



Europe Economics

Proof of Flow under Market Coupling

Review of Responses to the Consultation
on Market Coupling and LECs and
Options Analysis

A Report for Ofgem

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Executive Summary

Ofgem ran a consultation from 24 March 2015 to 19 June 2015 on market coupling and Levy Exemption Certificates and call for evidence on wider impacts. The CCL exemption for renewable source electricity was removed in July 2015. However proof of supply in the UK of overseas renewable power is still required for several UK schemes, and hence is valuable for market participants.

This report presents different options for recognising implicit flows of renewable power under market coupling. It provides elements of economic analysis of the potential market outcomes brought by each option, as well as the potential constraints around the realisation of these outcomes.

The options considered were the following:

- Option 1 Explicit-only.
- Option 2 Explicit and unconstrained implicit.
- Option 3 Explicit and constrained implicit.

Option 3 can be broken in sub-options depending on how the constraint on recognised flows (“the cap”) is (1) set and (2) allocated. Depending on the variant to set the cap and the one to allocate the cap, one can draw an options matrix as following to represent the sub-options.

Table 1: Determination and allocation of the cap

	Allocation based on...	
	Pro-rata historical trades	Auction outcome
Level of cap based on ...		
A1. Simple capacity cap	Option 3.A1/ trades	Option 3.A1/auction
A2. Reserved capacity cap	Option 3.A2/ trades	Option 3.A2/ auction
A3. Theoretical maximum assuming 100% netting	Option 3.A3/ trades	Option 3.A3/auction
B. Available capacity cap	Option 3.B/ trades	Option 3.B/auction
C. Flow based cap	Option 3.C/ trades	Option 3.C/ auction

The following table summarises the pros and cons of each option to set the cap. The key point is that the more realistic the implicit flows estimation is to set the cap, the more burdensome the implementation is for Ofgem and market participants.

Table 2: Pros and cons of capping option

Option	Pro	Con
A1 Simple capacity cap	Simple, transparent, easily communicated, predictable	Underestimates actual notional flows Challengeable rationale
A2 Reserved capacity cap	As per A1	As per A1 – underestimates even more Challengeable rationale
A3 Theoretical maximum assuming 100% netting	As per A1	Overestimates actual notional flows Challengeable rationale
B Available capacity	Closer to actual potential flow	Requires external data and calculations.

Option	Pro	Con
cap	Allows to disentangle between RE explicit imports (i.e. claims) and non-renewable explicit imports, which gives a degree of validation of explicit import claims	Harder to predict Can only know what the cap is once the implicit flow data is published by ENTSO-E
C Flow based cap	Closest to actual flow Strongest rationale	Wholly based on external data and calculations. Harder to predict Can only know what the cap is once the implicit flow data is published by ENTSO-E

The following table summarises how much renewable imports would be recognised in each option for an illustrative hour.

Table 3: Continental renewable flows recognised (delivery during the first hour of September, 13th 2015, MWh)

	Option 1	Option 2	Option 3.A1	Option 3.A2	Option 3.A3	Option 3.B	Option 3.C
Explicit claims recognised	2,822	2,822	2,822	2,822	2,822	2,822	2,822
Implicit claims (up to)	--	12,000	12,000	12,000	12,000	12,000	12,000
Cap on implicit recognised	--	--	178	600	3,000	893	192
Total recognised	2,822	14,822 (*)	3,000	3,422	5,822	3,715	3,014

Note: The capacity of the two continental interconnectors combined is 3,000MW. (*) Absolute maximum subject to additional economic and technical constraints.

The following table summarises our assessment of the following aspects for each option:

- Recognise all renewable power notionally capable to reach UK?
- Facilitates integrated European markets?
- Admin burden.
- Potential challengers.
- Distributional impacts.

Table 4: Summary of detailed assessment and option

	Option 1	Option 2	Options 3 (trades)	Options 3 (auction)
Recognise all renewable power notionally capable to reach UK	No	Yes	Partially (More than 1, less than 2)	Partially (More than 1, less than 2)
Facilitates integrated European markets?	No	Yes	Partially (More than 1, less than 2)	Partially (More than 1, less than 2)

	Option 1	Option 2	Options 3 (trades)	Options 3 (auction)
Main potential challengers	<p>European renewable generators</p> <p>Potentially large British suppliers</p> <p>EU institutions</p> <p>Interconnectors, e.g. BritNed (but less than in Option 2)</p>	<p>Potentially small British suppliers.</p> <p>UK-based renewable generators</p> <p>Interconnector operators</p>	Same as Option 1	<p>Same as Option 1 (less interconnector operators if auction administered by them)</p> <p>Potential challenge around validity of the auction and legitimacy of the auctioneer, especially if interconnector gains further value from it. Likely to include participants who did not enter or did not win the auction.</p> <p>Potentially small market participants</p>
Admin burden (for Ofgem)	As currently	As Option 1 + Processing evidence of trades & GoOs.	As Option 2 + cap calc. and allocation	As Option 2 & cap calc. & auction process (if administered by Ofgem)
Admin burden (for market participants)	As currently	Providing evidence of trades	Providing evidence of trades	Burden related to participants to an auction

We have also described what evidence could be provided by market participants to prove that they traded implicitly on coupled markets:

- Reports on trade submitted by the exchange (on behalf on market participants) to ACER as part of the REMIT requirements.
- Notification of trades sent by market participants to the British settlement party (and confirmed in return by the settlement party) for balancing purposes.
- Log of trades stored in the back-office websites of the two power exchanges.

1 Introduction

The Climate Change Levy (CCL) is a tax on non-domestic energy use, charged at time of supply, which includes an exemption for renewable source electricity¹. Under this CCL exemption for renewables scheme, accredited generators from overseas may be eligible to receive Levy Exemption Certificates (LECs). Generators can sell the LECs with the renewable power they represent to UK suppliers (directly or indirectly via a third party). Ultimately, licenced electricity suppliers who deliver power in the UK are able to use the LECs to claim an exemption from the CCL on behalf of business consumers.

Ofgem administers the LEC issuance. The CCL regulations state that's Ofgem needs to issue LEC only if it is satisfied that it represents electricity that is "consumed or to be consumed" in the UK. Applicants must therefore demonstrate a potential pathway from the generation site to GB, and are required by Ofgem to sign an annual 'consumption declaration'.² The specific evidence underpinning this is checked by Ofgem during generator audits.

LECs have been the only instrument demonstrating the supply of renewable power in the UK. LECs have therefore been used in schemes other than the CCL that also require proof of UK supply of overseas renewable electricity. They have been used in Fuel Mix Disclosure (FMD), the Feed-in Tariff (FIT), the Green Tariff conditions, and the Contracts for Difference (CFD) scheme³.

Historically, the main evidence provided by generators at audit has been evidence of booking and/or nomination of sufficient interconnector capacity linking the continent to GB. However, European spot power markets are currently shifting toward implicit trading as part of the process of market coupling. In implicit trading regimes, clearing price and cross-border capacity allocations are calculated by an algorithm. Therefore market participants do not book interconnector capacity themselves. They thus cannot provide evidence of booking / nominations of capacity at the interconnector.

The relevant EU legislation (the Regulation on Capacity Allocation and Congestion Management (CACM)) requires cross-border capacity in the day-ahead market to be implicitly allocated through auctions, and through continuous trading in the intraday market. Full implicit allocation of capacity on the day-ahead markets has been in place in the North West European (NWE) area⁴ since 2014 and is expected to be in the intraday market by summer 2018.

Once full implicit allocation of capacity in the day-ahead and intraday markets has come into force, market participants will only be able to provide evidence of explicit nominations / booking of cross-border capacity in the forward timeframe.

¹ On 8 July 2015, this exemption was removed for renewable source electricity generated on or after 1 August 2015.

² For electricity supplied in Northern Ireland, the competent authority is the Northern Ireland Authority for Utility Regulation (NIAUR).

³ The determination of green imports in the CFD scheme is the responsibility of the Low Carbon Contracts Company (LCCC), with Ofgem acting in an advisory capacity.

⁴ Comprising as of 2015: Belgium, Denmark, Estonia, Finland, France, Germany, Austria, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Sweden, Italy, Slovenia, Spain and Portugal.

Ofgem published guidance on the CCL exemption scheme does not address what evidence may be used to demonstrate the UK consumption of overseas renewable electricity under market coupling or the implicit trading of electricity. In this context, Ofgem ran a consultation from 24 March 2015 to 19 June 2015 on market coupling and Levy Exemption Certificates and call for evidence on wider impacts. The purpose of the consultation was to consult industry stakeholders on the “*use of LECs to prove UK consumption of overseas electricity for the CCL under market coupling, and in particular, the evidence required in this case.*”⁵ Ofgem also used the consultation to gather “*views and evidence on the use of LECs to prove UK consumption of overseas electricity under schemes other than CCL, and on the wider impacts that may arise from formalising [its] GB supply evidence requirements under market coupling.*”

The CCL exemption for renewable source electricity was removed in July 2015⁶. LECs are therefore no longer issued on new generation.⁷ However proof of supply in the UK of overseas renewable power is still required for several UK schemes, and hence is valuable for market participants. For instance, this is required in FMD, FIT and CFD. For this reason, the question of how to demonstrate the UK consumption of overseas renewable electricity that has been traded implicitly across coupled markets remains relevant.

This report presents different options for recognising implicit flows of renewable power under market coupling. It provides elements of economic analysis of the potential market outcomes brought by each option, as well as the potential constraints around the realisation of these outcomes.

The report contains the following section:

- In Section 2, we describe the current and expected implicit trading arrangements and how renewable power flows are recognised outside GB.
- In Section 3, we present a brief overview of the different options considered.
- In Section 4, we analyse in more detail the different options, notably in terms of impact on flows of renewable power recognised and potential revenue transfer across market participants.
- In Section 5, we describe what evidence is available to demonstrate implicit trades and assess the potential barriers to entry in the implicit trading market.
- In Section 6, we provide concluding comments and further analysis, which may be appropriate.

⁵ <https://www.ofgem.gov.uk/publications-and-updates/consultation-market-coupling-and-levy-exemption-certificates-lecs>.

⁶ <https://www.gov.uk/government/publications/climate-change-levy-removal-of-exemption-for-electricity-from-renewable-sources>.

⁷ There will be a transitional period from 1 August 2015, during which electricity suppliers will be able to continue to exempt RSE generated before that date.

2 Context

2.1 Implicit trading of electricity

2.1.1 Overview of power trading on exchanges in Europe

Power trading on exchanges

There are two basic ways to trade power in the wholesale market: the over-the-counter (OTC) market or through power exchanges. The OTC market has been the main channel for power trading, but volumes traded on exchanges have been growing over time. In the UK, the share of volume traded on exchange was around 5 per cent in 2011 and around 20 per cent end of 2014.⁸

“Power exchanges” provide a range of services but their core function is a supply and demand matching mechanism, traditionally through a day auction. In practice, they take the form of electronic trading platforms on which market participants (e.g. generators, suppliers and traders)⁹ submit anonymous bids and offers to buy and sell power. For the day auction, the different bids for selling power are stacked by increasing order of marginal cost until the stack matches demand.¹⁰ The clearing price is the marginal cost of the marginal technology (i.e. of the latest, most expensive, unit added in the stack).

There is currently no real-time trading of power in Europe. In other words, the trade always happens before delivery. Bids fall in two categories depending on the amount of time between the trade date and the delivery date. When delivery takes place in less than two day-ahead the contract is sometimes referred to as a “spot” contract. In spot markets, there are three types of bids depending on whether settlement takes place within the day of trading (intraday), the following day (day-ahead), or two-days ahead. When delivery is scheduled more than two-day ahead, the trade is sometimes referred to as “forward”.

Market participants value both the forward timeframe and the spot markets. Forward trades provide them with more certainty on their expected costs (for e.g. suppliers) and revenues (for e.g. generators).¹¹ But wind generation, power plant and interconnector outage and to some extent demand for power are not perfectly predictable more than a day or an hour ahead. Therefore market

⁸ https://ec.europa.eu/energy/sites/ener/files/documents/2014_countryreports_unitedkingdom.pdf.

⁹ Platforms differentiates between exchange “members”, who is a legal entity that has signed a trading agreement with the platform and exchange “trader” who is a person authorised to trade in the name of an exchange member. Power trading companies are typically registered as an “exchange member” and employees of the power trading companies are “exchange traders” as legally they trade on behalf their employing companies. We assume here that “trader” means an entity that buys or sells power without generating it or supplying it to end-users directly.

¹⁰ There are two power exchanges to trade wholesale power in the UK: N2EX and APX UK. N2EX’s traded volumes are around twice as large as APX UK but APX UK’s market share has been growing. Utility Week, *UK power market shifts towards ‘underdog’ exchange, 6 October 2015*. UK power futures exchange traded contracts are available on the Intercontinental Exchange (ICE).

¹¹ The value of this can be measured as the avoided costs of hedging the variation in spot markets prices for a supplier instance.

participants also value spot markets as a cost-effective way to balance their portfolio when more information is available.

When market participants in different zones trade power in the forward timeframe, they are responsible for booking enough interconnection capacity for the power to flow from one place to the other.¹² In the current state of forward trade rules, they need to book forward capacity by participating through an explicit auction for capacity at the relevant interconnector¹³. Closer to delivery, the parties who hold capacity rights and who want to use the interconnector need to schedule the volumes they wish to import or export by “nominating” capacity via the explicit auction platform.¹⁴ Capacity unused in the forward timeframe is rolled over to become available to timeframe closer to delivery (e.g. day-ahead and intraday).

In most parts of Europe market participants who wish to access cross-border trades in the day-ahead market currently do not need to book interconnection capacity themselves. Instead they must trade through an implicit day ahead auction, operated by power exchanges, whereby an algorithm matches orders taking into account available interconnector capacity and determines simultaneously the clearing price and allocation of capacity.¹⁵

However, the EU Regulation on Capacity Allocation and Congestion Management (the CACM Regulation), which entered into force in August 2015, requires all Member States to implement single day ahead and intraday coupling to allocate interconnector capacity implicitly.¹⁶ Given that the data on implicit trades is anonymous, as required by the CACM regulation (see Section 5.2) it will not be possible to match a trade to capacity at the interconnector in either day ahead or intraday markets.¹⁷

Resulting capacity bookings / allocation

Interconnector operators and national grids will need to allocate the capacity at the interconnectors by going through the following steps:

- **Initial split.** Before the first explicit auction for long term transmission rights, a share of total capacity (C in chart below, which we assume to be 2GW – the capacity between FR and GB) may be

¹² The forward contract specifies which party takes part to the explicit auction though the definition of the delivery point. When a British supplier buys power from a German generator, if the delivery point is in Germany then the suppliers needs to book capacity. When the delivery point is in the UK then the generator will book capacity (and the overall contract will be more expensive).

¹³ Access to the cross-border capacity in the forward time frame will be subject to forthcoming EU legislation on Forward Capacity Allocation, which is expected to require interconnector capacity to be explicitly allocated in the form of either physical or financial transmission rights in the forward timeframe.

¹⁴ E.g. Kingdom for BritNed.

¹⁵ In day-ahead markets, the algorithm matches orders and allocates capacity aiming to maximise economic surplus.

¹⁶ The capacity allocation mechanism differs slightly between day-ahead and intraday coupling as the operators allocate capacity using implicit auction on day-ahead markets and via an implicit mechanism based on continuous trading on the intraday markets. <http://www.elia.be/en/products-and-services/cross-border-mechanisms/cross-border-mechanisms>.

¹⁷ Note that in forward markets as well technically one cannot map power generated, consumed and flowed through an interconnector. The fact that power was generated in one place and consumed in another at the same time with enough shipping capacity in-between does not mean that the *same* power, i.e. the same precise electrons, were produced and then consumed in the two points. The mapping is a notional allocation of power flows. Kirchhoff's circuit law implies that power can flow in both ways along a particular line and that in a bi-directional interconnector, such as BritNed, the actual power flow is the net of flows in each direction.

reserved for allocation in the day ahead and intraday timeframes.¹⁸ We assume for the sake of the example that the interconnector reserves 20 per cent for implicit flows, i.e. only 80 per cent of the total capacity will be available to market participants through explicit auctions.

- **Explicit auctions.** During the explicit auctions market participants bid for long-term capacity bookings. The outcome of the explicit auctions is that some market participants have booked capacity for export (BE) and some have booked capacity for import (BI). Both BE and BI cannot exceed 80 per cent of the total capacity as we assumed that 20 per cent of the technical capacity had been reserved for implicit bookings.
- **Nominations.** Closer to delivery, but before the day-ahead implicit auction, holders of long-term capacity bookings communicate to the grid and interconnector operators their nominations for export (NE) and imports (NI).
- **Day-ahead implicit auction.** The capacity available for day-ahead implicit allocation is the sum of the reserved capacity for day-ahead + unsold/not nominated from forward explicit auction + netted capacity. “Netting” means that any capacity sold in one direction is netted off against capacity sold in the other direction. For example, if the technical capacity is 2,000 MW in either direction and 500 MW has been sold in the import direction, this leaves available capacity of 1,500 MW more import, or potentially 2,500 MW more export (backing off the 500 MW import sold, plus the full technical capacity to export).¹⁹ That means that in our example, if we assume 300MW is reserved for capacity booked as part of the simultaneous determination of power flows and capacity bookings in the day-ahead coupled market clearing algorithm, the capacity available for sale is:
 - GB to Continent = 300 (reserved) + 1,630 (unused/not nominated: 1,700-70) + 1,080 (netted: nominated capacity in the other direction) = 3,010.²⁰
 - Continent to GB = 300 (reserved) + 620 (unused/not nominated: 1,700-1,080) + 70 (netted nominated capacity in the other direction) = 990.²¹

As mentioned in the previous sub-section, market participants submit bids for buying and selling on power exchange and the platform determines simultaneously the clearing price and capacity needed at the interconnectors through implicit auctions. The outcome is that some additional capacity is booked in either exports or import direction (D).

- **Intraday implicit allocation via continuous trading.** The capacity to be made available to intra-day trading follows the same principle as the one made available for day-ahead trading, i.e. it is the reserved capacity for intraday + the sum of un-sold capacity from previous auctions (i.e. forward and day-ahead) plus the netted capacity of the previous auctions. In intraday markets, market participants can trade power up to one hour before delivery. In the continuous trading system,²² which is expected to be fully implemented in coupled markets in 2017,²³ orders of the members are

¹⁸ Pursuant to Article 2.6 of the EC Regulation 714/2009 (CMG Annex): “TSOs shall define an appropriate structure for the allocation of capacity between different timeframes. This may include an option for reserving a minimum percentage of interconnection capacity for daily or intra-daily allocation”.

¹⁹ The full amount is only available if the 500 MW sold as import is actually used.

²⁰ Note that $C - NE + NI$ gives the same result (i.e. $2,000 - 70 + 1,080 = 3010$). We provide an equation that is broken down into more building blocks to make apparent that the interconnector operator and the grid reserve a share of the technical capacity to implicit allocation (300MW in our example).

²¹ Note that $C + NI - NE$ gives the same result (i.e. $2,000 - 1,080 + 70 = 990$).

²² To note, the CACM regulation allows for transitional intraday arrangements that could include explicit as well as implicit access to interconnector capacity in the intraday timeframe.

²³ Ofgem (2015) Consultation on market coupling and Levy Exemption Certificates and call for evidence on wider impacts.

entered continuously into the order book. As soon as two orders are compatible, they are executed.²⁴ Therefore in the intraday market, assuming continuous implicit trading is in place, there could be 'x' number of additional trades in either direction that would 'free up' additional import capacity through further netting. This results in additional capacity being booked in import and export direction (II and IE).

- **Final flow.** The final physical flow of power is the netted sum of the flows of energy scheduled at the different timeframe, i.e. in our example in the import direction $D + NI + IE$ and in the export direction $II + NE$. Therefore the net physical flow (NF4) is $(D + NI + IE) - (II + NE) = (1,080 + 120 + 20) - (70 + 20) = 1,130\text{MW}$. The net physical flow cannot exceed the total capacity of the interconnector.^{25, 26}

The following diagram illustrates how the final flows at an interconnector (NF4 in the diagram) can be broken down in explicit nominations and day-ahead/intraday capacity allocations in a simplified manner.²⁷ The main points conveyed by the diagram are: (1) power flows work in such a way that capacity booked / allocated does not necessarily materialise in a physical flow: expected flows in one direction can net off expected flows in another; and (2) the implicit allocation of capacity in the day-ahead and intra-day timeframes is done anonymously by an algorithm and cannot be matched to individual participants.

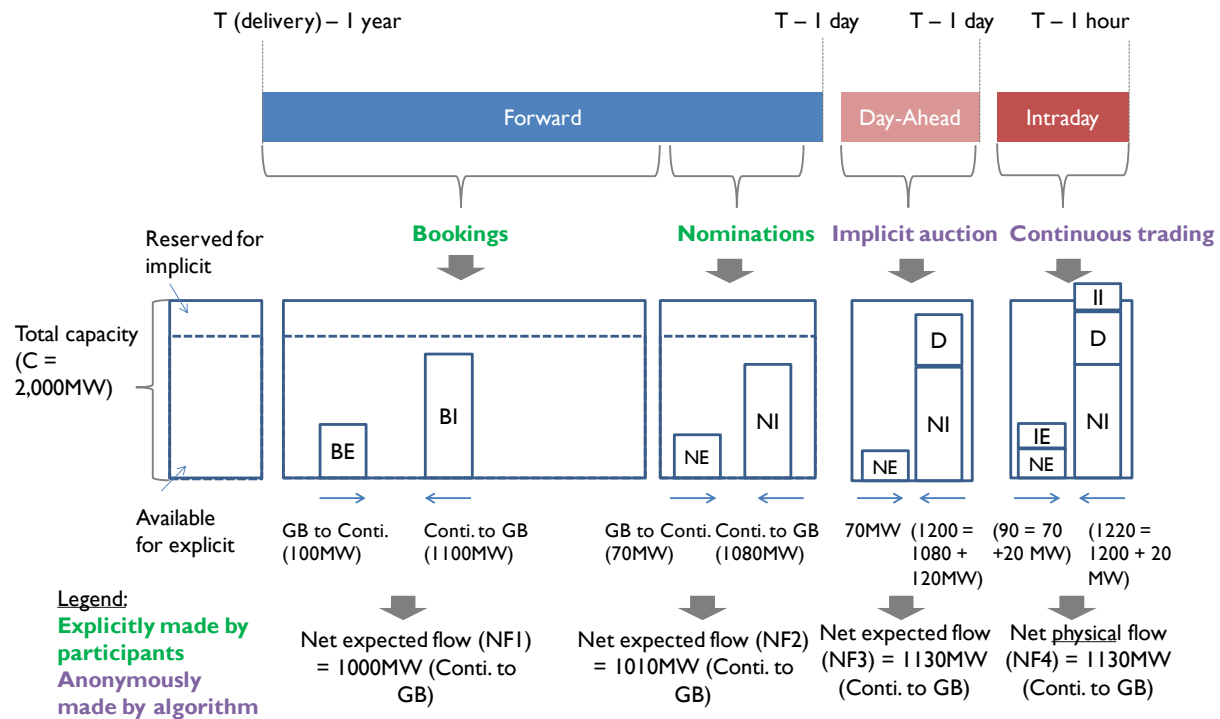
²⁴ <http://networkcodes.entsoe.eu/category/intraday-markets/?p=capacity-alloc-congestion-management>.

²⁵ In ENTSO-E terminology the netted sum of the forward, day-ahead and intraday trades is the "scheduled commercial flows". It systematically differs from the final flows, referred in ENTSO-E terminology as the "cross-border physical flows", due to the technical difficulty in flowing exactly the scheduled flows into the grid. The difference between the scheduled and final flows in a given hour is typically small (e.g. around 20-40MW in the FR – GB interconnector) but may add up to significant inconsistency if the flows are aggregated over a longer period, e.g. a month.

²⁶ In principle only the net flow is constrained by the interconnector capacity. This means that flows in a particular direction can exceed the interconnector technical capacity (assuming enough demand in the overall system) as a result of trading throughout the intraday period. For instance imports flows ($II + D + NI$) could be 15GW even if the interconnector's capacity is 2GW if flows in the opposite direction ($IE + NE$) are greater than 13GW. We understand that in practice, however, interconnector operators set a constraint on how much capacity can be booked in one direction for safety purposes.

²⁷ There are two caveats to the simplified illustration shown in the diagram:

- First the CACM Regulation requires the day-ahead cross-border market gate opening to be 11am CET, and gate closure to be at midday CET – an auction is run for all hours of the following day. Intra-day cross-border market gate closure is to be proposed by Transmission System Operators (TSOs) and approved by National Regulatory Authorities (NRAs). . The gate closure time must also be proposed and approved but it must be as close to real time (delivery) as possible as and no later than 1 hour before real time. In the diagram we simplified this timeline by describing that day-ahead closes at T (delivery) – 1 day, and T-1 hour for intraday.
- Second, in reality real-time flows and net physical flows (NF4) as broken down in the diagram differ slightly. On ENTSO-E Transparency the flows broken down in the diagram (NF4) add up to the "scheduled commercial flows" while real-time flows are measured by the "cross-border physical flows." Historically there has been a small but systematic difference between scheduled commercial flows and cross-border physical flows in European coupled markets due to the technical difficulty in injecting exactly the amount of power scheduled into the grid at time of delivery.

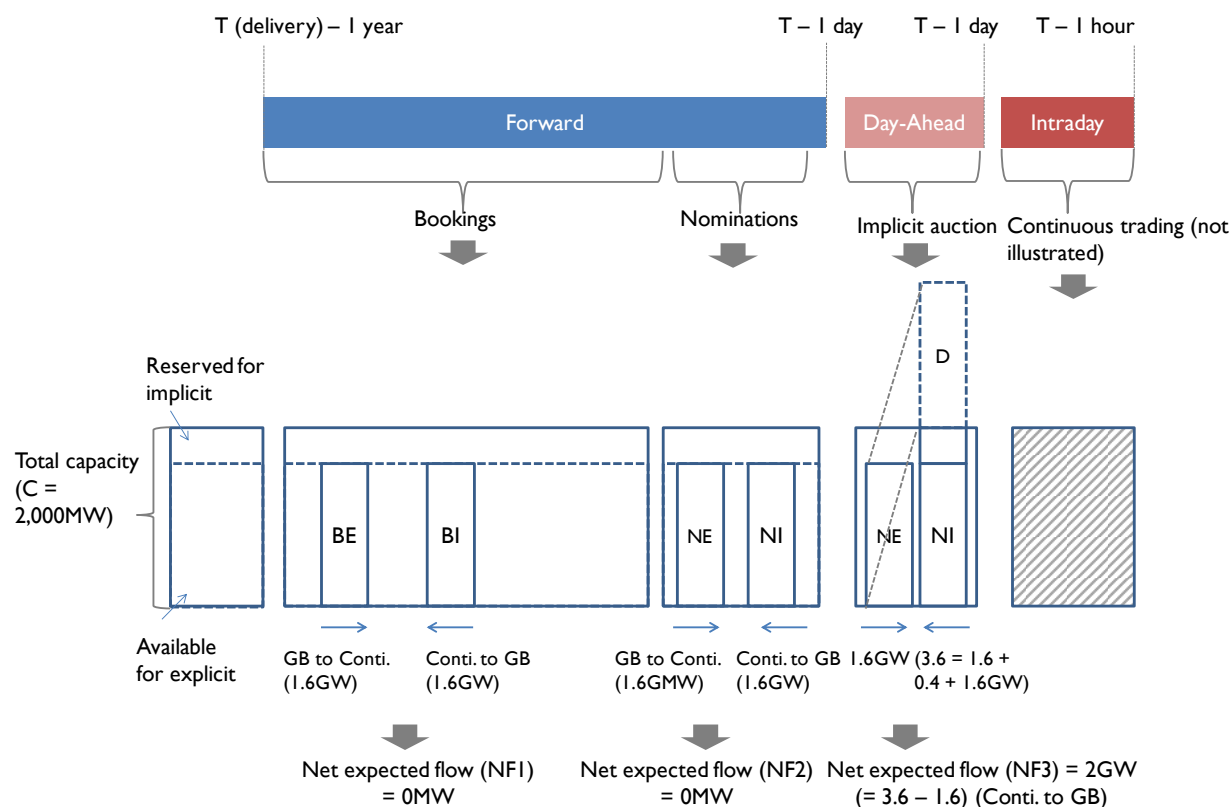
Figure 2.1: Simplified breakdown of a final hourly flow in successive capacity allocations

In the next diagram, we show what the maximum possible import flow could be (ignoring intraday continuous implicit trading). For a 2GW interconnector with 20 per cent reserved capacity (400MW), the maximum quantity of electricity that can be taken to have been imported in 1 hour would be 3.6GWh, consisting of:

- Full utilisation of 1.6GWh explicit imports offset by full utilisation of 1.6GWh explicit exports.
- Full utilisation in the continent-GB direction of resulting 1.6 GW netted capacity.²⁸
- Full utilisation in the continent-GB direction of reserved capacity (0.4 GW).

This example ignores intraday continuous implicit trading because, while 3.6GW would be the maximum possible import flow that could be evidenced under forward and day ahead trades, there could be further intraday import flows if intraday is under continuous implicit trading. Once we enter intraday, assuming continuous implicit trading, there could be 'x' number of additional trades in either direction that would 'free up' additional import capacity through further netting. Therefore, with intraday continuous trading, there is simply no ex-ante maximum possible flow in either direction, as an incremental flow in one direction can be scheduled very close to delivery (in the intraday timeframe) thus freeing up capacity in the other one almost up until delivery happens.

²⁸ According to IFA IC access rules, netting is only applied to the units nominated for long term allocation. Interconnexion France-Angleterre (France-England Interconnector), IFA Access Rules, Issue 9.0, p33.

Figure 2.2: Maximum possible import flows (ignoring intraday continuous implicit trading)

2.1.2 How the UK accounts for imported renewable source power currently

Historically, the UK has recognised renewable power when it is notionally imported in the forward timeframe only. Ofgem has used evidence of bookings/nominations of interconnector capacity to formally recognise that given units of renewable power had flowed into the UK. Ofgem has delivered certificates – the Levy Exemption Certificates (LECs) – to eligible overseas generators on the basis that they would be able to provide such evidence upon request.²⁹ One LEC is issued for each megawatt hour (MWh) of renewable source electricity generated.³⁰

In addition to the issuance of LECs (a certificate only recognised within the UK), Ofgem has also been recognising a EU-wide (plus Norway and Switzerland) certificate to account for imported renewable source power from EU countries,³¹ the Guarantees of Origin (GoOs).³² One GoO corresponds to 1 MWh of power.³³

²⁹ In 2013/14 Ofgem issued LECs for generation from Austria, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Slovenia, Spain, Sweden and Switzerland.

³⁰ Following an announcement by the Chancellor of the Exchequer in the summer 2015 Budget, LECs cannot be issued on electrical output generated on or after 1 August 2015. See: <https://www.ofgem.gov.uk/publications-and-updates/climate-change-levy-exemption-removed-faqs>

³¹ Norway and Switzerland issue GoOs but Ofgem does not formally recognise them for FMD.

³² In 2013/14, Ofgem recognised GoOs from Denmark, Finland, France, Germany, Ireland, Netherlands Spain, and Sweden.

³³ <http://www.eex.com/en/products/environmentals/guarantees-of-origins/trading>.

For Ofgem to recognise a GoO as evidence of import and supply in the UK, the GoOs need to be cancelled in the UK. Ofgem uses GoOs in the following schemes:

- For Fuel Mix Disclosure scheme (FMD), EU GoOs are used to prove the share of renewable source electricity generated in the EU and purchased for supply to customers in GB. However, since the GoOs do not carry proof of GB supply, they have been matched with their corresponding LECs.
- Under the Feed-in Tariff (FIT) scheme, some overseas renewable electricity is excluded from the 'relevant market share' for suppliers. This has been recognised by Ofgem using LECs and GoOs (as per FMD), and adjusting the proportion of payments made by each supplier to cover the costs of the scheme.

Market participants have the possibility to enter into power swaps in the forward timeframe to import certificates. A swap is an exchange of physical delivery or cash-flows.

Amount of renewable recognised in 2013/14

Ofgem publishes data on recognised LECs and GoOs. In 2013 / 14, Ofgem recognised the following amount of renewable imported into the UK based on these two types of certificates:

- Recognised EU GoOs from 1 April 2013 to 31 March 2014 (period 2013/14): 6,708,474MWh.³⁴
- Continental LECs issued as of 2013/14: 18,605,359MWh.³⁵³⁶

Over the course of the year, one can reasonably estimate the total explicit flows of renewable across the two interconnectors connecting GB to the continent as EU GoOs recognised x (1 + %Norwegian and Swiss LECs issued relative to EU ones). In 2013/14 we therefore estimate 8,144,029MWh of explicit flows of renewable across the two interconnectors.³⁷

According to ENTSO-E, the net cross-border flows from the continent to GB over period 1 April 2013 to 31 March 2014 was 17,573,312MWh, i.e. Ofgem recognised as renewable import around 46 per cent of the net flows in 2013/14 from the continent.

This is significantly larger than 33 per cent, the share of renewables in electricity net generation in the ENTSO-E area (including the coupled markets and Ireland) in 2014 (incl. hydro).³⁸ Renewables electricity net generation in the ENTSO-E area amounted to 1,072TWh in 2014.

Therefore Ofgem recognised around 1 per cent of the total renewable energy generated in the coupled market as having flowed into the UK in 2013/14.

Renewable recognised in 2014/15

Data on GoOs recognised and LECs redeemed for the period 2014/15 has not been published yet. We use the following figures based on data provided by Ofgem:³⁹

³⁴ <https://www.ofgem.gov.uk/publications-and-updates/recognised-guarantees-origin-2014>.

³⁵ The status 'Issued' refers to LECs that have been Issued but not yet redeemed; the status 'Redeemed' refers to LECs that have been Issued and subsequently redeemed against indirect supplies. The total of Issued and Redeemed thus represents the sum of all LECs originally issued. As of 23 September 2014, 13,048,903 EU LECs had been redeemed.

³⁶ <https://www.ofgem.gov.uk/publications-and-updates/summary-renewable-levy-exemption-certificates-lecs-april-2009-march-2014>.

³⁷ $8,144,029 = 6,708,474 * (1+21\%)$. Where 21 per cent was estimated using data from Ofgem on LEC issued (reference above).

³⁸ http://www.rte-france.com/sites/default/files/entsoe_electricity_in_europe_2014.pdf.

- EU GoOs Recognised: 19,145,249MWh.
- Non-EU LECs Redeemed: 6,596,419MWh.
- I.e. a total of 25,741,668MWh.

According to ENTSO-E net cross-border flows from the continent to GB over the period 1 April 2014 to 31 March 2015 was 22,859,509 MWh,⁴⁰ i.e. less than the total EU GoOs recognised and non-EU LECs redeemed. This may be due to the fact the LECs can be redeemed after the flows have reached GB. Also, the data on EU GoOs include Irish GoOs while the ENTSO-E flows quoted are limited to flows from the continent. However, we expect the amount of Irish GoOs to be relatively small (it was around 1 per cent of the total EU GoOs recognised in 2013/14).

We therefore assume in the rest of this report that Ofgem recognised 100 per cent of the net flows in 2014/15 from the continent as being renewable imports.⁴¹

2.2 Notions of supply

2.2.1 GoOs in the rest of Europe

In this section we describe the use of GoOs in Europe outside GB.

European directives have introduced the GoOs as a tool to identify the origin of renewable source power in EU.⁴² Some designated bodies supervise the issuance, transfer and cancellation of GoOs. The designated bodies have non-overlapping geographical responsibilities.

The Association of Issuing Bodies (AIB) provides the infrastructure to transfer GoOs from one country to another within its Member States. AIB focuses on European market players' demand.⁴³ It developed the European Energy Certificate System (EECS), which is an integrated platform for issuing, holding and transferring energy origin certificates. Each EECS certificate contains standard information on the source of the energy, and its method of production and is tradable. AIB aims to ensure *certificates are created, change owners and are eventually made untransferable under a carefully developed and managed control infrastructure*".

Member States have a duty to recognise GoOs issued by other Member States unless they are satisfied that there is good reason to doubt the "accuracy, reliability or veracity" of the GoO.⁴⁴ Some non-EU countries such as Norway and Switzerland are AIB members and also issue GoOs that meet the EECS standard.⁴⁵ Market participants have access to standardised GoO trading platforms on European power

³⁹ The EU figure can be taken to have definitely flowed across the interconnectors (including Ireland) in those time periods. The non-EU figure is an estimate only, since the LECs redeemed in that period may have flowed in previous periods, and similarly the LECs that flowed during that period may not have been redeemed.

⁴⁰ ENTSO-E reports cross-border flows as not available for most of 2014 so we used the scheduled commercial exchanges instead.

⁴¹ We use this ratio to calculate the amount of explicit nominations claimed as explicit renewable claims in the next section

⁴² EU Directive 2009/28/EC on trading of Guarantees of Origin, and previously by the 2001/77/EC, EU Directive 2009/72/EC, and previously by the Directive 2003/54/EC. RE-DISS Best Practice recommendations, December 2010.

⁴³ http://www.aib-net.org/portal/page/portal/AIB_HOME/AIB/Mission/Vision1.

⁴⁴ Directive 2009/28/EC on promotion of renewable energy sources ("the RES Directive").

⁴⁵ <http://www.eex.com/en/goo>.

exchanges, e.g. EEX.⁴⁶ As indicated by the exchange operators EEX:⁴⁷ *“As a rule, Guarantees of Origin are not delivered together with electricity. [They] are traded as certificates without electricity.” The fact that GoOs are traded without physical delivery is important when considering the scope of their validity as a proof of flow in the British legislation (see Section 2.2.2).*

The EU-initiative Reliable Disclosure Systems for Europe (RE-DISS) aimed at “improving the information given to consumers of electricity in Europe regarding the origin of the electricity they are consuming”.⁴⁸ It supported the designated bodies in improving the procedures and practices for issuing, trading and cancelling guarantees of origin. It held its final conference on 23 September 2015, with part of its responsibilities passing to AIB (e.g. calculation of the European residual mix figures)⁴⁹.

2.2.2 Pure GoOs-based system

GoOs are issued, exchanged and cancelled in Europe and could in principle be used to evidence consumption of renewable power in GB. However, as mentioned earlier, the trading of GoOs is not linked to physical delivery of electricity. Therefore using only GoOs, without further evidence of the GB supply of the electricity in question (e.g. booking/nomination of interconnector capacity or corresponding evidence of sale in coupled markets and buy transactions in the British coupled market), would be at odds with the British legislative requirement to evidence British supply (and not only of origin).

We therefore do not consider such an option in the analysis shown in the rest of this report.

⁴⁶ <http://www.eex.com/en/goo>.

⁴⁷ <http://www.eex.com/en/products/environmentals/guarantees-of-origins/faq>.

⁴⁸ <http://www.reliable-disclosure.org/>.

⁴⁹ <http://www.recs.org/news/re-diss-publishes-2014-residual-mixes>.

3 Options Overview

In this section we provide a brief overview of the options under consideration.

These options make apparent a fundamental trade-off between predictability and ease of communication/administration on one hand, and technical accuracy on the other hand.

3.1 Option 1: Explicit-only

Under the explicit-only option, Ofgem only accepts evidence of explicit flows as evidence of renewable source electricity consumed or to be consumed in the UK. For each forward trade, market participants make capacity bookings and nominations explicitly. Ofgem accepts evidence of nominations / bookings as evidence of the notional flow.

3.2 Option 2: Explicit and unconstrained implicit

In the explicit and unconstrained implicit option, Ofgem accepts evidence of both explicit flows and evidence of implicit flows in coupled markets as evidence of renewable source electricity consumed or to be consumed in the UK. Ofgem does not set a limit or cap to the quantity of implicitly traded renewable source electricity that may be recognised. We describe the specific evidence that Ofgem might require from market participants in Section 4.1.2.

3.3 Option 3: Explicit and constrained implicit

In explicit and constrained implicit options, Ofgem accepts all evidence of explicit flows but sets a limit on the amount of implicit flows of renewable source electricity it may recognise as having been consumed or to be consumed in the UK.

3.3.1 Setting the cap

In the “constrained implicit” options, Ofgem sets a cap on the total number of day-ahead and intraday flows of renewable source electricity it may recognise as having been consumed or to be consumed in the UK. Several variants of these options exist:

- Simplified theoretical maxima – options based solely on overall capacity and explicit import claims:
 - **Simple capacity cap.**
Overall cap/recognition = $C = [(C - \text{renewable explicit import claims}) + \text{renewable explicit import claims}]$ i.e. implicit cap = $(C - \text{renewable explicit import claims})$.
 - **Reserved capacity cap.**
Overall cap/recognition = reserved capacity + explicit import claims, i.e. implicit cap = reserved capacity.
 - **Theoretical maximum assuming 100 per cent netting of explicit capacity.**

Overall cap/recognition = C + explicit import claims, i.e. Implicit cap = C = assumed 100 per cent netted capacity + reserved capacity. This cap would exclude intraday trading and is equivalent to the situation presented in Figure 1.2 above.

- **Available capacity.**
Implicit cap is determined taking into account what the nominated export flows were (ENTSO-E data). Total cap / recognition = C + nominated export flows = explicit import claims + (C – explicit import claims + nominated export flows), i.e. implicit cap = C – explicit import claims + nominated export flows.⁵⁰
- **Flow-based.**
Ofgem sets the cap on implicit flows at a level equal to the estimated historic implicit import flows (ENTSO-E data).⁵¹ In Figure 2.1, implicit import flows are D + II – IE.

3.3.2 Allocating the cap

The second stage of the option constraining recognised implicit flows of renewable source electricity consumed or to be consumed in the UK is to allocate the capped amount of implicit flows recognised to the relevant individual market participants. There are two main ways:

- **Pro-rata:** Ofgem could allocate the capped amount using a simple pro-rata allocation based on historical implicit sell trades of renewable in the coupled markets over the relevant period. Ofgem would add up the claims on implicit sell trades, calculate the share of each participant in the total and allocate the cap proportionally to the shares.
- **Auction-based:** Ofgem or the interconnector operators could administer an auction to allocate retrospectively the capped amount to eligible participants. Eligibility could be restricted to participants involved in implicit sell trade of renewable over the relevant period. BritNed Implicit Flow Allocation (BIFA) is an example of retrospective allocation of the implicit flows through an auction.⁵²

3.3.3 Summary of constrained implicit options

Depending on the variant to set the cap and the one to allocate the cap, one can draw an options matrix as following to represent the potential constrained implicit options.

Across the options, notably in terms of options to set the cap, there is a trade-off between predictability and ease of communication /administration on one hand, and technical accuracy on the other hand. AI (Simple cap) would be the most straightforward to communicate and administer, with the other options gradually less and less straightforward up until C (Flow-based), which would be the most accurate estimation of the total implicit flows but would be the most challenging to administer and communicate to the public.

⁵⁰ In our example (Figure 1.1) it is C – NI + NE if we assume that all import nominations are claimed as renewables.

⁵¹ We understand that estimating implicit flows with a power market model could be a theoretically valid alternative to re-constructing implicit flows from historical data. However running and maintaining such a model is likely to prove more resource-intensive than a method based on historical flows without a clear offsetting gain in accuracy and validity of the results.

⁵² BritNed allocated an amount corresponding to the reserved capacity for day-ahead implicit auctions, i.e. akin to the option 1.b. above. The eligible participants were all registered customers at BritNed.

Table 3.1: Determination and allocation of the cap

Level of cap based on ...	Allocation based on...	
	Pro-rata historical trades	Auction outcome
A1. Simple capacity cap	Option 3.A1/ trades	Option 3.A1/auction
A2. Reserved capacity cap	Option 3.A2/ trades	Option 3.A2/ auction
A3. Theoretical maximum assuming 100% netting	Option 3.A3/ trades	Option 3.A3/auction
B. Available capacity cap	Option 3.B/ trades	Option 3.B/auction
C. Flow based cap	Option 3.C/ trades	Option 3.C/ auction

4 Detailed Options Analysis

4.1 Option 1: Explicit-only

4.1.1 Description

Under the explicit-only option, Ofgem only accepts evidence of explicit flows to demonstrate the consumption in GB of overseas electricity.⁵³ For each forward trade, market participants make capacity bookings and nominations explicitly. Ofgem accepts evidence of nominations / bookings as evidence of the notional flow. This option is effectively the status quo, i.e. it is the way Ofgem has historically been accepting evidence of renewable source electricity consumed or to be consumed in the UK.

4.1.2 Key processes, data and admin requirements

Ofgem would require the evidence set out in Section 2.1.2. Ofgem would continue to require the same data and use the same administrative processes as currently in place.⁵⁴

4.1.3 Risk / issues

One may argue that this option introduces the following risks / issues:

Arbitrarily excludes some trades

The main issue with the status quo is that Ofgem would potentially recognise only a share of the overseas renewable source electricity consumed, or to be consumed, in the UK.

First, this issue might become more problematic in the future if interconnectors and grid operators start to allocate capacity implicitly for forward trades as well or if the forward market moves to Financial Transmission Rights (FTR) only.⁵⁵

Second, some suppliers would not be reducing their share of costs in the FiTs levelisation process as much as they would expect to do in the unconstrained implicit option. These suppliers would potentially be the larger ones who have large trading desks, as they may be more likely to be able to trade implicitly.

However, in the option with unconstrained implicit, it would then be the other suppliers (potentially the smallest ones) who would potentially see their share of costs in the FiT levelisation increase (as large suppliers would be able to claim more implicit flows).

⁵³ Evidence may or may not include Financial Transmission Rights in addition to Physical Transmission Rights.

⁵⁴ For electricity supplied in Northern Ireland, the competent authority is the Northern Ireland Authority for Utility Regulation (NIAUR).

⁵⁵ FTR are financial contract entitling the FTR holder to a stream of revenues (or charges) based on the price difference across an energy path. (e.g. difference in day-ahead hourly price between two bidding zones). FTRs essentially allow market participants to offset potential losses (hedge) related to the price risk of trading energy. As they are purely financial instrument, it is not clear how proof of flow would be evidenced using them. FTRs do not fit within the scope of the analysis presented here.

Therefore, both Option 1 and Option 2 can potentially cause a loss of welfare because of the interaction between renewable flow claims and the share of costs in the FiT levelisation process. A decision would need to make a trade-off between the impact on large and small suppliers to establish what is in the consumer interest.

Last, ignoring some implicit flows (this applies both to Option 1 and Options 3) is at odds with the concept of single EU Energy Market (see Section 4.1.6) as Ofgem would not recognise some trades from EU countries (all the implicit ones).

Distorts market incentives

Assuming that forward trades will continue to require explicit bookings of capacity and day-ahead/intraday will remain implicit, one would argue that ignoring all implicit flows distorts incentives in favour of forward trades.

Academic studies and market participants have outlined that day-ahead and intraday markets provide some valuable market services,⁵⁶ which may contribute to the overall efficiency of the wholesale power markets. In other words, it may be more expensive to serve demand for power without day-ahead and intraday trades. The main reason is that day-ahead and intraday trades enable market participants to adjust their portfolio closer to delivery time, i.e. when more information is available about e.g. wind generation, demand or potential interconnector and power plant outages, than in timeframes ahead of one day ahead.

As also recognised by academic and market participants,⁵⁷ forward trades are also likely to make the market more efficient, e.g. by enabling producers to sell part of their generation in advance to suppliers who are in turn able to provide fixed prices to end-users while saving on hedging costs. Generators are also thus able to reduce the overall variability of their cash-flows, which may enable them to access better financing conditions.

It is therefore likely that both forward and day-ahead / intraday trades contribute to the efficiency of the market and that some combination of the two is the cheapest way to serve demand overall. If this proportion is at its equilibrium ratio in a given time, a regulatory intervention, which ends up giving more value to forward trades relative to day-ahead/intraday, may end up increasing the overall costs of providing customers with power.

In addition, interconnectors are likely to capture most of the incremental value of renewable power in GB in this option. When market participants bid for capacity at the interconnector, they are likely to include some of the value of a certificate in GB (over and above the value of this certificate in the continent) in their bid, which means that the clearing price of capacity will include some of the incremental value of renewable power in the UK.⁵⁸ As acquiring interconnection capacity is a

⁵⁶ E.g. Kovacevic, Pflug, Vespucci (2013) *Handbook of Risk Management in Energy Production and Trading* (for an academic perspective). Energy UK, Wholesale Electricity Market Report, Vol 8 November 2014 (market participant view).

⁵⁷ E.g. Kovacevic, Pflug, Vespucci (2013) *Handbook of Risk Management in Energy Production and Trading* (for an academic perspective). Energy UK, Wholesale Electricity Market Report, Vol 8 November 2014 (market participant view).

⁵⁸ This comes from the fact that both the coupled markets generation and the British supply market are fairly competitive. To see why, let's assume that there is only one generator in the continent. Then during the explicit auction, it would not have to bid a large price to ensure capacity at the interconnector since it is the only bidder. By bidding the lowest possible price - the reserve price - it would still obtain all the capacity available. But in European coupled market there is competition to obtain capacity at the interconnector.

transaction cost for market participants, this means that the value of certificate would be offset by a proportional increase in transaction costs, effectively creating a market distortion compared to a counter-factual where the value of a certificate remunerates suppliers and generators for providing renewable power to consumers in GB.

Unfit to the intermittent nature of wind generation

Besides, one might argue that market participants are likely to trade a significant share of renewable power generated in day-ahead and intraday trades due to the intermittent nature of wind generation. If the wind at time of delivery is unexpectedly stronger than expected a week before delivery then balancing the system would be handled at least partly by day-ahead/intraday trades.

4.1.4 Potential challengers

This option restricts the amount of evidence of renewable source electricity consumed or to be consumed in the UK more than the other options. Therefore the potential losers are:

- **Market participants trading on implicit** including **continental renewable generators** trading on implicit, as a larger share of their production may be recognised under the other options. Also because the interconnector captures some of the certificate value in this option. We expect that **large suppliers** might be more vocal as they may trade more on implicit than smaller ones given the fixed costs of setting a trading desk and paying the exchange fees (see Section 5.4). **“Green” suppliers** as well, as a smaller share of their purchase would be excluded from the Feed-in-Tariff (FiT) cost levelisation process than in the other options.
- **EU institutions** (see Section 4.1.6).
- **Interconnectors, e.g. BritNed** to some extent (although less than in Option 2) as in an option where they administer the allocation of implicit flows they could capture some of the value of the implicit flows (for the same reason as explained in Section 4.1.3).

4.1.5 Impact on volume of recognised renewable imports

This option is likely to be the option which leads to the smallest amount of recognised renewable imports.

ENTSO-E data on nominations from the continent to GB,⁵⁹ for delivery in the first hour of September 13th 2015 was 2,822MW (FR to GB: 1900MW, NL to GB: 922MW).⁶⁰

Assuming market participants are able to evidence contractual arrangements linking a renewable generator to a supplier in the UK for 100 per cent of this amount (see Section 2.1.2), then Ofgem would allow around 2,822MWh of renewable imports on that hour.

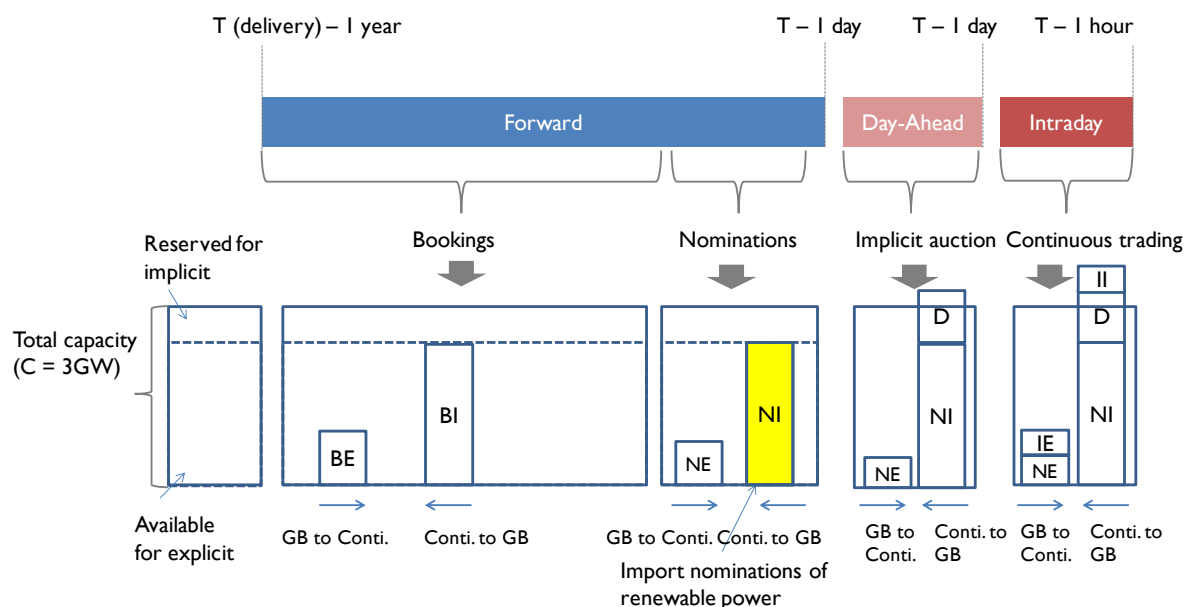
Therefore the bidders need to bid as high as possible subject to not making any loss by selling one unit of power. Since they do not need to receive the incremental value of the renewable power in GB to be profitable in the short-term (the short-term marginal cost of production of wind is zero), they are likely to include it in their bid for interconnection capacity during explicit auction.

⁵⁹ I.e. the “*aggregated capacity nominated by market participants from time horizons corresponding to explicit allocations [e.g. the forward timeframe], agreed between the TSOs and confirmed to the market*” in the direction NL to GB and FR to GB.

⁶⁰ Data available on hourly basis since January, 5th 2015. <https://transparency.entsoe.eu>. The user needs to login to access the data available.

In the following figure, 2,822MWh corresponds to the bar filled in yellow (in this chart capacity is equal to 3GW – the capacity between the continent (NL and FR) and GB).⁶¹

Figure 4.1: Amount of renewable recognised using explicit-only



4.1.6 European context

This option potentially does not recognise some of the renewable power imported from EU countries to the UK. It may thus create a barrier to the integration of European markets. Market coupling has been recognised as a key instrument in the integration of EU markets.

First, market coupling means that market participants do not need to explicitly book capacity anymore when trading across countries, which makes it more straightforward to trade across these countries.

Second, market coupling is particularly fitted to the European growth in intermittent renewable generation because it allows countries to offset peaks in supply in one area with demand in another. In its 2012 evaluation report, the German regulator, Bundesnetzagentur (BnetzA) argued as follows:⁶²

“The coupling and harmonisation of the European wholesale (day-ahead) electricity markets is not only a major European project, but also key to the success of the Energiewende. Coupling the markets more closely reduces price fluctuations and enables intermittent generation from renewable sources to be better incorporated by spreading electricity supply and demand over a wider basis.”

EPEX SPOT also analysed that “the number of negative (or positive) price peaks in Germany (or France) experienced during the past two years has decreased in comparison to 2009 figures”.⁶³

⁶¹ Over the period January, 1st 2015 to September 13th 2015.

⁶²

www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/PressSection/ReportsPublications/2013/AnnualReport2012.pdf?__blob=publicationFile&v=3.

⁶³ https://www.epexspot.com/en/renewables/day_ahead_market_coupling.

Last, market coupling potentially allows a more optimal utilisation and investment in power supply in general (not only renewable) as the aggregated European demand may be less peaky (and therefore less expensive to serve) than the sum of each individual country's demand. If daily peaks in demand happen at different times in the day, e.g. because of time differences or cultural differences, then the aggregate profile of demand will be flatter than its individual elements.

4.1.7 Overall assessment

In this section we summarise our assessment of this option with respect to the following aspects:

- Recognise all renewable power notionally capable to reach the UK: this option does not recognise all such power as it excludes all implicit flows.
- In line with European law: this option may create a barrier to the integration of European markets.
- The likely challengers would be:
 - Market participants trading on implicit.
 - Interconnectors, e.g. BritNed.
 - EU institutions.

The admin burden for Ofgem would be the same as the current situation (based on evidence of explicit bookings / nominations).

We have not identified any major distributional impact relative to the *status quo*, since this is equivalent to the current system.

4.2 Option 2: Explicit and unconstrained implicit

4.2.1 Description

In the explicit and unconstrained implicit option, Ofgem accepts evidence of both explicit and implicit flows as evidence of renewable source electricity consumed or to be consumed in the UK. In day-ahead and intraday market, a least-cost algorithm determines interconnection capacity bookings implicitly based on bids for power across the coupled markets. The evidence required for implicit flows would be evidence of matching sale / buy trades along with corresponding amount of GoOs (see Section 5 for more details).

4.2.2 Key processes, data requirements and administrative burden.

This option requires the same processes as Option 1 in order to process evidence of explicit flows (where market participants book and nominate capacity explicitly). In addition it would require market participants to provide Ofgem with evidence of implicit flows (see Section 5 for more details) and Ofgem to process them. We assume that Ofgem would commission external auditors to verify the claims.

4.2.3 Risk / issues

The technical issue around this option is that it may over-estimate the amount of renewable power imported into the UK, since it ignores some physical constraints. For instance, it ignores interconnection

constraints. Besides, counting all the flows that have potentially entered GB without subtracting the flows that may have exited GB, risks over-estimating the net flows entering GB.

A more economic and political issue is that this increased flow of recognised power would have an effect on the FiT levelisation outcome for GB suppliers. As part of the FiT levelisation process, suppliers who exempt more overseas renewable power pay a smaller share of the total costs of the FiT. However, the total FiT costs in a given year are fixed. In an option with unconstrained implicit flows, some suppliers (e.g. with trading desks) will potentially be able to pass on part of their share of the FiT costs to other suppliers (e.g. without trading desks).

4.2.4 Potential challengers

- **Small suppliers**, as they may pay a larger share of the FiT costs as they may find it harder to access international day-ahead/intraday markets, relative to larger players.
- **Interconnector operators** are likely to capture a smaller share of the value of imported renewable power than in other options, in particular explicit-only. In the explicit only option, it is likely that the interconnector operators capture most of the incremental value of renewable power in the UK compared to in the continent, because the capacity clearing price is likely to include this incremental value.
- Under the LEC regime this option increases the amount of tax exempt supply⁶⁴.
- **UK-based renewable generators** will lose compared to EU continental generators as the relative value of a unit of continental renewable power will increase, since all EU renewable power traded in coupled markets will be recognised. If it is easier to purchase overseas LECs/GoOs, then GB suppliers might seek to procure more of them, possibly at the expense of GB ones.

4.2.5 Impact on volume of recognised RE imports

Estimate of the absolute maximum of claims

In addition to explicit claims, Ofgem would accept unconstrained claims of renewable power traded on the coupled day-ahead and intraday markets in Europe, insofar as it can be matched with a corresponding purchase of power in GB through the coupled markets.

On September, 13th 2015 the total renewable power generated⁶⁵ in overseas coupled market countries over an hour was around 62GWh (ENTSO-E data). We assume that market participants traded around 20 per cent of this amount implicitly using historical data.⁶⁶ This means that around 12GWh of renewable power was delivered to the coupled markets on implicit.

Besides, we estimate the UK bought around 16GWh of power (renewable or not) on implicit in that hour (10GWh from N2EX,⁶⁷ and 6GWh from APX UK.⁶⁸). Anyone who has bought power from the coupled power exchanges on that hour could thus seek to obtain evidence from a renewable generator

⁶⁴ LECs are not issued on generation on output generated on or after 1 August 2015, although there are still some historical overseas LECs due to be imported into the UK.

⁶⁵ We include the following technologies: Biomass, Geothermal, Hydro Pumped Storage, Hydro Run-of-river and poundage, Hydro Water Reservoir, Marine, Other renewable, Solar, Waste, Wind Offshore and Wind Onshore.

⁶⁶ <https://www.energy-uk.org.uk/publication.html?task=file.download&id=4921>.

⁶⁷ <http://www.nordpoolspot.com/Market-data/1/N2EX/Volumes/UK/Hourly/?view=table>.

⁶⁸ <https://www.apxgroup.com/market-results/apx-power-uk/dashboard/>.

that he sold power on that hour in the coupled markets and then present the two pieces of evidence to Ofgem (potentially bundling or breaking down the evidence of sale to match his purchase). It means that the maximum unconstrained claims would be 12GWh for that hour.

Under this option, Ofgem would therefore recognise 2,822MWh of explicit claims and up to 12GWh of implicit claims for the first hour of September, 13th, which gives a total of up to 14,822MWh in this hour.

Market and regulatory constraints on the number of claims

It should be noted that both on the supply and demand side, the number of participants who will seek to demonstrate claims of implicit import of renewable power is limited by some economic and regulatory constraints:

First, participants may or may not seek to trade power implicitly. To trade implicitly one needs to (1) have a balance sheet sufficiently large to be able to cope with credit risk collateral requirements (e.g. around £39 million for trading in every hour of a year) (2) acquire a trading desk and hire staff and (3) purchase a membership from the power exchanges (e.g. around £45,000 for APX UK).⁶⁹

A collateral is not an expenditure – it is a blocked cash (or cash equivalent) account.⁷⁰ The requirement applies to all market participants (suppliers, traders and generators). Assuming a power market price of around £45/MWh, a participant buying 100MW in the UK every hour of the year would need to provide £39 million over the year as collateral.⁷¹ This requirement could be a considerable barrier to entry as only companies with large balance sheet have access to this magnitude of cash accounts or guaranteed bank credit.⁷²

In addition, given the level of traders competence and that trading occurs 24/7, one can expect staff costs (per unit of power traded) not to be insignificant.

Second, even if participants trade implicitly, there may be transaction costs around the matching process (the search costs of finding counterparty either informally or through an exchange, which would charge a fee for this service). We provide more details on the costs of matching in Section 5.3. In some conditions, one would expect that renewable generators make buyers compete for the evidence.

There may also be some regulatory constraints to the number of market participants who will seek to provide claims of implicit flows. For instance some overseas renewable power may be subject to support schemes that have local consumption requirements. We have not seen any explicit references to such conditions in Germany and France, regardless of the size of the power plant (i.e. large generator or e.g. domestic photovoltaic installation).

⁶⁹ Adding up Full Membership, ECV Notification Service, Clearing Membership (applied once per entity per year) and Technology (applied once per entity per year). <https://www.apxgroup.com/trading-clearing/spot-market/>.

⁷⁰ <http://www.nordpoolspot.com/TAS/Settlement-and-collateral/N2EX-settlement-collateral-and-risk-management/>.

⁷¹ $100\text{MW} * 8760 \text{ (hour)} * 45\text{£/MWh} = \text{£}39\text{m}$. Collateral requirements formulae depend on volumes of trades and market prices. Rules differ only slightly for the two UK-based power exchanges. https://www.apxgroup.com/wp-content/uploads/2014_11_01-Collateral-Requirement-Specification.pdf. <http://www.nordpoolspot.com/TAS/Settlement-and-collateral/N2EX-settlement-collateral-and-risk-management/>.

⁷² Of course, market participants who trade smaller amount over shorter time periods would need considerably less collateral requirements. That still implies that only companies with large balance sheet can trade large amounts of power, i.e. there is a barrier to certain trades. A market participants who is able to provide only £10,000 as collateral would be allowed by the exchange to relatively small trades only. A participants who is able to provide £10m as collateral would be allowed virtually any trade.

In Germany, the central pillar of the German renewable energy regime has been the fixed FiT system combined with a guaranteed right of access to the grid for renewable energy projects. For renewable power under a FiT PPA, it seems unlikely that such conditions would apply (this would be at odds with the commitment of guaranteed right of access to the grid).

However, German renewable plants also have the option to sell energy directly and outside the FiT structure. In 2013, around 45 per cent of all onshore wind capacity was marketed directly.⁷³ This share could potentially be subject to conditions of local consumption as condition of eligibility to investment grants or other subsidises than the FiT tariffs. In addition, the reformed German renewable laws⁷⁴ aim to pursue a new approach of remuneration by replacing the FiT with remuneration of subsidised direct marketing.⁷⁵ This new approach could potentially be granted with such conditions.

In France, a guaranteed FiT system also exists. Électricité de France (EDF) and other electricity distributors must purchase the electricity produced by a renewable energies producer at fixed tariffs and for a minimum duration.⁷⁶ Conditions that would require local delivery in exchange of giving subsidies would seem at odds with the guaranteed purchase from the grid. They may however exist in other parts of the regulation, e.g. as part of the conditions for eligibility to licence or investment grants and tax credit.

4.2.6 European context

This option does fit into the requirements of the European Energy Union (see Section 4.1.6).

4.2.7 Overall assessment

Option 2 would score best in terms of recognition of all renewable power notionally capable of reaching the UK and is most closely aligned with the principles of Energy Union

The potential challengers would be the following:

- Small suppliers.
- UK-based renewable generators.
- Interconnector operators.

The admin burden (for Ofgem) would be linked to collecting and processing evidence of trades to match against the GoOs. This would be lighter per transaction than in the options with a cap (no calculation and allocation of cap). The per transaction burden could be similar to Option 1 (processing evidence of nominations may require a similar process to processing evidence of implicit trades) but the volume of claims would be greater than in Option 1.

The potential distributional impact is an important issue of this approach as it could result in a transfer of costs from some British suppliers (likely to be larger ones) to other British suppliers (likely to be smaller ones) through the FITs levelisation process.

⁷³ <http://www.nortonrosefulbright.com/knowledge/publications/66180/european-renewable-energy-incentive-guide-germany>.

⁷⁴ Reformed Renewable Energies Act (EEG 2014), in force as of 1 August 2014.

⁷⁵ <http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Documents/taxes-incentives-renewable-energy-v1.pdf>.

⁷⁶ Law n° 2000-108 dated 10 February 2000, entitled loi relative à la modernisation et au développement du service public de l'électricité.

4.3 Option 3: Explicit and constrained implicit

4.3.1 Description

In explicit and constrained implicit options, Ofgem accepts evidence of all explicit flows but only a share of the implicit flows as evidence of renewable source electricity consumed or to be consumed in the UK. The following table recaps the key features of the sub-options (more details in Section 3.3).

Table 4.1: Determination and allocation of the cap

Level of cap based on ...	Allocation based on...	
	Pro-rata historical trades	Auction outcome
A1. Simple capacity cap	Option 3.A1/ trades	Option 3.A1/auction
A2. Reserved capacity cap	Option 3.A2/ trades	Option 3.A2/ auction
A3. Theoretical maximum assuming 100% netting	Option 3.A3/ trades	Option 3.A3/auction
B. Available capacity cap	Option 3.B/ trades	Option 3.B/auction
C. Flow based cap	Option 3.C/ trades	Option 3.C/ auction

4.3.2 Key processes

Ofgem would accept all claims of explicit flows as in the current situation and Option 1 and Option 2. It would receive all claims of implicit flows but it would set a cap on recognised implicit flows. If the cap is larger than the total amount of claims of implicit flows received, then Ofgem would recognise all claims. In the likely case that claims exceed the cap, then Ofgem would allocate the cap to claims holders in one of the specific ways described below.

Ofgem would set two caps: one for GB (e.g. interconnector capacity based on the capacity from France and Netherlands) and one for Ireland (e.g. capacity based on the links between Ireland and Northern Ireland and GB). We are not aware of how much implicit trading there is in Ireland. However, the CACM regulation requires implementation of single day-ahead and intraday coupling, which requires implicit allocation of cross-border capacity. We understand that the all-island Single Electricity Market Operator already runs implicit auctions on a daily basis. There was however no implicit flows on the interconnectors connected to Ireland on Sep, 13th according to ENTSO-E.

4.3.3 Data requirements and access and admin burden assessment

There are various possible capping options and these will have different levels of admin complexity. In a nutshell, the more realistically an option tries to estimate the true flows, the more complex it will be to administer.

We first describe the data requirements and admin burden to set the cap, and then continue with the ones for allocating the cap.

Setting the cap

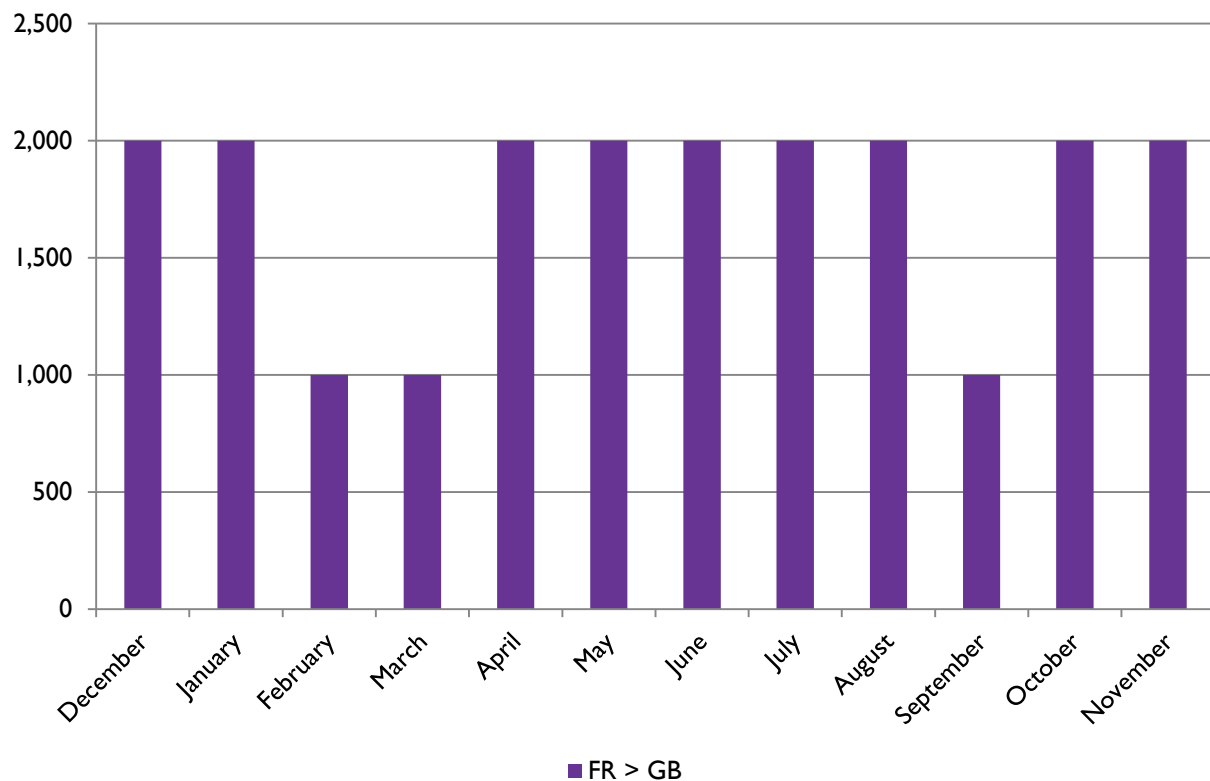
Ofgem would need the following data:

- **A1. Simple capacity cap:**

Data are available from interconnector operators and the National Grid website.⁷⁷ This gives the C in Figure 2.1. The admin burden for Ofgem would be limited as the data are readily available from National Grid reports and other publications.

If Ofgem decides to use some technically-adjusted measure of capacity (in order to take into account curtailments for instance) then the admin burden could increase relatively. ENSO-E publishes data on Forecasted Transfer Capacities - Year Ahead (Year ahead forecasted transmission capacities (MW) per direction between areas.), which could be used. The next figure shows the Forecasted Transfer Capacities - Year Ahead FR – GB in 2015. As shown in the Figure, the forecasted capacity is not always the full technical capacity (2GW) because e.g. planned maintenance. In some months it is even halved. Within a year, the link FR – GB is typically not always fully operational.

Figure 4.2: Forecasted Transfer Capacities - Year Ahead FR – GB in 2015 (MW)



Source: ENTSO-E.

- **A2. Reserved capacity cap:**

There is no mandatory level of reserved capacity, as CACM only requires that a mix of implicit and explicit be proposed to market participants, meaning that any level above zero for the reserved

⁷⁷ Around 6GW of additional interconnection capacity is expected to come online by 2022
[http://www.4coffshore.com/windfarms/interconnector-interconnexion-france-angleterre-\(ifa2\)-icid11.html](http://www.4coffshore.com/windfarms/interconnector-interconnexion-france-angleterre-(ifa2)-icid11.html) ;
<http://www.nemo-link.com/latest-news/> ; <http://www2.nationalgrid.com/About-us/European-business-development/Interconnectors/denmark/> ; <http://www2.nationalgrid.com/About-us/European-business-development/Interconnectors/Iceland/> ; <http://www.theengineer.co.uk/news/vattenfall-and-partners-to-build-uk-norway-interconnector/1007283.article#ixzz1GKUq7SoW>.

capacity is acceptable from the legislation point of view. Interconnector operators reserve a level of capacity, which depends on their expectation of market participants needs.

Ofgem would therefore need to obtain up-to-date data on the amount of reserved capacity. Even though there are some publicly available data on past levels (see Section 2.1.1), we have not been able to find the most up-to-date figures. Ofgem could potentially obtain this data from the interconnector operators.

- **A3. Theoretical maximum assuming 100 per cent netting of explicit capacity:**

In this option Total cap/recognition = C + explicit import claims, i.e. Implicit cap = C = assumed 100 per cent netted capacity + reserved capacity. Therefore this option requires the same data to set the cap as A.1 (interconnector capacity).

- **B Available capacity:**

In this option, total cap / recognition = C + nominated export flows = explicit import claims + (C – explicit import claims + nominated export flows), i.e. implicit cap = C – explicit import claims + nominated export flows.⁷⁸

Therefore, Ofgem would need to process explicit import claims (received as part of the explicit evidence collection process) and the publicly reported export nominations from ENTSO-E.⁷⁹

- **C. Flow-based:**

Ofgem would not need any evidence from participants to set the cap based on historical flows. It would however require relatively heavy calculations based on ENTSO-E data to set the cap. There are two ways to estimate of implicit flows based on data are available on ENTSO-E:

- **Using Implicit Allocation - Net Position:**

Ofgem can use the Implicit Allocation – Net Positions (IA-NP) on day-ahead and intraday from ENTSO-E.⁸⁰ Net position informs whether given area Import or Export energy. Negative values represent import while positive values need to be interpreted as export.

Ofgem would need to add day-ahead (D in Figure 2.1) and intraday (I in Figure 2.1) Implicit Allocation – Net Positions to obtain an estimate of total implicit flows.

For each hour, ENTSO-E indicates in the adjacent data column whether the net position was in the import or export direction. Ofgem would need to add up the import net position over the course of the relevant period.⁸¹

ENTSO-E reports the “Implicit Allocations - Net positions” for the GB zone which means that it would take into account implicit allocations from Ireland, while the GB cap needs to be set with reference to the two links to the continent in the options with constrained implicit flows. One needs to remove the allocation with Ireland to obtain the net implicit allocation on the two continental borders only. If GB was exporting a little to Ireland on that day through implicit allocation then the overall implicit allocation between the continent and GB would be larger than reported by ENTSO-E for GB as a whole. (On Sep, 13th net implicit allocations with Ireland were zero however.⁸²)

⁷⁸ In our example (Figure 1.1) it is C – NI + NE if we assume that all import nominations are claimed as renewables.

⁷⁹ <https://transparency.entsoe.eu/transmission-domain/r2/totalCapacityNominated/show>.

⁸⁰ <https://transparency.entsoe.eu/transmission-domain/r2/implicitAllocationsNet/show>

⁸¹ For instance, if Ofgem allocates the flows every month, then it would add the net hourly import positions over the month.

⁸² <https://transparency.entsoe.eu/transmission-domain/r2/implicitAllocationsNet/show?name=&defaultValue=true&viewType=TABLE&areaType=BZN&atch=faIse&dateTime.dateTime=13.09.2015+00:00|CET|DAY&contractType.values=A01&biddingZone.values=CTY|GB>

- **Using Cross-Border Physical Flow and Total Nominated Capacity:**
 Alternatively, Ofgem can use Cross-Border Physical Flow (NF4 in Figure 2.1),⁸³ and Total Nominated Capacity (NI and NE in Figure 2.1).⁸⁴ ENTSO-E defines Cross-Border Physical Flow (CBPF) as the measured real flow of energy between neighbouring areas on the cross borders. Total Nominated Capacity (TNC) are aggregated capacity nominated by market participants from time horizons (including Intra-Day) corresponding to explicit allocations, agreed between the TSOs and confirmed to the market.⁸⁵
 Ofgem would need to collect the sum of the import and export nominations on the GB- FR and GB – NL border, which are NI and NE in the Figure 2.1. Ofgem would then be able to calculate the implicit flows as the difference between the sum of the Cross-Border Physical Flow on the two borders (NF4 in Figure 2.1) and the net import nominated capacity, i.e. $NF4 - (NI - NE)$.
 Note that this gives the sum $D - I$ in Figure 2.1 and would give $D + I$ if intraday allocation were in the import direction.⁸⁶
- **Potential differences between the two methods:**
 Using the conventions introduced in Figure 2.1, the method using implicit allocation (net position) is a direct estimation of the net of D , IE and II , while the method using cross-border physical flows estimates them by subtracting the net nominations (the net between NE and NI) from $NF4$ (final physical flows).
 There will always be some small differences between the two because the sum of the nominations and the day-ahead/intraday allocation is the Scheduled Commercial Exchanges on ENTSO-E. There are differences between Scheduled Commercial Exchanges and final Cross-Border Physical Flow because of some technical constraints. In the first hour of September, 13th the difference between the Scheduled Commercial Exchanges from GB to continent (NL and FR) and the Total Nominated Capacity was 194MW and the Implicit Allocation - Net Position were 192MW, i.e. essentially the same. However the difference between Cross-Border Physical Flow and Implicit Allocation - Net Position was around 220MW.

Allocating the cap

The data requirements to allocate the cap are more straightforward:

- **Historical trades:** participants would need to provide evidence of implicit sale of renewable on a power exchange within a coupled market country and evidence of implicit buy in GB on power exchanges (See Section 5). Ofgem would add up the claims in volumes, calculate the shares for each participant and allocate the cap proportionally to the share. The evidence requirements would be the same as in Option 2 (unconstrained implicit) but the burden would be higher due to the capping and allocation processes. This applies to Ofgem, but the burden could also be higher for supplier

!BZN|10Y|00|A|00|A59C&dateTime.timezone=CET_CEST&dateTime.timezone_input=CET+(UTC+1)/+CEST+(UTC+2) .

⁸³ [https://transparency.entsoe.eu/transmission-domain/physicalFlow/show?name=&defaultValue=false&viewType=TABLE&areaType=BORDER_CTY&atch=false&dateTime.dateTime=13.09.2015+00:00|CET|DAY&border.values=CTY|GB|CTY_CTY|GB_CTY_CTY|10YFR-RTE-----C&dateTime.timezone=CET_CEST&dateTime.timezone_input=CET+\(UTC+1\)/+CEST+\(UTC+2\)](https://transparency.entsoe.eu/transmission-domain/physicalFlow/show?name=&defaultValue=false&viewType=TABLE&areaType=BORDER_CTY&atch=false&dateTime.dateTime=13.09.2015+00:00|CET|DAY&border.values=CTY|GB|CTY_CTY|GB_CTY_CTY|10YFR-RTE-----C&dateTime.timezone=CET_CEST&dateTime.timezone_input=CET+(UTC+1)/+CEST+(UTC+2))

⁸⁴ <https://transparency.entsoe.eu/transmission-domain/r2/totalCapacityNominated/show>.

⁸⁵ TBC includes some intraday explicit allocation as indicated by ENTSO-E in the definition of the data (“Total Nominated Capacity are aggregated capacity nominated by market participants from time horizons (including Intra-Day) corresponding to explicit allocations, agreed between the TSOs and confirmed to the market.”).

⁸⁶ A disadvantage of this approach is that it gives the implicit allocation of day-ahead and intraday combined. Therefore Ofgem would not be able to disentangle day-ahead and intraday implicit in this approach.

because of higher uncertainty around the amount of certificates recognised. This would feed into a higher uncertainty around their share of costs in the FiT levelisation process, which could have some cost implications. This increased uncertainty is true under all options but in this option not only would they not know other parties' imports (which they would not know in any case), but they would not even know their own.⁸⁷ It could also make the decision of opening / maintaining a trading desk more difficult to make (or less likely) as the expected benefit from renewable electricity sold / bought from the coupled market would be uncertain.

- **Auction-based:** the admin burden for market participants would be linked to the processes required to participate in the auction. Participants would potentially need to provide evidence of implicit buy / sale of renewable on a power exchange as well (for eligibility criteria).. For Ofgem, it would depend on whether Ofgem or the interconnector operators administer the auction.

4.3.4 Risk/issues

The main disadvantage of this method is that participants who have provided renewable power in the day-ahead and intraday market may not receive recognition of that power. Market participants would not know in advance how many renewable certificates they are likely to be able to make use of in GB. This may result in an acute uncertainty around their share in the FiT levelisation process as mentioned above.

Another related risk is that some GoOs would almost necessarily not be usable in GB, despite having been legitimately procured in another EU Member States. Since the FMD process happens annually with 1 July deadline, they would also not be usable in other countries either (it would be too late).

4.3.5 Potential challengers

As in Option 1, the likely challengers will be European renewable generators who may argue that their generation (if traded in coupled markets) may notionally have reached the UK. It is possible that some participants may be able to provide Ofgem with a combination of evidence on sale / buy trades and GoOs but that Ofgem does not recognise these certificates.

As mentioned above since the FMD process happens annually with 1 July deadline, they would also not be usable in other countries either (it would be too late). Therefore those un-recognised certificates would lose their value. Market participants would have to estimate the probability of a certificate being recognised or not (which depends on how many certificate the other relevant market participants decide to claim in the UK) before deciding to claim it in the UK or elsewhere in Europe. This would add a layer of costs / complexity to the use of renewable certificates for supplier/generators in the coupled market countries.

In the options A, i.e. where Ofgem set a very simple but unrealistic cap on implicit recognition, market participants may challenge Ofgem, and argue for a more realistic (and potentially larger) cap.

⁸⁷ "Game theory" models are particularly well suited to predict the possible outcomes and the constraints around them in situation where a participant's pay-off depends on other participants' decisions as well as his own. This particular situation, where a participant cannot fully control his own "behaviour" (its level of recognised imports) may be well modelled by "mixed strategy equilibrium", which introduces random variables in the modelling of participants' behaviour.

Conversely, in the option B and C, market participants might argue that the cap introduces too much uncertainty and unpredictability, while remaining only an approximation of maximum or actual implicit flows.

In the auction-based allocation, the small generators may argue that they are disadvantaged compared to the larger players. Participating in an auction incurs some costs, e.g. additional staff, which a large generator may be better able to spread over a larger number of auction (or a higher volume per auction). If larger players benefit from such economies of scale then they are more likely to participate into the auction and for a larger volume. Larger participants may therefore receive a larger proportion of the total certificates than their market share in implicit trades.

Some participants may challenge the validity of the auction and legitimacy of the auctioneer, especially if the interconnectors gain further value from running the auctions.

4.3.6 Impact on volume of recognised RE imports

In this report we focus on the cap set on imports from the continent to GB (i.e. using the links from France and the Netherlands to GB). Ofgem would need to follow an identical process to set the cap on flows from GB to Ireland.

The total volume of explicit power recognised would be 2,822 MWh for the first hour of September 13th 2015, as calculated above (Section 4.1.5).

We estimated the amount of claims of day-ahead and intraday trades of renewable power imported in the UK on the coupled markets at 12,000MWh for the first hour of September, 13th in Section 4.2.5. The following sections assess what the caps would be under the various capping sub-options.

If the cap happens to be larger than 12,000MWh in this hour, then Ofgem would recognise all implicit flow claim presented, i.e. 12,000MWh. If the cap is found by Ofgem to be smaller than the claims on implicit flows (i.e. smaller than 12,000MWh), Ofgem would then need to allocate this amount using pro-rata or auction-based methods.

A1. Simple capacity cap

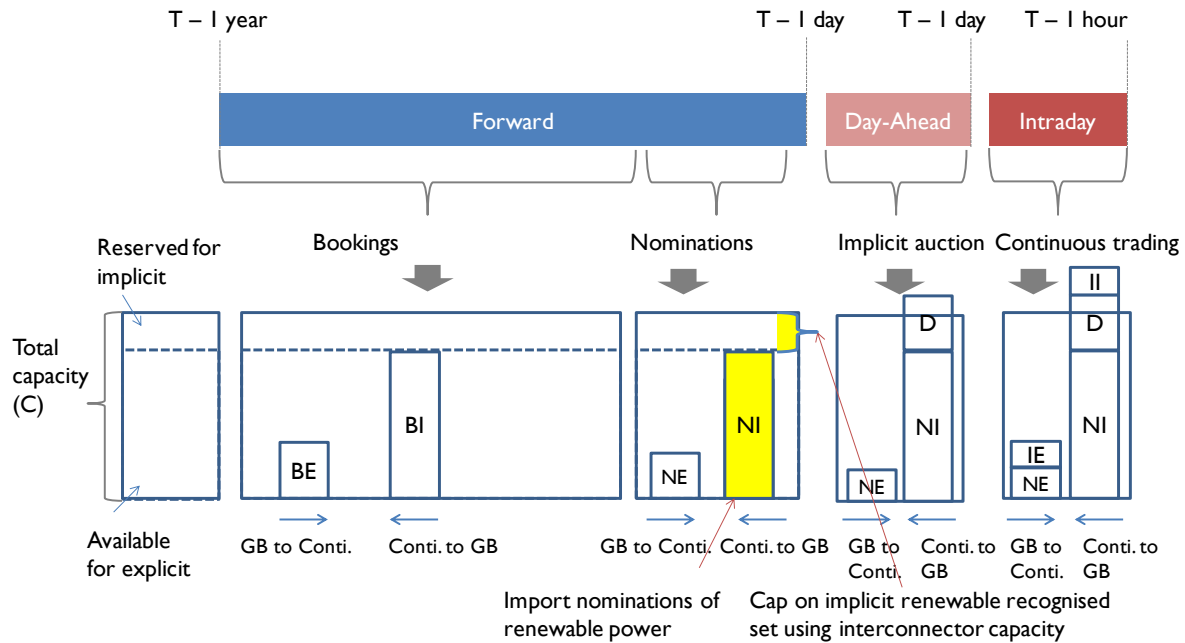
The current technical import capacity from the continent to GB is 3GW,⁸⁸ ⁸⁹ i.e. in the first hour of September, 13th 2015 the maximum flow in the import direction was 3GWh. Therefore, the implicit cap would be $(C - \text{explicit import claims of renewables}) = 3,000 - 2,822 = 178\text{MWh}$.

We illustrate this capping option in the following figure. The cap on renewable implicit flows recognised is shown as the yellow area.

⁸⁸ Counting the links to France (2GW), Netherlands (1GW). We do not include the links Northern Ireland to Scotland (0.5GW) and Ireland to Wales (0.5GW) as these would need to be including in a separate cap between Ireland / Northern Ireland and GB. <http://www.gridwatch.templar.co.uk/>.

⁸⁹ Between 4 and 5 additional GW are expected by 2020. <http://www.nemo-link.com/pdf/NG-Getting-More-Connected.pdf>.

Figure 4.3: Amount of renewable recognised (cap AI “Simple capacity cap”)



A2. Reserved capacity cap

We assume reserved capacity across the two interconnectors is 20 per cent of the total, i.e. Ofgem would set the cap on recognised implicit flows at 600MWh.

A3. Theoretical maximum assuming 100 per cent netting of explicit capacity

In this approach the implicit cap is equal to C, i.e. it is 3GWh.

B. Available capacity

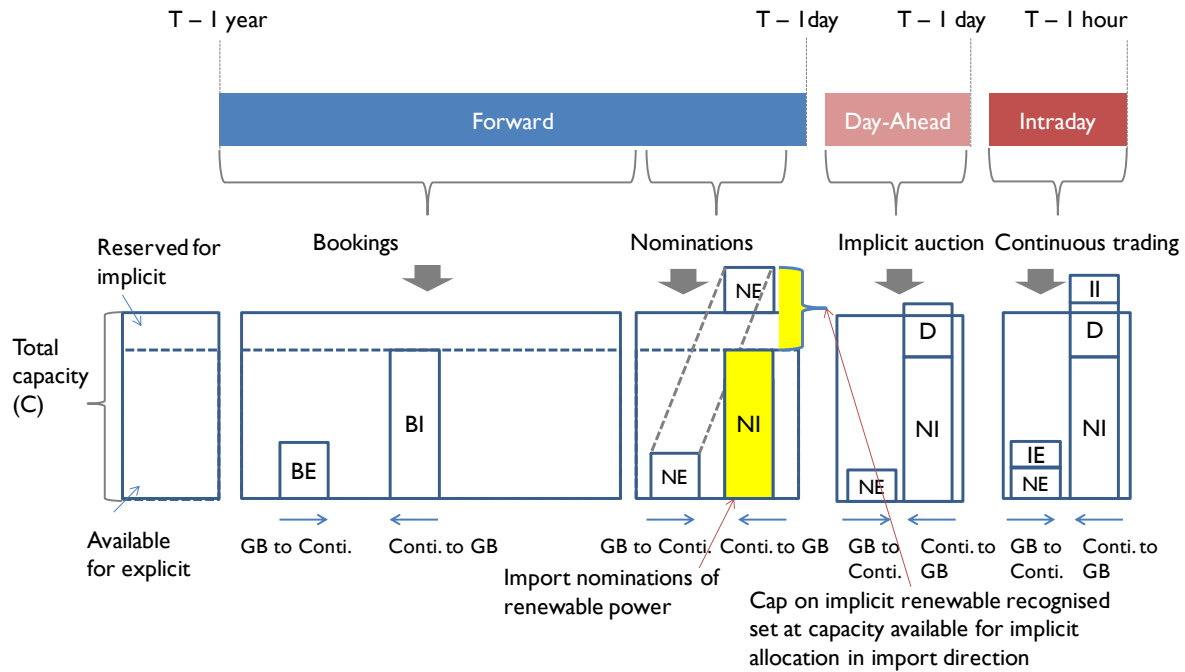
The current technical import capacity from the continent to GB is 3GW, i.e. in the first hour of September, 13th 2015 the import capacity (C) was 3GWh.

1,900MWh was nominated from FR to GB and 460 from GB to FR. 922MWh was nominated from NL to GB and 255 from GB to NL. We assume all import nominations are import claims as mentioned earlier.

Therefore, a total of 2.822MWh was nominated in the import direction (NI) and 715MWh was nominated in the export direction (NE). Therefore the cap on implicit trades would be $C + NE - NI = 3,000 + 715 - 2,822 = 893\text{MWh}$ for the first hour of September, 13th.

We illustrate in the following figure the amount of renewable recognised using option B. “Available capacity” to set the cap on implicit flows recognised.

Figure 4.4: Amount of renewable recognised (cap B. “Available capacity”)



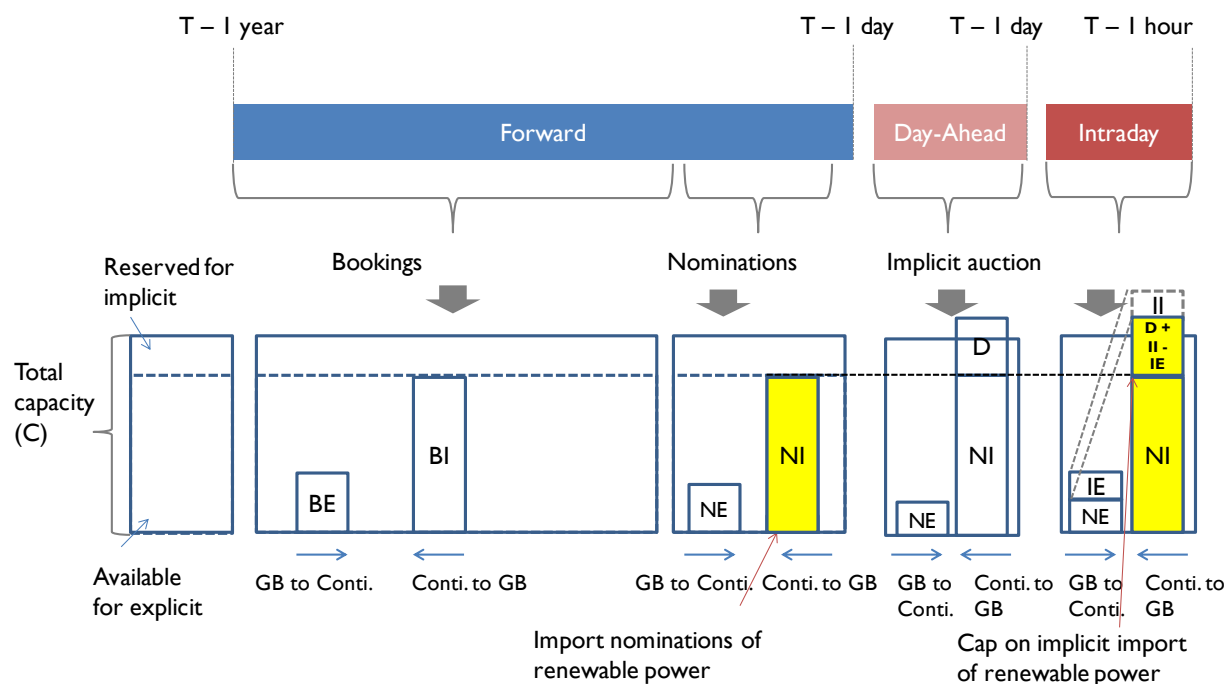
C. Flow-based

Ofgem would need to estimate the amount of net implicit flows in this approach. In the Figure 2.1, the net implicit flows are shown by the bars D, II and IE. As mentioned earlier, the net flows in this hour are $D + II - IE$.

In the first hour of September, 13th, the net day-ahead flows on the GB bidding zone were 192MWh in the import direction (the D in Figure 2.1). On the same day, intra-day flows were 0. Therefore the cap set on implicit flows under this option would be 192MWh in the first hour of September, 13th.⁹⁰

We illustrate in the following figure the option C. “Flow-based” to set the cap on implicit flows of renewables recognised.

⁹⁰ Note that one can estimate the implicit flows alternatively using the difference between cross-border flows / schedule commercial exchanges and nominations. This does not enable one to disentangle day-ahead and intraday allocations however.

Figure 4.5: Amount of renewable recognised (Option C. “Flow-based” cap)

Allocation of the cap

We do not provide numerical examples of the allocation outcomes. For the pro-rata allocation method, Ofgem would need to collect claims from market participants and there is no publicly available proxy of how many implicit trades were made by each market participant (trades on implicit power exchanges are anonymous).

Similarly, estimating the outcome of an auction-based allocation process is outside the scope of this study, in particular since the precise design of such auction is not defined, which is likely to have an impact on the possible outcomes. Granular data (i.e. over time and by participants) on the expected valuation of the certificates and the costs of participating in the auction are likely to be required to perform such analysis.

4.3.7 European context

This option does not fully fit into the requirements of the European Energy Union. It leads to non-recognition of some GoOs despite there being no doubt as to their accuracy, reliability or veracity.

4.3.8 Rating

In this section we summarise our assessment of how this option scores against the different criteria considered.

- Recognise all renewable power notionally capable of reaching the UK: these options do not recognise all the power that may notionally reach the UK since it sets a cap on the implicit flows recognised.

- Facilitates integrated European markets? This option does not recognise some renewable power produced by EU generators.
- The potential challengers would be the same as in Option 1. In the allocation option based on an auction, it is possible that small generators would be disadvantaged if there are economies of scale relating to taking part in the auction (e.g. by spreading over more auctions the costs of additional staff). Market participants, especially those who did not enter or win the auction, might challenge the validity of the auction and legitimacy of the auctioneer. This would be particularly likely if the interconnectors gain further value from running the auctions.
- The admin burden (for Ofgem) would be the same as in Option 2 (evidence of trades & GoOs) but Ofgem would also need to administer the calculation of the cap and the allocation of the claims).
- The potential distributional impact could be from small generators to large generators in the auction-based allocation.

4.3.9 Pros and cons

The following table summarises the pros and cons of each option to set the cap. The key point is that the more realistic the implicit flows estimation is to set the cap, the more burdensome the implementation is for Ofgem and market participants.

Table 4.2: Pros and cons of capping option

Option	Pro	Con
A1 Simple capacity cap	Simple, transparent, easily communicated, predictable	Underestimates actual notional flows Challengeable rationale
A2 Reserved capacity cap	As per AI	As per AI – underestimates even more Challengeable rationale
A3 Theoretical maximum assuming 100% netting	As per AI	Overestimates actual notional flows Challengeable rationale
B Available capacity cap	Closer to actual potential flow Allows to disentangle between RE explicit imports (i.e. claims) and non-renewable explicit imports, which gives a degree of validation of explicit import claims	Requires external data and calculations. Harder to predict Can only know what the cap is once the implicit flow data is published by ENTSO-E
C Flow based cap	Closest to actual flow Strongest rationale	Wholly based on external data and calculations. Harder to predict Can only know what the cap is once the implicit flow data is published by ENTSO-E

4.4 Options comparison

4.4.1 Summary of impact on volume of recognised renewable imports

The following table summarises how much renewable imports would be recognised in each option for an illustrative hour.

Table 4.3: Continental renewable flows recognised (delivery during the first hour of September, 13th 2015, MWh)

	Option 1	Option 2	Option 3.A1	Option 3.A2	Option 3.A3	Option 3.B	Option 3.C
Explicit claims recognised	2,822	2,822	2,822	2,822	2,822	2,822	2,822
Implicit claims (up to)	--	12,000	12,000	12,000	12,000	12,000	12,000
Cap on implicit recognised	--	--	178	600	3,000	893	192
Total recognised	2,822	14,822 (*)	3,000	3,422	5,822	3,715	3,014

Note: The capacity of the two continental interconnectors combined is 3,000MW. (*) Absolute maximum subject to additional economic and technical constraints.

4.4.2 Assessment summary

In this section we summarise our assessment of the following aspects for each option:

- Recognise all renewable power notionally capable to reach UK?
- Facilitates integrated European markets?
- Admin burden.
- Potential challengers.

We also summarise the distributional impacts identified through the detailed options analysis in the previous sections (e.g. when an option would transfer revenues from large to small suppliers). Each individual assessment is described in more details in the relevant sections above.

Table 4.4: Summary of detailed assessment and option

	Option 1	Option 2	Options 3 (trades)	Options 3 (auction)
Recognise all renewable power notionally capable to reach UK	No	Yes	Partially (More than 1, less than 2)	Partially (More than 1, less than 2)
Facilitates integrated European markets?	No	Yes	Partially (More than 1, less than 2)	Partially (More than 1, less than 2)
Main potential challengers	European renewable generators Potentially large British suppliers EU institutions Interconnectors, e.g. BritNed (but less than in Option	Potentially small British suppliers. UK-based renewable generators Interconnector operators	Same as Option 1	Same as Option 1 (less interconnector operators if auction administered by them) Potential challenge around validity of the auction and legitimacy of the auctioneer,

2)				<p>especially if interconnector gains further value from it. Likely to include participants who did not enter or did not win the auction.</p> <p>Potentially small market participants</p>
Admin burden (for Ofgem)	As currently	As Option 1 + Processing evidence of trades & GoOs.	As Option 2 + cap calc. and allocation	As Option 2 & cap calc. & auction process (if administered by Ofgem)
Admin burden (for market participants)	As currently	Providing evidence of trades	Providing evidence of trades	Burden related to participating in auction
Potential distributional impact (revenue flows)	--	From small British suppliers to large British suppliers (FiT)		From small generator / suppliers to large (auctions)

5 Evidence of Implicit Flows

5.1 Principle

In the option where Ofgem recognises only explicit flows the same evidence as currently provided would be required. The main one is evidence of booking/nominations at the interconnector.

In all the options where Ofgem recognises some implicit flows, market participants claiming implicit flow recognition would need to provide the following documents to support the claim that they sold/bought renewable power into/out of the coupled markets in a given time period:⁹¹

- Evidence of sale / buy on coupled market:
 - Evidence of implicit sale of renewable on a power exchange within a coupled market country.⁹²
 - Evidence of implicit buy amount of electricity by a supplier on a power exchange in the UK in the same time period.⁹³
- Matching GoOs for corresponding amount of renewable electricity cancelled for consumption in the UK (See Section 2.2).⁹⁴

5.2 Practical examples of evidence of sale/buy on coupled markets

In the following section we describe in more detail what evidence could be provided by market participants to prove that they traded implicitly on coupled markets.

5.2.1 Overview

Trades on coupled markets are anonymous (it is a requirement of the CACM regulation)⁹⁵ so the power exchanges would not be able to provide a list of names matching the trades over a period as part of a regular process for collecting the claims.⁹⁶ There are three types of evidence that market participants can provide to Ofgem:

- Reports on trade submitted by the exchange (on behalf on market participants) to ACER as part of the REMIT requirements. Market participants can obtain their own reported trade data upon request.

⁹¹ In the Option 2 (unconstrained implicit), all claims would be recognised. In the options with a cap (Option 3), some claims would not be recognised if the total amount of claims exceeds the cap.

⁹² Belgium, Denmark, Estonia, Finland, France, Germany, Austria, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Sweden, Italy, Slovenia, Spain and Portugal.

⁹³ Depending on administrative choice, the relevant time period would not necessarily have to be on an hourly basis. Quantities of electricity sold/purchased implicitly could be aggregated daily, weekly, monthly, etc

⁹⁴ GoO is a "green certificate" which tags a unit of renewable source electricity. After selling the associated power, the relevant institution cancels the GoO, so that a generator or a trader in principle cannot sell the same amount of electricity a second time as renewable source electricity. Ofgem has a statutory duty to recognise GoOs (albeit not strictly under CCL).

⁹⁵ http://ec.europa.eu/energy/sites/ener/files/documents/cacm_final_provisional.pdf, Article 7, 1.(d).

- Notification of trades sent by market participants to the **British settlement party** (and confirmed in return by the settlement party) for balancing purposes.
- Log of trades stored in the **back-office websites** of the two power exchanges.

The following table summarises the main characteristics of the three types of evidence in terms of:

- Function - e.g. enable the central settlement party to balance the system or enable ACER to monitor market abuse.
- Status of the evidence – e.g. reports to third party or notification sent to the settlement party to enable it to balance the system.
- Time frame - sent ex-post (at the end-of the day) or real-time (during the trade).
- Geographical scope – whether it could be used to show evidence GB-based market participants trades only or overseas trades as well?
- Market participant – whether only GB off-taker would be able to provide the evidence (“buy evidence”) or overseas seller as well (“sale evidence”)

Table 5.1: Characteristics of evidence, which market participants can provide to Ofgem

	REMIT	British central settlement party	Exchange back-office website
Function	Regulatory (monitoring market abuse).	Safety (system balancing).	Back-office (keeping audit trail of trades).
Status	Reports sent by exchange to ACER.	Notification that bids for buying / selling has been successful sent by market participants (or exchange on their behalf) to settlement party. Confirmation sent in return by the settlement party that trade can go ahead.	Back-office audit trail.
Timeframe	Daily ex-post (after end of previous trading day)	Real-time (part of the trade)	Ex-post (after trade)
Geographical scope	All coupled markets.	Potentially all coupled market as all coupled countries likely to perform similar process locally. Evidence from overseas e.g. FR, DE may be in different format / language than British ones.	All users of exchanges, which offer back-office services (likely to be all coupled market).
Market participant	All (suppliers, generators, traders).	Potentially all.	All

Here are the pros and cons of each option:

- ACER may be more pro-active in collaborating with Ofgem than e.g. power exchanges in case of e.g. a technical failure of their database because of its statutory duty as an association of regulators.
- The grid and the power exchanges back office systems have been up and running for a much longer time than ACER / REMIT wholesale transaction reporting requirements , which came fully into force on October, 7th 2015. It means that the former have more data history and that the systems may be

less likely to meet technical issues. This may be counter-balanced by the fact that ACER may use more recent database technology.

- It is not clear whether the records of the notifications to the British settlement party would provide evidence of sale transactions. It may only provide evidence of buy transactions. The settlement party must receive notifications from the exchange that a matching sale order corresponds to a buy order but it may not store the identity of the sale party since it is located outside the UK.⁹⁷

In the following sections we provide more details on the different possible evidence.

5.2.2 From ACER

Since 7 October 2015,⁹⁸ all market participants in the coupled market are required by REMIT Article 8 to provide ACER with a record of their wholesale energy market transactions.⁹⁹

For instance, N2EX provides automated reporting of contracts traded on N2EX day-ahead and intraday markets directly to the ARIS system.¹⁰⁰ N2EX is a Registered Reporting Mechanism (RRM) to ACER. Every trade on the N2EX day-ahead and intraday markets is reported automatically to ACER on a daily basis, i.e. the whether or not market participants access the REMIT Portal. Market participants can see when data is sent to ACER and whether it was submitted successfully. APX is also an RRM and offers REMIT data reporting services. The European Energy Exchange (EEX) and EPEX SPOT will offer REMIT reporting services as well.¹⁰¹

Details of standard contracts and order to trade shall be reported no later than on the working day following the conclusion of the contract or placement of the order.¹⁰² ¹⁰³ The information reported includes

- The price and quantity agreed.
- The dates and time of execution.
- The parties to the transaction.

On N2EX, market participants can on request get their trade data from the platform. They can on request get their trade data from Nord Pool Spot. APX provides a copy of the reported trade data to its members. Data are reported in a daily batch (T+1).

⁹⁷ To be verified by reviewing the notifications database, which is accessible to registered trading parties.

⁹⁸ <http://www.nordpoolspot.com/services/remit/>.

⁹⁹ REMIT is an EU regulation on energy market integrity and transparency (No 1227/2011). Its main purpose is to prevent market abuse. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R1227&from=EN>

¹⁰⁰ <http://www.nordpoolspot.com/services/remit/>.

¹⁰¹ https://www.epexspot.com/en/press-media/press/details/press/EEX_EPEX_SPOT_Gaspoint_Nordic_and_Powernext_to_launch_REMIT_reporting_services_on_7_October.

¹⁰² A standard contract concerns a wholesale energy product admitted to trading at an Organized Market Place (OMP), irrespective of whether or not the transaction actually takes place on that market place. N2EX and APX are OMPs.

¹⁰³ <http://remithelp.nordpoolspot.com/remit-regulation>.

5.2.3 From the settlement party

In GB, when participants both agree to make a trade on an exchange, they, or the power exchange on their behalf, notify the central settlement party (ECVAA) of the traded volume.¹⁰⁴ ¹⁰⁵ This notification includes details of the trading parties and the kWh quantities of trade.

The ECVAA web-service (EWS) reports all Energy Contract Volume Notification (ECVN).¹⁰⁶ The reports are available to all registered market participants. They provide information volume traded between sellers and buyers by settlement period.

In particular:

- The “Seller” will have an account debited and so the volume recorded is negative.
- The “Buyer” will have an account credited and so the volume recorded is positive.
- The party ID provides information on the identity of the seller and buyer.¹⁰⁷

Although we were not able to verify this information without accessing the EWS, we understand that where the party has bought energy on the exchange, then the selling party may be identified as the exchange. In that case this evidence could only be used for GB-based market participants buying power from a GB exchange. However, grids in overseas coupled countries are likely to perform the same type of process. Overseas generators would thus be able to provide evidence from their local settlement party. In that case, evidence might be provided to Ofgem in different format and languages, which would make their implementation more costly in resources.

5.2.4 From the power exchanges

Market participants have back-office software or websites provided by the power exchanges,¹⁰⁸ which keep a log of the trades done over a period. In APX UK’s back-office website, this is the “Contract Book”.¹⁰⁹

The contract book contains the following information, which would be needed to prove a sale / buy on coupled markets:

- Organization name and Meter no. (in the case of a sale this will be used to prove that generation come a renewable source).
- Volume (this will be used to establish the number of claims).
- Trade time (this will be used to prove that the trade happened in the relevant time period).

¹⁰⁴ Under the New Electricity Trading Arrangements (NETA), all trading parties have to report contracted positions to the Energy Contract Volume Aggregation Agent (ECVAA).

¹⁰⁵ The Energy Contract Volume Notification Agent (ECVNA) acts on behalf of the trading parties, and notifies information relating to the electricity trade into central settlement. See http://www.uea.ac.uk/~e680/energy/energy_links/electricity/Overview_NETA_V1.0.pdf for more details on the duties of market participants in terms of notification to the central settlement party.

¹⁰⁶ http://www.elexon.co.uk/wp-content/uploads/2013/11/ecvaa_web_service_v5.0_cgi.pdf.

¹⁰⁷ The current list of Party-IDs can be found at <https://www.elexon.co.uk/bsc-related-documents/bsc-signatories-qualified-persons/>.

¹⁰⁸ For APX, it is the Back office Website. https://www.apxgroup.com/wp-content/uploads/Back_Office_Website_User_Manual_V2_doc.pdf.

¹⁰⁹ Not to be confused with the “Order Book”, which includes information all order stored in APX’s database, including orders in the market that have not yet been matched.

The contract book also reports the location, which would be useful for reporting purposes (to establish the geographical origins of the sale claims). The following figure shows how the results are displayed for APX’s contract book.

Figure 5.1: APX’s c back-office contract book

The screenshot shows the 'Historical Contract Book' interface. It includes a sidebar with navigation options like 'Home', 'Organisational Report', 'Historical Contract Book', etc. The main area has search filters for Organization, Position account, Platform, and Market segment. A 'Filter on:' section includes checkboxes for 'Apply date' and 'Trade time', and date pickers for 'From' (2007-03-30) and 'To' (2007-04-03). A 'Query' button is present. Below the filters is a table with the following columns: Contract ID, Organization code, Organization name, Position account, Instrument, Date, Order ref, Order book ref, Order creation type, Order price, Contract price, Volume, Contract value, Start, Finalisation status, Reverse contract ID, Lead time, Location, Order ref, Position code, and Trade date. The table contains five rows of data for contracts 1000, 1012, 1017, 1012, and 1000.

In the version of APX’s Back Office website we have seen, only the past 3 days of data can be queried so the process of collecting the evidence of trades would have to be made up to three days after the evidenced trades by market participants.

5.3 Contractual chain with more than two parties

It is possible that a supplier / renewable generator may need to evidence more than one sale and buy if a third party, e.g. a power trading company was involved. Traders are always “flat” at the time of delivery, i.e. when they buy an amount of power they sell this same amount to another party before delivery. The evidence required would be the same as for a straightforward trade between a renewable generator and a supplier (see Section 5.2) but market participants would need to provide a contractual chain, i.e. matching amount of sale from the renewable generator, buy from the trader, sale from the trader and final buy from British supplier.

In theory they may more than one third party involved so the contractual chain could be further extended.

5.4 Costs and other constraints around providing the evidence

We anticipate that market participants may be willing to enter bilateral contractual arrangements to facilitate the process of matching concurrent sale and trade. This could be a relatively lengthy process unless some arrangements (e.g. PPAs) are already in place.

It is also possible that the power exchanges would offer to perform this matching process. In that case, we anticipate that the costs for the exchange of setting up the matching platform would be limited, as power exchanges already have the skills and the tools to design this type of platform (since they already manage day-ahead and intraday markets).

A matching process organised by a platform has the potential to be more efficient than bilateral contractual arrangements. If a renewable generator has a bilateral arrangement with a supplier who did not buy power at a time when the generator did sell into the coupled markets, then the contractual arrangements would be worthless in that delivery period. A matching process organised by an exchange could find another counter-party to the renewable generator. However, power exchanges would organise such a process only if the value of certificates (and the certainty around it) is large enough for market participants to be willing to pay the fees.

If there is sufficient competition between renewable generators who sold into coupled markets, the price of a certificate is likely to equate its marginal cost, which would cover the cost of finding a matching party. Examples of these costs include the fees asked by the exchange to organise the market or the opportunity cost of the time and resources used to find a matching counterparty. For market participant who do not currently trade on implicit, then the marginal cost would include the cost of trading implicitly (See Section 4.3.6).

If renewable generators have some bargaining power, e.g. if renewable generation in a period is more scarce than purchase of power in GB in the same period, then the price of the evidence is likely to be closer to the value of a certificate for a supplier, e.g. the value for a supplier to reduce its cost contribution in the FiT levelisation process.

6 Concluding Comments

Some concluding points of this analysis may be summarised as follows:

- Three options have been considered to allocate renewable flows under market coupling, ranging from not recognising any implicit flows (Option 1) to recognising virtually all implicit flows that may have entered GB (Option 2). The intermediary options (Option 3) aim to provide a more realistic assessment of what may have entered GB in practice than Option 2 by setting a constraint (“the cap”) on the amount of flows recognised. We have identified the main pros and cons of each option and sub-options. The key point is that the more realistic the implicit flows estimation is to set the cap, the more burdensome the implementation is for Ofgem and market participants.
- The different options would have a different impact on the amount of renewable flows recognised. Option 1 is likely to recognise the smallest amount (e.g. 2,822MWh over an hour) and Option 2 the largest (up to 14,822MWh in an hour), while the sub-options 3 lie in the middle of the range towards its lower end (from 3,000MWh to 5,822MWh). In Option 2, we have identified a number of search and matching costs and barriers to entry in the trading market, which means that the actual amount of flows recognised may be smaller than the absolute maximum we identified (i.e. smaller than 14,822MWh).
- We have also identified types of evidence of trades on coupled markets, which may be provided by participants in Options 2 and 3.

The question of the allocation of renewable flows is highly complex for a number of reasons including the technical complexity of the implicit allocation of capacity and inter-dependencies of renewable electricity subsidy schemes in GB, i.e. it is not possible to change one element of the renewable regulation without having to weigh in the impact on a range of other schemes and market mechanisms outside the direct scope of the scheme.

Therefore, a number of further analyses would be helpful in understanding the potential impacts of each option:

- Game theory models are particularly well suited to predict the possible outcomes and the constraints around them in situations where a participant’s pay-off depends on other participants’ decisions as well as his own. The situation where a participant cannot fully control his own “behaviour” (in Option 3, its level of recognised imports before allocation of the cap) may be well modelled by “mixed strategy equilibrium”, which introduces random variables in the modelling of participant’s behaviour.
- In the options, which use auction-based allocation mechanisms, further analysis of the expected outcome of such auctions would be appropriate before opting for them. This may be related to the game theory study mentioned above.
- Further analysis on the impact on power prices of the options would also be appropriate as part of a comprehensive economic impact assessment.
- This report has focused primarily on imports from continental Europe to GB, but one would also need to describe how the considered options would apply to electricity imported from Ireland.

- The list of evidence of implicit trades presented in this report might not be exhaustive and participants may prefer other types of evidence. A consultation on this specific question by Ofgem might be appropriate.
- This study has not focused on the legal aspects of the different options proposed, in particular the legal status of evidence of trades as part of the REMIT process (e.g. can they be used for other purposes than market abuse monitoring?).
- The numerical estimations in this report have relied on a number of assumptions, e.g. the first hour of September 2015 was used as a representative hour, while demand and supply are strongly cyclical in power markets. These numerical estimations may be extended to a whole month, or a sample of months to provide more robustness to the estimates.



Appendix



Europe Economics

Appendix – Consultation Responses

Introduction

Ofgem received a large number of answers with 27 official responses. The respondents were generators, suppliers, energy traders, green certificate issuing bodies and trade associations operating in GB and overseas.

The following table shows a summary of the official responses received as part of the consultation.

Table A.1 High-level summary of responses

QUESTION	YES	NO	N/A	KEY
Part A: Consultation on market coupling and Levy Exemption Certificates				
Question 1: Where renewable electricity is traded implicitly across coupled markets, is it possible to evidence the electricity is consumed (or to be consumed) in the UK? Please explain your answer.	19	7	1	Yes = Possible No = Not possible
Question 2: What evidence might generators use to demonstrate that an overseas LEC represents electricity that is, or is to be, consumed in the UK when that electricity has been traded implicitly across coupled markets?	21 ¹¹⁰	6	0	Yes = Evidence provided No = Not provided
Question 3: Are stakeholders aware of any reasons for limiting the issue of overseas LECs to electricity that has been or is to be explicitly traded? Please explain your answer.	13	13	1	Yes = Agree with limiting to explicit No = Disagree
Part B: Call for evidence on the use of LECs in renewable electricity schemes and on wider impacts				
Question 4: Are stakeholders aware of alternative ways of demonstrating proof of GB supply of overseas electricity that do not involve LECs, and, if so, what are they?	12	12	3	Yes = Aware of alternatives (described) No = Not aware
Question 5: Do stakeholders currently acquire LECs purely for non-CCL purposes?	4	16	7	Yes = They do No = They do not
Question 6: What do stakeholders foresee as potential impacts if:				
6.1 Overseas renewable electricity can be demonstrated as consumed (or to be consumed) in the UK where it has been implicitly traded, and LECs are issued for this accordingly?	22	5	0	Yes = Potential impacts described No = Not described
6.2a Overseas renewable electricity was only accepted as consumed (or to be consumed) in the UK (and LECs issued accordingly) where there is explicit booking and nomination of interconnector capacity? – Impact on electricity markets (volume, price and distributional issues)	15	12	0	Yes = Potential impacts described No = Not described
6.2b Overseas renewable electricity was only accepted as consumed (or to be consumed) in the UK (and LECs issued accordingly) where there is explicit booking and nomination of interconnector capacity? – Impact on CCL and UK Renewable Electricity schemes, including FMD, FIT, CFD, and SLC 21D	5	22	0	Yes = Potential impacts described No = Not described

¹¹⁰ We note that more respondents have responded “yes” to Question 2 (i.e. provided examples of evidence) than to Question 1 (i.e. whether they consider that one can provide such evidence). We understand some participants have interpreted Question 1 as referring to physical evidence and Question 2 as referring to notional evidence.

Part A – Consultation on market coupling and Levy Exemption Certificates

The three questions of Part A were the following:

Question 1: Where renewable electricity is traded implicitly across coupled markets, is it possible to evidence the electricity is consumed (or to be consumed) in the UK? Please explain your answer.

Question 2: What evidence might generators use to demonstrate that an overseas LEC represents electricity that is, or is to be, consumed in the UK when that electricity has been traded implicitly across coupled markets?

Question 3: Are stakeholders aware of any reasons for limiting the issue of overseas LECs to electricity that has been or is to be explicitly traded? Please explain your answer.

In this section we analyse the responses in terms of applicability to the options identified in the previous sections. We therefore map the responses to the options identified (Explicit-only, Explicit and unconstrained implicit, Explicit and constrained implicit). When there were salient points, i.e. points that did not fit into the framework of the options identified, we have outlined them.

Overview

We provide below a summary table of the responses, split into the main options considered in the previous section.

Table A.2: Main options identified

Option	Description	Number of respondents
Explicit-only	Ofgem only accepts evidence of forward trades only as evidence of renewable source electricity consumed or to be consumed in the UK. For each forward trade, market participants make capacity bookings and nominations explicitly. Ofgem accepts evidence of nominations / bookings as evidence of the notional flow.	5
Explicit and unconstrained implicit	Ofgem accepts evidence of both forward trades and day-ahead and intraday trades as evidence of renewable source electricity consumed or to be consumed in the UK. In day-ahead and intraday market, a least-cost algorithm determines interconnection capacity bookings implicitly based on bids for power.	8
Explicit and constrained implicit	Ofgem accepts evidence of all forward trades but only a share of the day-ahead and intraday trades as evidence of renewable source electricity consumed or to be consumed in the UK.	13

Note: figures add up to 26 because one respondent described the different options without giving his view on the most desirable one. Some respondents have approached the question of the option as a binary one, e.g. either explicit only or explicit and unconstrained implicit. In one case, we have allocated it to explicit-only but the answer implied that the respondent may have been supportive of an option with a cap if presented with such. One respondent provided details of how the cap might have worked in practice but remained of the view that it would remain insufficient under CCL requirements. We have allocated this respondent to explicit-only.

We provide below the main arguments provided for each option. In a number of cases, they are in line with the options defined in this analysis. However, we have identified a number of salient points brought up in the responses, i.e. which do not fit squarely into one of the options identified.

We discuss the key arguments along with the salient points below.

Explicit-only

Respondents who were in favour of this option were all UK-based generators or suppliers.

They brought forward the following arguments for this option:

- The main argument for this option was that allowing implicit trades would recognise an unrealistic amount of flows into the UK, given capacity constraints.
 - Respondents have mentioned the negative impact on other schemes of allowing unconstrained implicit than the CCL such as the Feed-in Tariffs. Some respondents expect that it would make the FIT levelisation process much more volatile, as it would depend on much smaller GB market supply figure. Respondents have also mentioned that it could imply that some suppliers would bear a disproportionate share of the costs. Participants have mentioned that those could be the small independent suppliers.
 - A respondent has provided details on the following effects:
 - “ensure that the link between the UK taxpayer subsidy and the displacement of conventional generation in favour of new, renewable generation in GB is retained, such that the UK is able to meet its renewable energy targets.
 - “ensure that existing renewable generators in GB, who have made investment decisions based on current market arrangements, are not adversely affected by changes in GB LEC values caused by an increase in the supply of overseas LECs”.
 - Pressure on the prices of UK LECs as continental LECs would become cheaper.
- Some respondents have also doubted of the sheer technical possibility of providing evidence of implicit flows for instance because “power transported is the result of numerous sales and purchases in the two connecting price areas.”
- Respondents have argued that the retrospective allocation of flows is a “grey area” from a EU law compatibility perspective and thus should be avoided to maintain the “reputation and environmental integrity of the continental-LEC.”

The points, which do not fit squarely into one of the options identified, were the following:

- Some participants have referred to the laws of physics to rule out any evidence of implicit flows,¹¹¹ while claims accepted as part of the explicit only option (i.e. as part of the status quo) only provide evidence of a notional flow not proof of physical flow.

Explicit and unconstrained implicit

Respondents in favour of this option were representative bodies of overseas generators, energy traders, a few UK-based suppliers and one confidential green certificates issuing body.

They have brought the following arguments to support this option:

- No physical link can be established between power production and consumption, regardless of whether it was traded implicitly or explicitly. In the current situation, the proof of notional flows is a sufficient evidence to prove the electricity is or is to be consumed in the UK. Therefore it is only an extension of the current system to implicit flows to accept evidence on all implicit flows insofar as one can establish a notional flow between generation and consumption.
- A participant has explained that if one considers that the UK is part of a European Union in the same way as England and Scotland as part of GB, then Ofgem should treat the trades with the European

¹¹¹ Kirchhoff's law of current and one of its implications, which is that the fact that one entry and one exit trade happen over the same half-hour with enough interconnection capacity does not mean that the same electron went from the entry point to the exit point.

coupled markets in the same way as it deals with the trades from Scotland. In particular Ofgem accepts evidence on power produced in Scotland as consumed or to be consumed in the rest of the UK regardless of the availability of interconnection capacity. Another participant has mentioned that not recognised some implicit flows is “not consistent with an open-border approach” and would go “against the tide” of the single European market project. A participants has argued this it would “contravene European law” (mentioning the Articles 34, 36, 30 and 110 of the “TFEU”). A participant also mentioned that continental generators may challenge Ofgem in that case.

- The British legislation requires to provide evidence of origin and supply in the UK as evidence that renewable source power is consumed or to be consumed in the UK. There is however some margin of interpretation around the term “consumption” in the UK as literally one cannot prove consumption in the UK as it is not possible to tag electrons. In other European countries the act of cancelling a GoO against a unit of supply is sufficient to “prove” establish notional consumption in a country. Market participants have mentioned other tools that enable to provide evidence of import of implicit flows (Renewable Directive 2009/28 and “statistical transfer ex post”).
- Some participants expect that in the future both forward and day-ahead / intraday trades will be based on implicit allocation of capacity so one needs to recognise implicit flows otherwise no imported power will be recognised at all at some point.
- In the option where no implicit flows are recognised, the interconnectors are capturing a large amount of the value of the LECs, which increases transaction costs. Recognising implicit flows would allow the value of the LEC to “go directly” to the renewable producers. This would “potentially increase the renewable capacity in Europe over time”.
- A participant considered that implementing an option where not all implicit flows are recognised would be technically “extremely” difficult.
- Market participants have described the potential distorting effect on trades of not recognising some implicit flows.
- Recognising only explicit flows benefit an “oligopoly of suppliers in the UK”. Recognising implicit flows would thus promote better competition in the supply market, which would be to the “clear advantage of UK consumers”.
- A participants has referred to the fact that interconnection capacity will increase “dramatically” in the future.
- A participant has recognised that the CCL regime will need to be “revisited” in the near term based e.g. on previsions that “LEC production will meet demand early next decade” so that there would be little advantage in “considering the restriction of imported LECs in isolation”.

A salient point in the responses in favour of this option was the following:

- Some respondents have drawn out scenarios for the power market in the UK, whereby market participants trade all the power implicitly. In the option identified in this report, Ofgem always recognises evidence on explicitly booked capacity as evidence of renewable source electricity consumed or to be consumed in the UK.

Explicit and constrained implicit

Respondents in favour of this option were a balanced mix of UK/Ireland-based generator / suppliers, trade associations and traders and continental traders, generators, suppliers, certificate traders and a confidential aggregator / supplier of LECs.

The main argument for these options is that it is a balanced option; it recognised implicit flows but set a potentially realistic cap on the amount of power imported into the UK via implicitly booked capacity. Respondents also referred to the arguments included in responses in favour of the two other option (explicit only or explicit-only and unconstrained implicit) to dismiss using either of those (e.g. respondents

have argued that notional evidence of implicit flows can be provide to rule out the explicit only option but then argued for a cap to avoid recognising a quantity of flows that would exceed the capacity of the interconnector).

A salient point of the responses for this option was:

- One respondent has referred to using Financial Transmission Rights traded over a period to set the cap on implicit flows recognised. Financial Transmission Rights, which are financial products whose main purpose is to hedge the risks associated with another trade, do not fit into the framework of the options identified in this report.

Respondents provided specific examples of evidence the generators can provide to demonstrate renewable source electricity is, or is to be, consumed in the UK, when that electricity has been traded implicitly across coupled market. In the following table we list the individual suggestions by option (for the two options we have identified, which recognise evidence on implicit trades, i.e. explicit and unconstrained implicit and explicit and constrained implicit).

Table A.3: Suggested evidence of implicitly traded renewable power (Question 2)

Option	Evidence suggested
Explicit and unconstrained implicit	<ul style="list-style-type: none"> • Series of bilateral contracts and membership contracts with exchanges via REMIT / ACER processes. • Produced electricity. • Simultaneous sell trade on European coupled exchange and buy trade on coupled UK exchange. • Sufficient contract with end-user based in the UK to match sale/buy trade on wholesale markets. • Guarantees of Origin. • Power invoice to counterpart in UK. • Financial Transmission Rights.
Explicit and constrained implicit	<ul style="list-style-type: none"> • Trades on the coupled exchanges (APX NL, Belpex, EPEX SPOT, GME, Nord Pool Spot, OMIE and OTE). • Simultaneous sell trade on European coupled exchange and buy trade on coupled UK exchange. • Auction-based allocation of implicit flows. • Energy bilateral contracts. • Data on capacity available for implicit day-ahead allocation in the import direction.¹¹² • Contractual arrangements.

Part B - Call for evidence on the use of LECs in renewable electricity schemes and on wider impacts

Question 4

Are stakeholders aware of alternative ways of demonstrating proof of GB supply of overseas electricity that do not involve LECs, and, if so, what are they?

12 respondents provided examples of alternative ways of demonstrating proof of GB supply of overseas electricity that do not involve LECs. Three respondents have provided two alternatives.

¹¹² In Figure 2.1, this is $C - (NI - NE)$, i.e. 990MW.

The alternatives focused on GoOs (10) but also mentioned matching sale trades in coupled markets from renewable generators and buy trade in UK coupled market (two); explicitly booked/nominated interconnector capacity (one); Renewable Energy Guarantees of Origin (REGO) (one) and generic renewable energy certificates (one).

Question 5

Do stakeholders currently acquire LECs purely for non-CCL purposes?

Four respondents recognised that some stakeholders acquire LECs purely for non-CCL purposes.

Respondents provided examples of power suppliers who acquired LECs solely to evidence the “greenness” of electricity supplied (i.e. regardless of CCL duty) (three). For instance residential customers did not pay CCL but some suppliers acquired supported residential offers with LEC to evidence the greenness of their product to residential customers.

Respondents mentioned the use as part of the Fuel Mix Disclosure (two) and fuel labels (one). Respondents also mentioned the use of LECs to support exemption claim from other schemes, e.g. Feed-in-Tariffs (FiT) (one).

Note on Q6: In the following answers we have described a comprehensive list of the answers provided and have explained some rationale between the arguments given. The rationales do not always come from the responses themselves as they sometimes only provide high-level description. In these cases and we have provided examples of rationale behind the arguments and mentioned that the logic was not provided as part of the answer.

Question 6.1

What do stakeholders foresee as potential impacts if:

6.1 Overseas renewable electricity can be demonstrated as consumed (or to be consumed) in the UK where it has been implicitly traded, and LECs are issued for this accordingly?

22 respondents have described potential impacts. Most participants described that this option would increase the supply of continental LECs to the UK but outlined different potential impacts. The main themes outlined were the following:¹¹³

Increased competition for UK LEC

As there will be more continental LEC issued, the price of UK- LECs might be under downward pressure. As a result, **investors** may foresee a decrease in realised future revenues for their projects as they would anticipate that renewable projects in the UK might become less profitable. This assumes that UK generators derive a profit from the generation of UK LEC.

Multinational energy companies (i.e. with both renewable generators in Europe and retail supply subsidiaries in Europe) will **benefit more** from the LECs than smaller independent suppliers/generators located only in GB.

¹¹³ We realise that some impacts would be incompatible with each other but report here the main themes as provided.

As the number of EU LEC increases and the value of UK LEC decreases because of competitive from the EU LECs, then renewable generators in Europe will be better off than UK renewable generators (assuming generators are able to derive a profit from the generation of UK LEC).

Lower funds collected by HMRC:

Suppliers holding LECs reduce their tax payments as they are exempted from Climate Change Levy (CCL). Therefore if Ofgem issues more LECs then, *ceteris paribus*, HMRC will collect fewer funds as more consumption become tax exempt.

In the FiT scheme,¹¹⁴ suppliers reduce their contribution to the totals costs of the scheme when they are able to prove that they have bought more renewable power but the total costs of the scheme remain constants.

Therefore is some implicit flows are recognised then some suppliers might increase the recovery rate of FiT (in £/MWh) on some customers. Respondents have argued that suppliers are likely to focus the increase on domestic customers more than businesses (domestic consumption is potentially more inelastic to price changes than businesses).

Respondents have also argued that the FiT funding system might become “not tenable”. Although not fully described in the answer, we understand they might refer to the possibility that large suppliers would be better able to claims the incremental amount of LECs than small suppliers. This would be at odd with Ofgem’s duty and goal to promote competition.

- In the case of constrained implicit, **interconnector operators** would continue to capture some of the value attached by the different environmental schemes to continental LECs.

Although not fully described in the answer the argument seems to be the following. Operators are likely to continue to capture some value of the explicitly imported LECs (See Section 0). In addition, this argument also applies to the option where capped implicit flows are recognised and allocated through an auction (assuming the auction is held by the interconnector operators). In the sub-option where the cap is allocated using an auction-based process of retrospective allocation of naming rights for the flows, then market participants are likely to include the value of the LECs in their bid for the naming rights. The interconnector (or Ofgem if it administers the auction) would capture some value of the LECs as part of the revenue from the auction.¹¹⁵

Increased administrative costs (for Ofgem) as the increased amount of continental LECs will imply an increased amount of accreditation requests for Ofgem to process.

Some less recurrent themes were the following:

Limited impact on price spreads: although not entirely described by the respondents, we understand that this could have the two following meanings:

- Spreads between forward and day-ahead/intraday power prices: an option, which gives LECs to renewable power regardless of whether it was traded on the forward or day-ahead/intraday market will have less impact on the price spread between the two timeframe than an option which gives LECs only for forward flows. An option which gives LECs only for forward flows is giving an extra value to the renewable power traded under forward agreement which may materialize through higher power prices. Note that if the interconnector operator captures the value of the LEC, it is the capacity price that will include the value of the LEC not the power prices on forward markets.

¹¹⁴ Under the Feed-in Tariff (FIT) scheme, some overseas renewable electricity is excluded from the ‘relevant market share’ for suppliers.

¹¹⁵ As interconnector operators hold auctions for Financial Transmission Rights whose value is derived from the difference in prices between interconnected zones, then they will be exposed to the spreads in the value of GB LEC and EU LEC in any option, although indirectly.

- Spreads between bidding areas: the more EU LECs are issued relative to GB LECs, the smaller the difference in prices between the zones will be since the underlying value of power will align more.

Potential double-counting of overseas GoOs. Although not described in more details by the respondent, we understand this risk is related to the administration of GoOs and the fact that it is not possible to know where they will be cancelled when they are issued.

Collapse of the trading market: although the exact chain of effect we understand that as LECs have an impact in price and investment incentive they could in principle direct market forces towards e.g. an excessive amount of renewable, which could not balance the market because of intermittency.

Question 6.2a

What do stakeholders foresee as potential impacts if:

6.2a Overseas renewable electricity was only accepted as consumed (or to be consumed) in the UK (and LECs issued accordingly) where there is explicit booking and nomination of interconnector capacity? – Impact on electricity markets (volume, price, and distributional issues).

15 respondents have described potential impacts. The main common themes were the following:

- **Interconnector operators** would continue to capture most of the value attached by the different environmental schemes to continental LECs.

Although not fully described in the answer, we understand the logic to be the following. Even without an auction operated by the interconnector, it is likely that the interconnector operators capture some incremental value of renewable in UK (compared to renewable value in the continent) when the issuance of LEC is constrained directly or indirectly by the interconnector capacity because capacity at the interconnector is auctioned off in explicit forward and implicit day-ahead auctions.

Suppliers / generators are likely to include the value of EU LEC when bidding for interconnector capacity from EU to GB. The clearing price of capacity in the explicit auction for capacity is likely to be the marginal cost of capacity or power plus the value of EU LECs. In that case, instead of allowing the subsidies to flow from suppliers to renewable generators, the interconnector captures this value in the price of the interconnector capacity. This stems from the fact that the European generation and British supply markets are more competitive than the interconnection market in-between the two, so that both ends charge close to their short-term private marginal costs and the subsidies (which cover long-term public costs) can be captured by the interconnector.

- Distortion of **incentives towards forward trades** as an explicit-only option recognises and thus rewards more power traded under forward arrangements than day-ahead/intraday.
- **Increase in generation from more carbon-intensive** generators in Europe as renewable generation in Europe is less incentivised than if implicit flows are recognised.
- Reduce **suppliers' administration costs** (and therefore prices to customers) as there are fewer flow claims to handle than in option which ranges implicit flows.
- **Required revision** of approach to recognise overseas renewable power if interconnectors move to implicit only (or ban imports of EU LECs at that stage). If the interconnector moves to implicit only, then under this option GB would recognise no renewable power from overseas.

Against EU conditions as it may create barrier to the integrating of EU market.

Question 6.2b

What do stakeholders foresee as potential impacts if:

6.2b Overseas renewable electricity was only accepted as consumed (or to be consumed) in the UK (and LECs issued accordingly) where there is explicit booking and nomination of interconnector capacity? – Impact on CCL and UK Renewable Electricity schemes, including FMD, FIT, CFD, and SLC 21D.

Five respondents have described potential impacts. Some impacts described included the following:

- **Little impact on the CCL** as proportional increase in UK LEC would offset reduction in continental LECs.
- **Positive impact on renewable energy schemes**, by preserving the policy intent behind the CCL and maintaining the LEC market incentive to invest in renewable generation.
- **REGO** may become an EU-wide instrument and the main evidence to prove overseas renewable source power is consumed in the UK.