The East West Interconnector and Moyle Interconnector Customer Conference will discuss commercial and operational aspects in relation to the interconnectors.
<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:30</td>
<td>Registration &amp; Coffee</td>
<td></td>
</tr>
<tr>
<td>10:00</td>
<td>Welcome</td>
<td>Peter Lantry (EIDAC)</td>
</tr>
<tr>
<td>10:10</td>
<td>EWIC and Moyle Commercial Overview</td>
<td>Fergal McParland (EIDAC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paul McGuckin (Mutual Energy)</td>
</tr>
<tr>
<td>10:40</td>
<td>EWIC and Moyle Operational Update</td>
<td>Philip Jordan (EIDAC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stephen Hemphill (Mutual Energy)</td>
</tr>
<tr>
<td>11:00</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>11:30</td>
<td>European Codes Development</td>
<td>Mark Lane (EirGrid)</td>
</tr>
<tr>
<td>11:50</td>
<td>I-SEM Update</td>
<td>Mark Needham (I-SEM)</td>
</tr>
<tr>
<td>12:10</td>
<td>Celtic Interconnector</td>
<td>Gary Nolan (Celtic)</td>
</tr>
<tr>
<td>12:30</td>
<td>Questions / Discussion</td>
<td></td>
</tr>
<tr>
<td>13:00</td>
<td>Lunch</td>
<td></td>
</tr>
</tbody>
</table>
Introduction

- Interconnection is fundamental to the delivery of EU energy and climate objectives

- 5 Key benefits:
  - Market Integration
  - Security of Supply
  - Climate and Environmental
  - European integration
  - Competitiveness and Innovation

- Moyle & EWIC deliver against these benefits

- Celtic will deliver similar benefits on delivery

Sample regional wholesale electricity prices Q1 2018 (EU Market Report)
East West Interconnector Commercial

November 2018
EWIC has been commercially operational with unrestricted power flows since 1st May 2013.

EWIC offers capacity products to customers and ancillary services to EirGrid and National Grid.
Interconnector Operators & I-SEM

ICO’s sell Financial Transmission Rights (FTR) in the forwards market

Interconnectors participate in the I-SEM Capacity Market

FTR Payout is based on loss-adjusted price spreads daily

Congestion revenue is received by providing capacity daily into the energy markets
JAO: I-SEM Forwards Market

JAO Auctions

- JAO now operates the Single Allocation Platform (SAP) in accordance with Article 49(1) of the FCA Regulation
- EWIC & Moyle offer FTR’s to customers through the JAO E-CAT Platform
- Register for auctions on JAO:

http://www.jao.eu/support/resourcecenter/overview
EWIC: FTR Auctions

- Large capacity mix offered to auction on JAO by EWIC & Moyle in line with FCA objectives

- Forthcoming consultation on Long Term Capacity Calculation and Splitting (Dec 2018)

Capacity Auctions per Product

- Annual Calendar
- Annual SEM
- Seasonal
- Quarterly
- Monthly
EWIC: FTR Auction Prices (GB:IE)
EWIC: FTR Auction Prices (IE:GB)
EWIC: Interconnector Flows (Oct 17 v Oct 18)

I-SEM

MW

SEM

MW

<table>
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<tr>
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</thead>
<tbody>
<tr>
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<td>09/10/2017</td>
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<td>22:30</td>
<td>12/10/2017</td>
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<td>30/10/2017</td>
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<tr>
<td>23:00</td>
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<td>23:00</td>
<td>08/10/2018</td>
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</tr>
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<td>23:00</td>
<td>16/10/2018</td>
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<tr>
<td>23:00</td>
<td>20/10/2018</td>
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<td>23:00</td>
<td>24/10/2018</td>
</tr>
<tr>
<td>23:00</td>
<td>28/10/2018</td>
</tr>
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</table>

EIRGRID
East West Interconnector
EWIC – Sample daily flow & price spread

Interconnector Flow

DAM-IE Price
DAM-GB Price
REMIT Reporting

- Market participants required to complete REMIT disclosure practice and compliance with regulation (EU) No 1227/2011

- EIDAC has been using the ENTSO-E Transparency platform as an interim disclosure process

- Third party Urgent Market Messaging (UMM) platforms referred to by ACER in their guidance now being proactively assessed for use

- Customers should link to the selected platforms RSS feed when the platform is selected.
Last year

<table>
<thead>
<tr>
<th>Item</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Interconnector Forum</td>
<td>Submission</td>
<td>Approval</td>
</tr>
<tr>
<td>Trial / Training / Testing</td>
<td>Plan</td>
<td>Initial test</td>
</tr>
<tr>
<td>Year Ahead Interconnector Capacity</td>
<td>Published</td>
<td>Main</td>
</tr>
<tr>
<td>FTR trading information update</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTR Auction – Live on JAO &amp; Auctions</td>
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<td></td>
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<tr>
<td>Interim cross-zonal arrangements</td>
<td>Approval</td>
<td></td>
</tr>
<tr>
<td>SEM-GB Day Ahead</td>
<td>Framework Agreement</td>
<td>Approval</td>
</tr>
<tr>
<td>SEM-GB Intraday</td>
<td>Framework Agreement</td>
<td>Approval</td>
</tr>
<tr>
<td>I-SEM Market Trial / FTR information</td>
<td></td>
<td></td>
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Key: RA; ICO; TSO
## Last year

### Table

<table>
<thead>
<tr>
<th>Item</th>
<th>2017</th>
<th>2018</th>
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</thead>
<tbody>
<tr>
<td>HAR, annex, SAP, RD-LTTR</td>
<td>Submission</td>
<td>Approval</td>
</tr>
<tr>
<td>Annual Interconnector Forum</td>
<td></td>
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<tr>
<td>I-SEM Market Trial / FTR information</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Key
- RA; ICO; TSO

### Diagram

- Green check marks indicate completion.
- Red triangles indicate milestones.
- Blue arrows indicate the flow of events.

---

**mutual energy**

---

**moyle interconnector**
Pre go-live auctions

- Full capacity of interconnector allocated
- 6 auctions in 6 weeks (plus same again for EWIC)
Auctions out-turn

Import (GB -> NI)

- SEM Annual
- Calendar Annual
- Seasonal
- Quarterly
- Monthly
- Weighted Average

€ 4.50
€ 4.00
€ 3.50
€ 3.00
€ 2.50
€ 2.00
€ 1.50
€ 1.00
€ 0.50
€ -

Auctions out-turn
Auctions out-turn (Oct)
Auctions out-turn (Oct)

Export (NI -> GB)

- Monthly Average
- Weighted Average Price
- 3-Day Rolling Average

[Graph showing energy prices over time]
Auctions out-turn (Nov)
Auctions out-turn (Nov)

Export (NI → GB)

- Monthly Average
- Weighted Average Price
- 3-Day Rolling Average

Dates: 01/11/2018 to 30/11/2018

Price range: €18.00 to €€
Physical flows – Nov 17 v 18
### National Grid Transmission Entry Capacity “TEC” offer

<table>
<thead>
<tr>
<th>Date</th>
<th>TEC not subject to restrictions - MW</th>
<th>Additional TEC subject to limitations (reduces as forecast wind production rises with forecast wind levels) - MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/11/17</td>
<td>80</td>
<td>420</td>
</tr>
<tr>
<td>01/12/19</td>
<td>307</td>
<td>193</td>
</tr>
<tr>
<td>01/06/20</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>01/04/22</td>
<td>500</td>
<td>0</td>
</tr>
</tbody>
</table>

- Commercially firm capacity not available all the time
- Calculated and released on a short term basis
- Based on an estimate of the capacity not used by windfarms

**Date**

01/11/17
01/12/19
01/06/20
01/04/22

**TEC**

80
307
250
500

**Additional TEC**

420
193
250
0
D-2 capacity release

Moyle Capacity Release (West to East)

MW

21/12/2017 21/01/2018 21/02/2018 21/03/2018 21/04/2018 21/05/2018 21/06/2018 21/07/2018 21/08/2018 21/09/2018 21/10/2018

'Firm' TEC (NG) (MW) Additional capacity released (MW) Capacity available (SONI) (MW) Average total capacity released to date (MW)
Future/current issues

• Day ahead capacity calculation at both sides

• GB Capacity Market

• Long term capacity calculation and splitting

• Brexit
Contents

• Overview of the EWIC Assets
• Availability Performance
• EPC Warranty Arrangements
• Maintenance & Repair Performance
• Year Ahead
Overview of the EWIC Assets

Portan Converter Station

Shotton Converter Station

Cable Facility

- Land Cable
- Marine Cable
Improvements to the EWIC Assets

Capital Investments
- Advanced IT Servers Upgrade
- Cyber Security Improvements
- Procured Additional Strategic Spares
- Comprehensive Marine Surveys
- Advanced Cable ‘Fingerprinting’
## Availability Performance

### Reliability & Availability

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
<th>Forced Outages</th>
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</thead>
<tbody>
<tr>
<td>2014</td>
<td>97 %</td>
<td>(7)*</td>
</tr>
<tr>
<td>2015</td>
<td>98 %</td>
<td>(6)*</td>
</tr>
<tr>
<td>2016</td>
<td>76 %</td>
<td>(2)* (Major Fault)</td>
</tr>
<tr>
<td>2017</td>
<td>96%</td>
<td>(1)*</td>
</tr>
<tr>
<td>2018</td>
<td>89%</td>
<td>(2)*</td>
</tr>
<tr>
<td>2019</td>
<td>97 %</td>
<td>(Forecast)</td>
</tr>
</tbody>
</table>

* No. of forced outages

*Picture: HVDC Valve Hall*
EPC Warranty Arrangements

- **EPC Contract with ABB**
  - Full warranty cover of 6.5 years expires in January 2020 (extending to ‘22)
  - Reliability and Availability period (target 98%)
  - Allowed 1% (84 hrs.) forced outages and (1%) for annual maintenance

- **Maintenance & Repair (M&R) Contract**
  - ABB Ireland employed as M&R Contractor (Parent Company Guar.)
  - Initial term of 5 years (2013-2018), recently renewed – 2023
  - Services include 24/7 monitoring of alarms and 1 hr. response to site
ABB Maintenance/Repair Performance (Cont’d)

- ABB M&R Performance during the past 5 years
  - Excellent emergency response times to site, averaging 1 hour from receipt of alarm; (2hrs in Contract) [4-5 call outs per month]
  - Fault finding capabilities reduce the reliability on remote fault finding (Sweden) reducing downtime
  - Delivered on Major projects, such Connahs Quay Cable Relocation and have performed very well during major repairs

Zero Safety Incidents or accidents in 5 years of operations
Plant Performance

- **ABB Plant Performance** during the past 5 years

  - Traditional Plant, Power Transformers & Cables Very Reliable
  - Issues primarily associated with the Valve Hall (Cooling Systems & Micro Electronic Boards)
  - These are typical across the industry with HVDC VSC schemes
  - Additional Spares now held on site to mitigate outage durations
  - Constant updating of IT Security (Firewalls etc.) required
Resolution of Technical Faults (Example)

- 2016 and 2018 Repairs (IGBT)
Resolution of Technical Faults

- Each Converter has 2,500 IGBT’s
Resolution of Technical Faults

- Each Converter has 2,500 IGBT’s
Resolution of Technical Faults

- Each Converter has **2,500** IGBT’s
- Each IGBT has in excess of **100** components
Resolution of Technical Faults

- Each Converter has **2,500** IGBT’s
- Each IGBT has in excess of **100** components
- Total of **25,000** components
Resolution of Technical Faults

- Each Converter has **2,500** IGBT’s
- Each IGBT has in excess of **100** components
- Total of **25,000** components
- All Switching 25 times per second
- Perfectly in synch
- At **70** degrees Celsius (ambient!)
- With 400,000 Volts flowing through constantly
- Being force cooled by 20,000 litres of high pressure Glycol
- While riding through external faults on the system
- **Operating 358 days, 24 hours per day.**
- But there is redundancy built in!. 
Year Ahead

- Finalise Warranty Negotiations with ABB Sweden
- Further Enhancements to Cyber Security Infrastructure
- Technical Workshops to further improve repair times
- IGBT performance monitoring – further investigations with the supplier to improve reliability
- Implement the necessary control system changes to provide additional DS3 services to the TSO
- Undertake a Marine Survey to ensure the integrity of the Marine Cable
Interconnector Users Forum

Dublin

21st November 2018

Stephen Hemphill
MEL Operations Director

Moyle Operational Update

- Recap – the physical asset
- What we envisaged 17/18
- What we actually did 17/18
- Availability results
- Operational priorities 18/19
The physical asset

ELEMENTS of the MOYLE INTERCONNECTOR

Co.Antrim
Larne
Belfast
North Channel

Ayrshire
Ayr
Coylton Substation

Kintyre
Arran

Undersea Cable Routes
Overhead Line Route
Auchencrosh Converter Station
Underground Cable Route

Ballycronan More Converter Station
Currie Port
Portmuck

A Northern Ireland company working for consumers
## Key characteristics of Moyle

<table>
<thead>
<tr>
<th>Positives</th>
<th>Negatives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Convertor Technology (LCC vs VSC)</strong></td>
<td></td>
</tr>
<tr>
<td>Less losses</td>
<td>(1) No black start capability</td>
</tr>
<tr>
<td></td>
<td>(2) More vulnerable to ac disturbance</td>
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</tr>
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<td><strong>Dual monopole (2 x 250MW vs 1 x 500MW)</strong></td>
<td>(1) More cables&lt;br&gt;(2) More complicated to operate</td>
</tr>
<tr>
<td>Higher availability</td>
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</tbody>
</table>
Dual Monopole HVDC 2 x 250MW

A Northern Ireland company working for consumers
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</tr>
<tr>
<td><strong>AC System Connection</strong></td>
<td></td>
</tr>
<tr>
<td>Robust location on NI grid…</td>
<td>(1) … but size still leads to constraint</td>
</tr>
<tr>
<td></td>
<td>(2) Scotland single circuit</td>
</tr>
</tbody>
</table>
Grid Connections NI & Scotland

A Northern Ireland company working for consumers
## Key characteristics of Moyle

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<tr>
<td>Robust location on NI grid…</td>
<td>(2) Scotland single circuit</td>
</tr>
<tr>
<td><strong>Asset Maturity &amp; Obsolescence</strong></td>
<td></td>
</tr>
<tr>
<td>(1) Operational confidence</td>
<td>(1) Increasing effort to maintain high levels availability</td>
</tr>
<tr>
<td>(2) Opportunity to refurbish control system and incorporate enhancement</td>
<td>(2) Costs and risk of refurbishment project</td>
</tr>
</tbody>
</table>
Our Forecast Operational Priorities 17/18 (3rd May 2017)

• Cables
  – Two campaign submarine cable repair
  – First end-to-end survey of all four cables now due in 2018

• Convertor stations
  – Integration of new cable system into control system
  – Control system replacement & obsolescence planning

• Changing commercial use of Moyle
  – Directions of flow – we now have two system operators keen to know that we are reliable
  – Value of ancillary services
  – Interconnected system – Moyle reacts to IFA incident
  – New SEM trading arrangements i-SEM due 2018
  – Maximising what headroom on SPT system will be made available through the capacity calculation

• General
  – New staff
What actually did 17/18

- **Cables**
  - Timely completion of cable repair at minimal impact on CAIRt
What we actually did 17/18

• Cables
  – Timely completion of cable repair at minimal impact on CAIRt
  – Good result from procurement of submarine survey, including use of Pangeo, and successful delivery of same by DOF
What we actually did 17/18

• Cables
  – Timely completion of cable repair at minimal impact on CAIRt
  – Good result from procurement of submarine survey, including use of Pangeo, and successful delivery of same by DOF

• Convertor stations – Business as Usual
  – Tightened up change control process to ensure C&P settings, such as those required for new cables, implemented in a seamless manner
  – Demonstrating compliance to NGT notably control system behaviour against reducing fault levels in Scotland
  – DS3 & i-SEM : Availability & Reliability
System Service - Static

7/7/2015 14:52

A Northern Ireland company working for consumers
System Service - Dynamic

5/6/2016 07:01

A Northern Ireland company working for consumers
What we actually did 17/18

• Cables
  – Timely completion of cable repair at minimal impact on CAIRt
  – Good result from procurement of submarine survey, including use of Pangeo, and successful delivery of same by DOF

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  – DS3 & i-SEM : Availability & Reliability
  – Maximising TEC – NGT calculation to release headroom when available
A Northern Ireland company working for consumers

Maximising TEC Scotland
Increased levels of TEC against contracted position, plus the ability to flow above this where conditions allow

<table>
<thead>
<tr>
<th>Dates</th>
<th>Contracted</th>
<th>TEC</th>
<th>CACM</th>
<th>Solution</th>
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<tr>
<td>Up to 2017</td>
<td>~295</td>
<td>~295</td>
<td>~295</td>
<td>~295</td>
</tr>
<tr>
<td>Nov 2017</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>500 (80)</td>
</tr>
<tr>
<td>Dec 2019</td>
<td>80</td>
<td>307</td>
<td>500 (307)</td>
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<td>Jun 2020</td>
<td>80</td>
<td>250</td>
<td>500 (250)</td>
<td>500 (250)</td>
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<tr>
<td>Nov 2021</td>
<td>80</td>
<td>160</td>
<td>500 (160)</td>
<td>500 (160)</td>
</tr>
<tr>
<td>Apr 2022</td>
<td>80</td>
<td>500</td>
<td>500 (500)</td>
<td>500 (500)</td>
</tr>
<tr>
<td>Beyond 2022</td>
<td>80</td>
<td>500</td>
<td>500 (500)</td>
<td>500 (500)</td>
</tr>
</tbody>
</table>
Maximising TEC Northern Ireland

Since 17 December 2017, Moyle capacity west to east has been constrained by:

- 39% NG
- 61% SONI
- 0% both

A Northern Ireland company working for consumers
What we actually did 17/18

• Cables
  – Timely completion of cable repair at minimal impact on CAIRt
  – Good result from procurement of submarine survey, including use of Pangeo, and successful delivery of same by DOF

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  – Maximising TEC – NGT calculation to release headroom when available

• Control System Refurbishment Project
A Northern Ireland company working for consumers
What actually ended up keeping us busy 17/18

• Cables
  – Timely completion of cable repair at minimal impact on CAIRt
  – Good result from procurement of submarine survey, including use of Pangeo, and successful delivery of same by DOF

• Convertor stations – Business as Usual
  – Tightened up change control process to ensure C&P settings, such as those required for new cables, implemented in a seamless manner
  – Demonstrating compliance to NGT notably control system behaviour against reducing fault levels in Scotland
  – DS3 & i-SEM : Availability & Reliability
  – Maximising TEC – NGT calculation to release headroom when available

• Control System Refurbishment Project
  – Procured client side technical advisers Q1 2018
  – Engaged OEM in a FEED Study Q4 2018
What actually ended up keeping us busy 17/18

- **Cables**
  - Timely completion of cable repair at minimal impact on CAIRt
  - Good result from procurement of submarine survey, including use of Pangeo, and successful delivery of same by DOF
- **Convertor stations – Business as Usual**
  - Tightened up change control process to ensure C&P settings, such as those required for new cables, implemented in a seamless manner
  - Demonstrating compliance to NGT notably control system behaviour against reducing fault levels in Scotland
  - DS3 & i-SEM : Availability & Reliability
  - Maximising TEC – NGT calculation to release headroom when available
- **Control System Refurbishment Project**
  - Procured client side technical advisers Q1 2018
  - Engaged OEM in a FEED Study Q4 2018
- **New members operational team & building the wider project team**
A Northern Ireland company working for consumers

Availability Results

1. Pole 1 back after cable fault
2. Pole 2 trip UPS issue 4hr9m
3. Pole 2 trip in preparation for scheduled outage 19min
4. Pole 2 replace thyristor 2hr45m
5. Pole 1 planned repair control system fault 4hr56m
6. Pole 2 trip faulty sensor 24min
7. Pole 2 trip faulty sensor 11hr27m
8. Pole 2 operator issue 2hr 57m
9. Pole 2 planned 48hr annual outage
10. Pole 2 trip UPS issue 1hr27m
11. Pole 1 trip activation of fire protection system 5h32m

Forced outage: 26hr 15m
Scheduled outage: 55hr 41m
Total: 81hr 56m

99.5%
Operational Priorities 2018/19

• Cables
  – Potential marine campaign to rock dump elements of cable system with insufficient burial based upon risk analysis of the 2018 survey data
  – Utilisation of distributed temperature sensing for ongoing condition monitoring of cable system

• Convertor stations
  – Strive to maintain high levels of availability & reliability
  – Planning to maximise what we can get done in 9 day outage required by SPT for works in Scotland 12th June -20th June 2019

• Control System Refurbishment Project
  – Continue with refurbishment front end engineering design and finalise specification, costs and programme for delivery

• ISO55001
EWIC & Moyle Interconnectors Conference

European Codes Development

Mark Lane
All 8 Network Codes have entered into force

- Requirements for Generators to connect to the grid
- Demand Connection Code for connecting large RES as well as demand response facilities
- HVDC requirements for long distance direct current (DC) connections
- System Operations specifies what TSOs should do to manage and coordinate their grids
- Emergency & Restoration processes that TSOs must follow when they face an incident on the grid
- Capacity Allocation & Congestion Management for calculation & allocation in day-ahead/ intraday
- Forward Capacity Allocation for calculation & allocation before day-ahead for hedging purposes
- Electricity Balancing creating new platforms for sharing capacity for balancing purposes
Capacity Calculation

- CACM CCM approved & FCA CCM consultation starting in Dec ’18
- Capacity is by default Maximum Permanent Thermal Capacity of the HVDCs (except during planned outage on CNE)
- Takes top down approach. Other regions apply bottom up approach
- CEP advocating 75% target, EWIC and Moyle already surpass this
Forward Market

- Single Allocation Platform operational from Oct 2018. EWIC and Moyle already joined even though HVDC not required to do so until end 2019
- Harmonised Allocation Rules review every two years so next review expected before end 2019
- Ireland-UK Long Term Capacity Calculation and Splitting Methodologies for consultation in Dec 2018
Day- ahead Market

- I-SEM introduced market coupling on 1 Oct 2018, joining the SDAC
- Work in progress to finalise the DAOA
- Group established to work on single enduring Day-ahead and Intraday governance solution
- I-SEM go-live had little effect on PCR performance but issues looming
- PCR Multiple NEMO Arrangements expected end 2018
Intraday Market

- XBID went live on 12/13 June 2018
- I-SEM interim Intraday Auctions went live on 1 Oct 2018
- ACER decision on 24 Apr 2018 calls for harmonised Intraday GOT at 15.00 CET & GCT of 60 mins
- EC study on future Intraday market design due in Dec 2018
- ACER decision on Intraday Capacity Pricing in Jan 2019
Balancing Market

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<td>Q4</td>
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</tbody>
</table>

Key
Proposal | Deadline | Derogation

- RR IF EIF+6m
- RR IF EIF+2yrs
- mFRR IF EIF+1yr
- mFRR EU Platform EIF+4yrs
- TSO Join Derogation +2yrs
- TSO Join Derogation +2yrs

Each process has different specifications
Each process has different timing
Each process has different geographical scope

mFRR: MARI
RR: TERRE

Legal obligation to join the platform (additional TSOs may join the platforms)
Clean Energy Package

• 4th trilogue: 13 November
• 5th trilogue: 5 December
• Austrian Presidency’s objective is still to have political agreement for 19 December 2018 European Council
• Some issues being discussed include:
  • Definition of interconnector
  • Cross Border reservation of capacity for balancing
  • Intraday GCT – 60-15 mins,
  • Imbalance Settlement Period to 15 mins
  • Use of congestion income
  • Capacity Mechanisms
ENTSO-E Network Code APP

And all this information available in your pocket? ENTSO-E App

The app can be downloaded from the App Store and from Google Play.

Available for iOS and Android...
I-SEM Overview

Mark Needham
I-SEM
I-SEM Market Timeframes

Forwards
- Forwards Market (From years in advance up to 12:00 CET day-ahead)

Day Ahead
- Gate Closure At 12:00 Noon CET day-ahead for trading day from midnight 00:00 CET to following midnight 00:00 CET

Intraday
- Continuous trading from day-ahead market clearance to 1hr before real-time

Balancing and Dispatch
- From 1hr before real-time to real-time

Imbalance
- Marginal price based on balancing or ex-post unconstrained market schedule
Ex-Ante Markets : 31 Days Our Highlights

• Market **STABLE** and performing

• Approx. €¼ BILLION Cleared through our EX-ANTE MARKETS

• Just over **3TWh** of Energy traded in October

• Our DAM auction is clearing **98%** of Suppliers’ demand requirements

• With Average price of **€72.44** ( GB neighbour avg price **€72.57** )

• As expected we are highly correlated with our Euphemia partners!

• Interconnectors are efficient
  – Importing when demand is high and exporting off the Island when excess energy available
Ex-Ante Markets

- Volumes from ex-ante auctions (1\textsuperscript{st} Oct – 31\textsuperscript{st} Oct)
  - DAM still dominant

<table>
<thead>
<tr>
<th>Market</th>
<th>Value</th>
<th>% of DAM</th>
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<tbody>
<tr>
<td>DAM</td>
<td>€228,120,058</td>
<td>4.70%</td>
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<tr>
<td>IDA1</td>
<td>€10,715,591</td>
<td>2.36%</td>
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<tr>
<td>IDA2</td>
<td>€5,377,678</td>
<td>0.56%</td>
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<td>IDA3</td>
<td>€1,273,174</td>
<td>0.55%</td>
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<tr>
<td>IDC</td>
<td>€1,243,887</td>
<td>0.55%</td>
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</table>

*Using approx. prices*
Forwards
• Forwards Market (From years in advance up to 12:00 CET day-ahead)

Day Ahead
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Balancing and Dispatch
• From 1hr before real-time to real-time

Imbalance
• Marginal price based on balancing or ex-post unconstrained market schedule
Balancing Market: 31 Days Our Highlights

• Market **performing and participation** is as planned

• **5 minute** and **30 minutes prices** being calculated as planned

**Today's Operational Indicators**

- Pricing: ✔
- Settlement: ⚠️
- Invoicing: ✔
- Funds Transfer: ✔
- CRM: ✔

• Working on **repricing**

• Resettlement
Thank you for listening....Any questions?
Celtic Interconnector

Connecting Ireland to Continental Europe

EWIC Conference Presentation 21/11/2018
Gary Nolan, Celtic Project Manager
Introduction

- EirGrid TSO Licence - “explore and develop opportunities to interconnect the transmission system with other systems”.
- Delivered East West Interconnector 2012.
- Celtic Interconnector – new direct energy link between Ireland and continental Europe.

Key Facts

- 575km
- 2
- 700 MW
- EU PCI
WHOLESALE BASELOAD ELECTRICITY PRICES
Second Quarter of 2018

Competition
Security of Supply
Telecoms

Source: Telegeography, Analysys Mason
Strategic Imperative

- Allows Ireland directly contribute to, and be part of, EU’s Energy Union.
- Reduces Ireland’s electrical isolation (below EC’s targets and thresholds for Interconnection).
  - Average yearly price difference > €2/MWh.
  - Interconnection capacity is < 30% of peak load.
  - Interconnection capacity is < 30% of installed renewable generation.
Project Roadmap

<table>
<thead>
<tr>
<th>Phase Description</th>
<th>Feasibility</th>
<th>Initial Design &amp; Pre-Consultation</th>
<th>Detailed Design &amp; Consents</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>EirGrid / RTE Project Work Streams</td>
<td>Marine survey</td>
<td>Initial Design Pre-Consultation Investment Request</td>
<td>Detailed Design EPC Procurement Consenting</td>
<td>Contract Award Manufacturing Energisation</td>
</tr>
<tr>
<td>Economic &amp; Financial Analysis</td>
<td>Initial Design Pre-Consultation</td>
<td>Detailed Design EPC Procurement</td>
<td>Detailed Design EPC Procurement Consenting</td>
<td>Construction</td>
</tr>
</tbody>
</table>

**Key Milestones**

- Early 2020 – Launch EPC Tender
- Mid 2020 – Submit Consents Applications
- End 2021 – Final Investment Decision
- 2026 – Go Live
Investment Request

Following TEN-E Regulation:

• Investment Request submitted to the Irish and French National Regulatory Authorities (NRAs) in September.

• NRAs have 6 months to decide under regulation (decision Mar/Apr 2019).

• Grant application to be made under EU Connecting Europe Facility (expected April 2019 subject to EC timing).
Funding

- Estimated cost €930m (-12% / +15%)
- Cost split between EirGrid and RTE.
  - Proposal made to both National Regulatory Authorities (CRU & CRÉ).
- Connecting Europe Facility:
  - EU funding instrument for targeted infrastructure investment.
  - Celtic has received grant of €3.6m and allocated further €4m to date.
  - Budget of €4.7bn for grants for energy projects up to 2020.
Project Development – 2017/18 Surveys
Project Development

- Confirmed East Cork as best performing connection point in February 2018.
- Current objectives:
  - Identification of a shortlist of converter station location zones.
  - Identification of best performing landfall options (narrow down current shortlist).
Summary

Benefits
- European energy market integration
- Facilitates low carbon future
- Improved security of supply
- Direct telecoms link to EU

Key Approval Steps
- Investment Request
- Grant Application

Project Development
- Project progressing on all fronts
- Consultation and engagement ongoing
EAST WEST INTERCONNECTOR
AND
MOYLE INTERCONNECTOR
5TH ANNUAL CONFERENCE

Q&A