial | 3 Months |
| Certification and Cutover | 1 to 2 Months |
| Go Live | ? |