



Quick Guide to the Integrated Single Electricity Market

The I-SEM Project
Version 1



The current. The future.

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Abbreviations and symbols

Abbreviation	Term
BM	Balancing Market
CfD	Contract-for-Difference
CM	Capacity Market
CMU	Capacity Market Unit
DAM	Day-Ahead Market
FWM	Forwards Market
FTR	Financial Transmission Right
IDM	Intraday Market
IEM	Internal Energy Market
I-SEM	Integrated Single Electricity Market (arrangements)
MW, MWh	megawatt (electrical power), megawatt hour (electrical energy)
SEM	Single Electricity Market
TSO	Transmission System Operator

1. What is the I-SEM?

The Integrated Single Electricity Market (I-SEM) is a new wholesale electricity market arrangement for Ireland and Northern Ireland. The existing market arrangements are replaced by multiple markets or auctions, each spanning different trading time frames, with separate (although related) clearing and settlement mechanisms, covering both energy and non-energy commodities.

Note. The all-island electricity market is still referred to as the Single Electricity Market (SEM), but, for the purposes of this document, the existing arrangements are referred to as the SEM and the new arrangements are referred to as the I-SEM.

The new market arrangements are designed to integrate the all-island electricity market with European electricity markets, making optimal use of cross-border transmission assets, which, according to the SEM Committee¹, is expected to “deliver increased levels of competition which should help put a downward pressure on prices as well as encouraging greater levels of security of supply and transparency”. In addition to integration with Europe, some of the key considerations in the design of the I-SEM included how energy is bought and sold; how generators are remunerated for availability; forward trading arrangements and market liquidity; market power controls; and the systems, policies and procedures that are required to operate the market.

The new market arrangements present participants with many new challenges, but they also offers participants many new opportunities. Broadly, the I-SEM arrangements are intended to:

- enable broad participation in energy markets,
- increase the opportunities for participants to trade in different time frames,
- provide participants with a variety of arbitrage and hedging opportunities,
- maximise the efficient use of interconnectors in system balancing,
- provide cost drivers for system balancing, and
- integrate balancing and system security actions with market operation.

The I-SEM arrangements are due to go live mid-2018.

Note. Following the UK Brexit referendum in June 2016, the SEM Committee voiced its continuing support for I-SEM, noting that “there are good economic reasons for the all-island market which exist independently of European Union law or policy.”

¹ SEM Committee is the peak decision-making body for the SEM, <<https://www.semcommittee.com>>

2. Market coupling

The transmission system (also called the “grid”) in Ireland and Northern Ireland, when compared with the rest of Europe, is a relatively small synchronous transmission system. It is linked to European markets through Great Britain via the Moyle Interconnector (Northern Ireland to Scotland) and the East-West Inconnector (Ireland to Wales).

The Internal Energy Market (IEM) for electricity and gas is one of the key pillars for the European single market. Free trade across borders and non-discrimination between internal and cross-border transactions are the foundations of the single market. Since the early 1990s, this vision has been progressively realised through the creation of new legislation by the European Commission.

With the implementation of the I-SEM in 2018, the IEM will comprise 20 countries (Figure 2), including Ireland and Northern Ireland, coupled by 38 cross-border interconnectors, containing a total generating capacity of over 3,000 terawatts (TW).

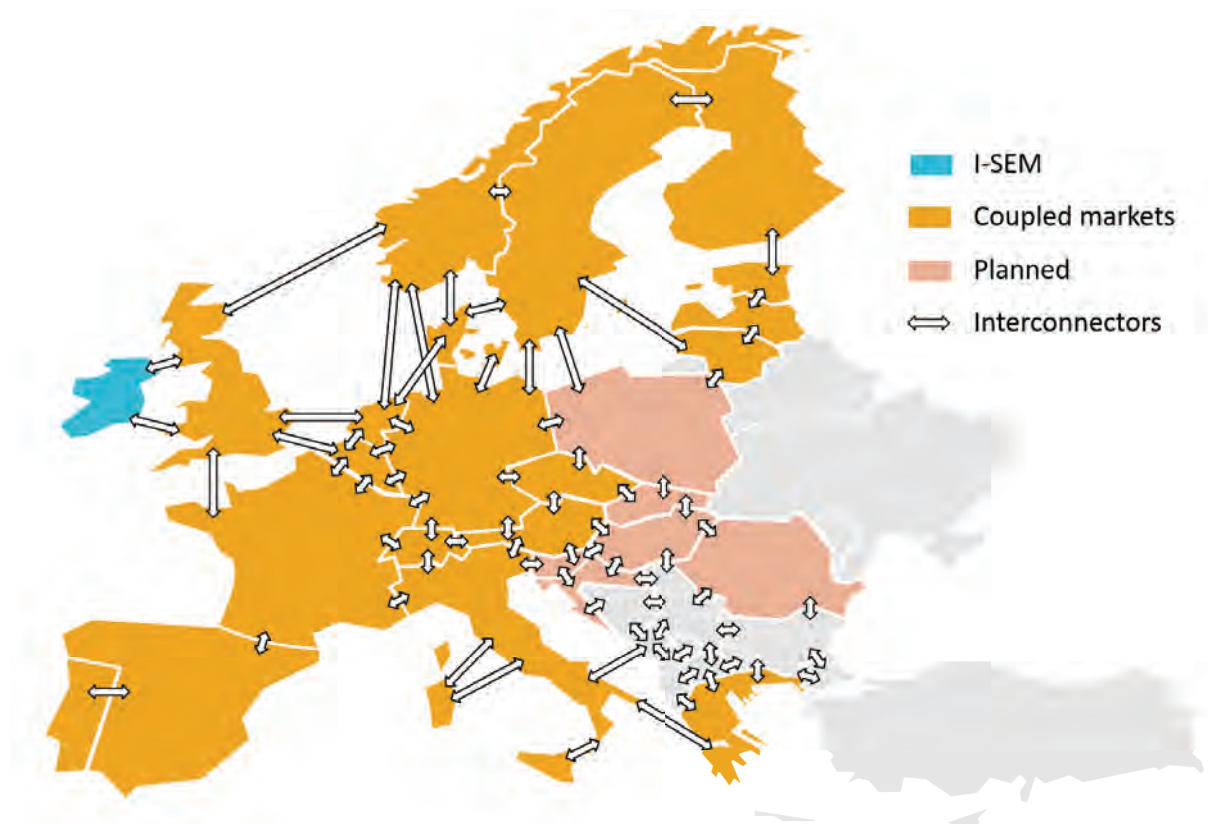


Figure 1 Internal Energy Market showing cross-border interconnectors (2018)

Market coupling is the means by which these energy markets are integrated. To enable cross-border trade across Europe, each coupled market implements a common set of rules and standardised wholesale trading arrangements. This is achieved by adopting the European Target Model, which is the blueprint for market integration across the IEM, including the I-SEM. Key features of the Target Model are:

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- A common price coupling algorithm for scheduling day-ahead markets and determining flows between geographic regions.
- Energy trading within regions and across borders up to close to real time.
- A hedging facility for price differences between regions due to transmission congestion.
- Integrated balancing arrangements that will ultimately enable neighbouring system operators to trade between regions as part of balancing.

In a coupled market, energy transactions involving sellers and buyers from different bidding zones are centrally collected to maximise the most efficient and effective trades. Trades from one bidding zone to another are only restricted by cross-border capacity. Market coupling involves system operators working together to allocate cross-border capacity and optimise cross-border flows, without the need for explicit auctions.

In theory, with market coupling, as long as energy can flow freely, there will be a single price. When the network is congested, prices diverge. The price differential between bidding zones incentivises investment in the most efficient infrastructure to relieve the congestion.

3. Administration

The **SEM Committee** is the governing body for the I-SEM. It oversees the design and implementation of the I-SEM and makes decisions on licenses and market codes relevant to the implementation of the I-SEM. The mission of the SEM Committee is to protect the interests of consumers of electricity by promoting effective competition in the sale and purchase of electricity through the I-SEM.

The **Regulatory Authorities**—the Commission for Energy Regulation (CER) in Ireland and the Utility Regulator (UR) in Northern Ireland—are responsible for administration of the market codes; licensing of market operators and participants; and monitoring the operation of the I-SEM and the conduct of its participants.

The **Transmission System Operator** (TSO) in Ireland is EirGrid and SONI is the TSO for Northern Ireland. Responsibilities for market operations, settlement and credit risk management are split between the TSOs, SEMO (a joint venture between EirGrid and SONI), and the (European) Joint Allocation Office (JAO).

EirGrid and SONI are also the **Nominated Electricity Market Operators** (NEMOs) for their geographic regions² in the (coupled) ex ante markets. The NEMOs interact with the (European) **Market Coupling Operator** (MCO), who is responsible for running the market coupling process.

² TSOs in other bidding zones can also act as a NEMO in the SEM, subject to complying with the NEMO rules.

Governance and administration of the IEM and intermarket network codes falls under the EU Agency for Cooperation of Energy Regulators (ACER) and the European Network of Transmission System Operators for Electricity (ENTSO-E). ACER oversees the development of the IEM, and ENTSO-E is responsible for developing the detailed technical and commercial requirements for market coupling.

4. Markets

The I-SEM comprises two ex ante³ energy markets, a balancing market, two markets for financial instruments, and a market for capacity remuneration. These markets operate independently and on different timelines.

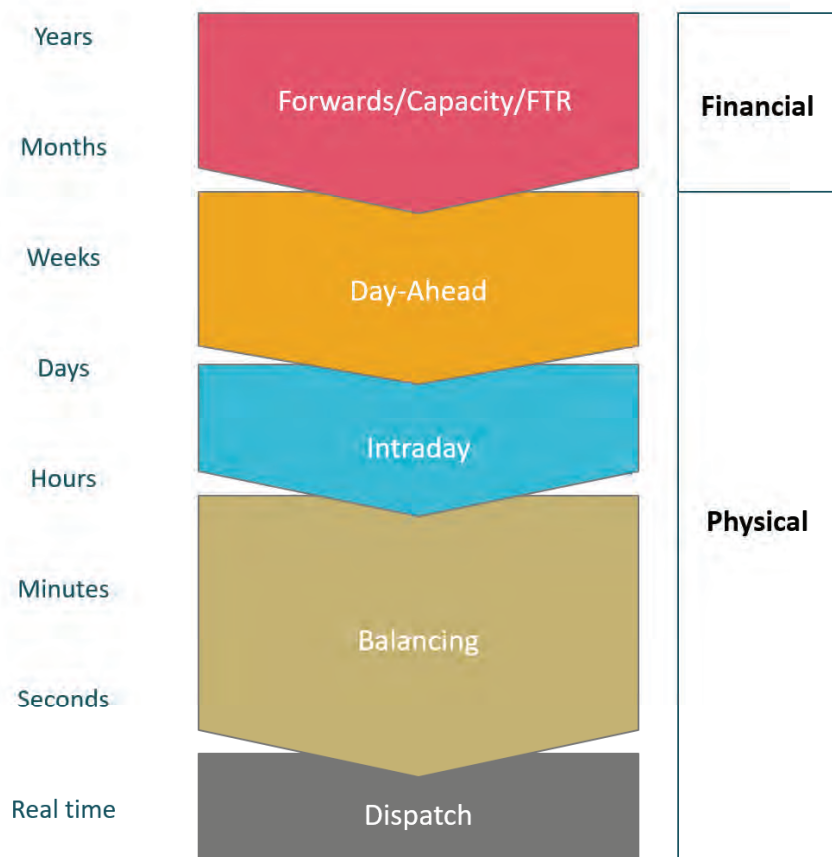


Figure 2 Market time frames

³ The term “ex ante” means “from before” and is applied to markets that are run before the energy is delivered, i.e. before real time. An ex ante market is also referred to as a “spot” market.

Ex ante markets

There are two ex ante markets for physical energy: the **Day-Ahead Market** (DAM) and the **Intraday Market** (IDM). As the names imply, the DAM closes the day before delivery and the IDM operates in the interval between closure of the DAM and one hour before delivery.

The DAM is a highly liquid, pan-European market and is the cornerstone of European market integration. The DAM is operated by the MCO, and participants submit orders via their respective NEMOs, who, in turn, interact with the MCO.

The IDM operates in a similar fashion to the DAM (although there are some important differences) and provides traders with the ability to adjust their positions as market conditions fluctuate closer to real time—for example, an unscheduled outage.

Balancing market

Before and into real time, the TSO calls on balancing services to keep the transmission system balanced (i.e. energy supply = energy demand). Energy balancing services are offered into the **Balancing Market** (BM) by generators (energy producers) and suppliers (energy consumers). For example, if demand is higher than expected, the TSO might instruct a generator with available capacity to increase its output. The generator is then paid through the BM for the additional energy used to balance the grid.

Note. The TSO can also call on non-energy balancing services, such as voltage regulation or energy reserves.

A participant's net energy position is the accumulated volume of all its trades in the ex ante markets (DAM and IDM) and any balancing actions taken by the TSO in the BM.

Financial instruments

The I-SEM provides market participants with hedging facilities against price fluctuations in the forwards time frame—that is, months to years in advance of energy delivery.⁴

A Contract-for-Difference (CfD), purchased in the **Forwards Market** (FWM), is a hedging instrument in which a price is struck (the "strike price") for a quantity of energy delivered on a future day. The contract holder then receives or pays the difference between the contract strike price and the spot price (called the "reference price"). As a financial trade, the CfD results in a profit or loss in euros, but there is no resultant net energy change.

⁴ The Forwards Market and FTR auctions are European-wide and available to SEM participants, but are not formally part of the I-SEM arrangements and not covered by the I-SEM design or codes.

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A Financial Transmission Right (FTR), purchased in an **FTR auction**, is a hedging instrument that protects the holder from price differentials between coupled markets. If energy flows freely between adjacent “bidding zones” (e.g. the islands of Ireland and Great Britain), then the price in each market will be equal. However, if flow on an interconnector is congested, prices will diverge. FTRs are offered by interconnector owners and the revenues they earn is called “congestion rent”.

Capacity market

Capacity is a commitment by a generator or interconnector owner to be available to deliver energy into the grid, if called on to do so. Capacity providers who are successful in the **Capacity Market (CM)** receive a regular capacity payment, which assists with funding generation capacity. The costs of purchasing capacity are socialised amongst suppliers and funded, in part, by the capacity providers returning revenues above a regulated “strike price” back to suppliers.

5. Participation and roles

Participation in the Balancing Market is mandatory for most generators. And participation in the Capacity Market is mandatory for interconnectors and most generators. But participation in the other markets is at the discretion of the participant. The roles available to participants in the I-SEM are outlined below.

Role	Description	Markets
Generator	Generators supply energy to the grid.	All
Supplier	Suppliers take energy from the grid for consumption.	All
Assetless Trader	Assetless Traders take positions in the ex ante markets but have no physical assets.	DAM and IDM
Interconnector	Interconnectors offer capacity in the CM and FTRs in FTR auctions. They do not trade in energy markets but they can have exposure in settlement of the BM for differences between dispatched and delivered positions.	CM, BM, FTR auctions
Agent of Last Resort (AOLR)	The AOLR is an automated data processing service provided through the market systems to facilitate participation by smaller generators in the ex ante markets.	DAM and IDM
Capacity Market Unit (CMU)	Interconnectors and large generators are represented in the Capacity Market as CMUs. Small or intermittent generators can be aggregated.	CM

6. Trading options

Typically, generators and suppliers will establish a physical position in the ex ante markets to reduce their exposure in the BM. This affords traders the flexibility of adjusting their position in the IDM up to one hour before real time. Participants can further reduce their risk by adopting arbitrage and hedging strategies prior to entering the ex ante markets. A trading approach that might be used by, say, a medium-to-large generator is illustrated in Figure 5, which demonstrates some of the trading options available to participants.

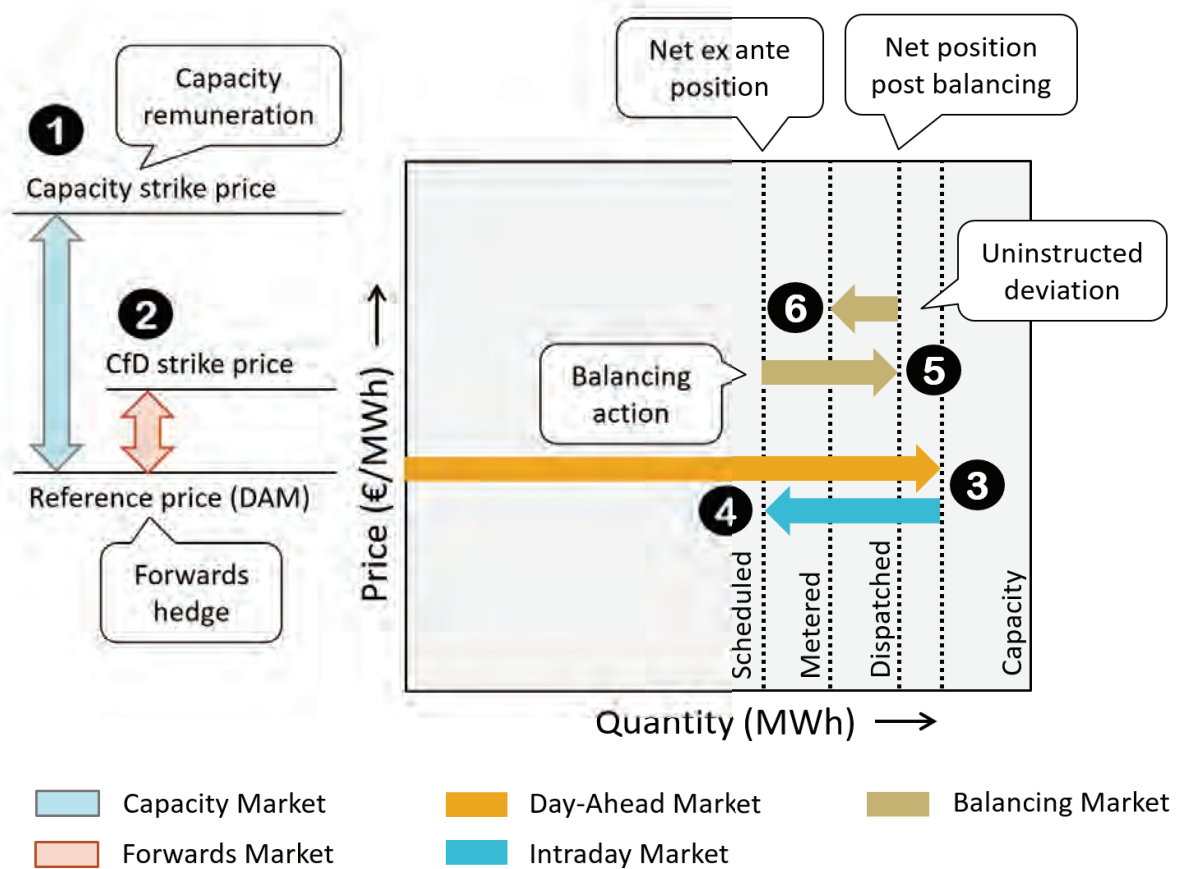


Figure 3 Example trading position

- 1** Some years in advance of the trading day, the generator sells capacity in the Capacity Market. This provides the generator with a regular income stream to fund capacity. On the day, if the spot price in the DAM (the reference price) exceeds the capacity strike price, the generator pays the excess revenues back to the suppliers. In this case, the spot price is lower than the strike price, so the generator is not liable for any additional payments.
- 2** Some months in advance of the trading day, the generator purchases a CfD in the Forwards Market. The CfD protects the generator against low prices caused by, say, surplus capacity from Europe flowing into the SEM. On the day, the spot price is in fact lower than the CfD strike price, and so the generator is paid the difference between the two prices by the party who sold the CfD. If the spot price was higher, the

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generator would instead pay the difference to the other party.

- 3** The day before the trading day, the generator succeeds in establishing a position in the DAM that reflects its expected delivery in that trading period. The DAM is cleared daily and the generator is paid for the energy it successfully offered into the market at the DAM spot price.
- 4** On the day, due to improved weather conditions, demand is lower than expected and the generator successfully adjusts its position in the IDM. The generator effectively buys energy back at the IDM spot price, which it sold the day before at the DAM spot price. In this case, the IDM spot price is lower than the DAM (because demand is lower than expected), so the generator makes a trading profit.
- 5** But, elsewhere in the grid, there is a problem with a transmission line, which is restricting flow from another generator. And so, to compensate, the TSO instructs the generator to increase its output. The generator will be paid for the energy it supplies for balancing at a price determined in the BM, which might be higher or lower than the ex ante spot prices.
- 6** However, due to operational issues, the generator is unable to achieve the instructed output level. The generator is being paid for the balancing energy it failed to deliver (in 5), and so it must pay for this deviation at a price calculated in the BM for such deviations.

The generator's net (post-dispatch) energy position is the sum of all its trades in the DAM and IDM plus any instructed energy balancing actions less any uninstructed deviations.

The trading options available to suppliers are similar to the options described above for generators, except that their net energy position will usually be negative.

7. Settlement and credit risk

Separate settlement and credit cover arrangements apply in each market and under the rules of each market operator.

The ex ante markets are settled daily. Each participant appoints a clearing member—a bank that is a member of the European Commodity Clearing (ECC) clearing house—who settles with the market operator on behalf of the participant. The ECC acts as a central counterparty for all payments in the market and guarantees payments in the event of a default by a participant. The ECC assesses the collateral requirements of each clearing member and ensures it holds adequate security to protect against default. Each clearing member then imposes similar obligations on the participant.

The Balancing Market is settled weekly. Settlement documents reflect balancing and capacity transactions in that billing period. Credit management is in the form of credit cover provided by a qualified bank. The market operator draws on the participant's credit cover to cover any defaults and monitors the exposure of every participant. Settlement in the BM takes into account instructed and uninstructed imbalances. The payments and charges that arise from balancing depend on the nature of the

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imbalance, the commercial data submitted, the status of the generating unit, the available metering data, and other data.

Settlement and credit risk management for the FWM and FTR auctions are outside the I-SEM arrangements.



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