Vedlegg til høringsnotat fra Nærings- og fiskeridepartementet om innretning av auksjon av tillatelser til oppdrett av laks, ørret og regnbueørret – vurdering foretatt av DotEcon Ltd.

Award of capacity for aquaculture licences

Report on the framework for the award – Demand assessment and Auction format

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1 Demand assessment

1.1 Structure of demand

Substitutes

Licence capacity in different production areas is probably substitutable for most bidders. This is supported by the fact that there was switching between areas in the previous auction. However, tonnes in different areas are not perfect substitutes and we expect bidders to have some regional focus, but to switch between neighbouring areas when there is a sufficient price differential.

Regional focus

The licence conditions state that bidders with capacity in two adjacent areas may use the capacity anywhere across the two, subject to constraints on farming sites. Companies holding capacity in three adjacent areas may do the same if they meet criteria on the degree of processing of the fish.

This provides an incentive to equalise competition across adjacent areas early in the process, avoiding putting price pressure on the main areas. We expect bidders to be focused in the areas where they already have infrastructure and licence capacity, but beyond this, they will be largely indifferent between fulfilling their demand in these or adjacent areas, so will make decisions based on price.

Diversification

The possibility of capacity reductions in future allocation rounds create an incentive for diversification. In this case, players may specifically want capacity in areas that are not adjacent to each other in order to diversify risk of future changes in the 'traffic lights' classification. However, operating across distant production areas may only be feasible for large companies. Only very large companies, who already have a presence throughout the country, won capacity in non-adjacent areas last time.

Concerns for entrants

Entrants, by definition, do not have areas in which they are already based. They may also have requirements for a minimum licence size in order to make a viable business case. In the previous allocation round, licences were required to be a minimum of 100 tonnes. We note that in a clock auction, there is no risk of winning only part of the quantity bid for; therefore, this format is quite suitable when some bidders have minimum quantity requirements.

Synergies

Operational costs and the flexibility derived from holding capacity in adjacent areas could create synergies of a particular form: if an operator cannot have all its capacity in one area, and must spread it across a number of areas, it would prefer these to be adjacent. However, this does not lead to any strong complementarities across areas within the auction. If a bidder is unable to satisfy their demand

in one of their main areas, then it will want to also win capacity in an adjacent production area, to meet its requirement; therefore, capacity in the main area and the adjacent will still be substitutes at the margin, rather than complements, for the bidder.

Our assessment is that bidders' demand will be centred in areas where they are already active, but capacity in different areas, and particularly in adjacent areas, will be substitutes at the margin (i.e. bidders will be willing to trade off a little more capacity in one area with a little less in another).

Implications

The objectives and the structure of demand inform our recommendation about auction format. Capacity being substitutable across production areas implies:

- switching between areas based on price will be important;
- it is reasonable to assume that there should be no reason to reduce demand in an area from one round to another if the price for lots in that area remains unchanged as in this case substitute lots may have become more expensive or remain the same (and so would not have become relatively more attractive); and
- the auction format should restrict the possibility that bidders win capacity they ultimately do not want, for example, to address minimum capacity requirements for entrants.

2 Auction format

2.1 Key issues for auction design

Promoting competition and truthful bidding

An auction process is most likely to generate higher revenue and achieve efficient outcomes if it is competitive and the bids submitted by bidders are aligned with their valuations. Thus, the auction design should ensure that every bidder can express its preferences over what it wants without distortions that might arise from exposure to risks and uncertainty over outcomes, strategic complexity, bidding mistakes arising from unduly complex processes, or strategic bidding incentives.

Flexibility for bidders to express their demand

The definition of 'lots' that are available in the auction is crucial in determining the options available to bidders. Ideally, bidders should be allowed to specify the capacity they wish to acquire in each area, and the price they are willing to pay for this. This can be readily achieved by setting a 'lot' to be a small unit of capacity (say one tonne) in a production area and then ensuring that the auction format allows bidders to bid easily for multiple lots, as a clock auction does.

Aggregation risks

Lots are complementary when a bidder's valuation of the combination exceeds the sum of the standalone values of the individual lots (i.e. valuations are synergistic). When complementarities are strong, bidders might be exposed to *aggregation risks*.[1] Complementarities could arise within a given area (for instance, if some bidders require a minimum capacity that can only be achieved as a combination of lots), or between lots in different areas (for instance, if a bidder's demand for capacity in one area is strongly dependent on whether the bidder will also obtain capacity in a different area).

Aggregation risks can be addressed through lot definition, by defining larger lots (e.g. lots of 50 or 100 tonnes). However, this may unnecessarily restrict the choices available to other bidders, and the possible outcomes of the auction[2] and thus is only a good option when it is possible to define large blocks for which there is consensus

1 The risk that bidders who bid for several lots could end up with an unwanted subset of lots if they only win some of the lots for which they bid.

2 For instance, capacity could be offered in lots of 100 tonnes to prevent outcomes in which entrants end up with less that this amount; however, this will also constrain the options available for other bidders (who may then be unable to bid for the specific capacity they want if it cannot be obtained as a combination of these larger lots) and the extent to which we allow for outcomes where existing users can be given smaller capacity increments.

amongst bidders, and in a way that does not preclude competition at the margin.

Package bids

When this simplification is not possible through larger lots without compromising the flexibility of the process, it is preferable to address aggregation risks through the choice of auction format and rules, for example by accepting bids for combinations of lots ('package bids') that will be accepted or rejected in their entirety. This approach protects bidders from aggregation risks whilst maintaining greater flexibility for bidders when expressing their demand and when determining the optimal assignment of capacity amongst bidders.[3]

Limitations of linear pricing

Another issue if complementarities are strong arises from the limitations of linear pricing. With strong complementarities, bidders will be willing to pay a higher price per lot when they win a greater number of lots.[4] In this context, traditional ascending price auction formats may fail to achieve maximise revenue. This can happen because if there is a uniform price per lot that is increased, then bidders may reduce their demand in large steps, rather than smoothly. This is because at a price per lot that makes a large number of lots unattractive, a smaller number of lots may be even more unattractive (for example, being below the minimum efficient scale for production); this can lead to behaviour such a bidders dropping directly from a large quantity to zero in one step, regardless of how small price increments are set.

Where demand has this feature, it may be preferable to use alternative formats that allow bidders to make alternative offers depending on the number of lots they win, allowing them for example to make a lower offer for a single lot – this would allow the bidder to win a single lot at a lower price. We emphasise that these

[3] For example, clock auctions (such as those used in the previous allocation round) assess aggregate demand on the basis of bids received, and only select winning bids when there is no excess demand. Conversely, in the event that it is not possible to satisfy the demand expressed by all bidders, the clock price is raised, and bidders are given the opportunity to maintain, reduce or withdraw their demand, eliminating the risk that they may win only some of the lots they have bid for. In some cases there may be other restrictions when reducing demand, aimed at reducing the risk of unsold lots and/or strategic bidding. This was the case in the previous allocation round, where bidders were not allowed to reduce demand in areas for which the price had not changed relative to the preceding round. Such restrictions can introduce some aggregation risks for some bidders. However, the materiality of these restrictions depends on the structure of demand. We discuss the use of this restriction below.

[4] To see this, consider a simple case where we use a clock auction to assign three identical lots. Suppose that we have two bidders who each value two lots at more than twice the value they place on a single lot. If bidders simply indicate their preferred number of lots at the clock price, then they will bid for two lots up until the point at which the price per lot exceeds half their valuation for two lots, and then reduce their demand to zero lots – as at this point the clock price exceeds their valuation for a single lot. In this case, one lot would remain unsold.

issues cannot simply be addressed by, say, using a clock auction but increasing prices more slowly.

Switching across categories

Where the lots offered in a multi-item auction may be substitutable, the auction format should ideally allow bidders to express this substitutability, by providing mechanisms by which bidders can switch their demand across lots depending on relative prices. Impediments to switching would lead to *substitution risks*[5] for bidders who would be willing to consider different distributions of capacity across different areas.

In sealed bid processes, substitution risks can be mitigated by allowing bidders to make mutually exclusive bids for alternative portfolios (each portfolio indicating the capacity that the bidder would obtain in each area, with the bidder winning at most one of these). This allows bidders to reveal their full demand profile across substitutable portfolios. However, the number of possible portfolios could be very large if bidders can bid for a wide, continuous range of capacity across a number of areas. Thus, in practice it may not be reasonable to expect bidders to reveal their full demand profile in a sealed bid process.

Switching may be simpler in open bidding processes, where prices are adjusted progressively and bidders can revise their bids on the basis of price and demand information disclosed in the process. However, the auction format and rule are crucial in determining switching possibilities, especially where bidders may wish to switch between different combinations of lots rather than on a lot-by-lot basis (e.g. switch full capacity across areas rather than only some marginal capacity). The challenge with open processes is finding the right balance between keeping bids committing to prevent strategic bidding and providing sufficient flexibility for bidders to adjust their demand (through switching or demand reductions) in response to price developments.

Unmitigated substitution risks may also result in some lots ending up inefficiently unsold, not because of insufficient demand but simply because those bidders who would be willing to acquire the lots have been unable to make the relevant bids, or have simply failed to do so if they failed to anticipate the outcome.

Reducing strategic complexity aids efficiency

A further reason why bids might provide distorted signals of individual valuations is underlying *strategic complexity*, by which we mean the complexity of the decisions that bidders need to take in order to bid successfully. Strategic complexity arises mainly from uncertainty over results and the inability of bidders to control their outcomes. Often strategic complexity arises because of strong interrelationship between bidders' strategies, so that it becomes

[5] The risk faced by a bidder that at the final auction prices it might preferred to win an alternative combination of lots.

important to anticipate what others will do when decided what to do oneself.

A good example of strategic complexity arising with running multiple clock auctions with restarts, as was using in 2018. Bidders need to anticipate the likely prices for subsequent auctions when deciding how much capacity to obtain in earlier auctions and how much to defer.

Strategic complexity is different from the complexity of the auction rules or the auction mechanism itself. For instance, the procedural rules of a first price, sealed-bid auction of a single lot are simple: the highest bidder wins and pays the amount of its bid. However, from the point of view of a bidder, determining the right bid level is strategically complex. In order to make winning worthwhile, the bid should be below the value that the bidder attributes to the item. The lower the bid, the larger the surplus enjoyed by the bidder if it wins. At the same time, lowering the bid reduces the probability of winning. With an objective of maximising expected surplus, bidders will typically need to determine their bids not only based on their own valuations for the lots, but also taking account of their expectations about the valuations and the behaviour of other bidders. These expectations could be incorrect. As a result, determining by how much bids should be reduced below value is strategically very complex.

Both substitution and aggregation risks introduce strategic complexity. If bidders are exposed to such risks, then they will typically need to bid on the basis of their expectations about the final auction prices and outcome in order to minimise the risk of an unsatisfactory outcome.

In general, there may be some degree of trade-off between the complexity of auction rules and the strategic complexity of the decisions faced by bidders. In order for bidders to be able to bid straightforwardly, they need to be given opportunity to express their preferences for what they want, which may in turn tend to lead to somewhat more complex auction rules. Therefore, there is a balance to be struck, but the priority should be to ensure that bidders are not faced with complex decisions where there is a high risk of error.

The auction should discourage strategic behaviour

Bids may not reflect underlying valuations if bidders try to game the auction through their bids rather than responding to price signals and revealing their valuation of different portfolios through truthful bids. Attempts to manipulate prices or winning outcomes – often called '*strategic bidding*' – cover a very wide range of possible behaviours.

In broad terms, strategic bidding may take the form of understating demand in order to keep prices down[6] or overstating demand in order to drive up the prices paid by others.[7]

In general terms, strategic behaviour is less likely the more competitive the auction process, as the ability of individual bidders to affect outcomes is more limited and constrained by competition. In very competitive auctions, bidders will be less able to manipulate prices, and thus they are less likely to reduce demand or overstate their needs. Conversely, in auctions with few bidders we need to much more concerned about the potential for tacit collusion to keep prices low. Therefore, encouraging competition in the auction helps generating efficient outcomes.

A simple and transparent auction format helps avoiding bid mistakes

Finally, bids may fail to reflect valuations because of bidding mistakes that come from complex auction rules. Simplicity and transparency in this regard are not only additional objectives but contribute to efficiency. Complex rules that are difficult for bidders to understand increase the risk of bidding mistakes and inefficient outcomes. Bidders should be able to understand how bid decisions translate into results, so this process needs to be easy to follow and transparent.

For these reasons, where an auction process is used over time to assign resources that are released in batches, as is the case with the release of additional capacity for aquaculture licences over time, it seems to be reasonable to keep similar format and rules over time, and to only make changes if they are deemed to be necessary to address specific concerns.

2.2 Key issues for this assignment

Based on our assessment of the likely structure of demand for aquaculture capacity (see Section 4), we expect that:

[6] Understating demand aimed at keeping prices low is a typical problem of multi-unit auctions with pay-as-bid pricing. Bidders may have an incentive to reduce their demand even if *current* prices are well below their valuation for marginal lots if they expect that doing so leads to lower *final* prices. In this case a bidder may prefer to settle for fewer lots that it would be willing to acquire at a given price, as competing for additional lots might lead to higher prices.

[7] Price-driving behaviour may be part of tacitly collusive strategies (i.e. as punishment for deviating from the collusive outcome) but can also be aimed at exhausting other bidders' budget in order to limit competition for specific areas. Both cases require that bidders can bid for areas that they do not want to win themselves, but in which their competitors are interested. In both cases, the behaviour is aimed at keeping one's own prices down by increasing, or threatening to increase the prices paid by others and is therefore consistent with the assumption that bidders are motivated by maximising the difference between their valuation of the lots they win, and the prices they pay (surplus maximisation).

- Bidders will be willing to reduce demand progressively in response to price increments (even if demand from some bidders might only start from a minimum level if they do not already hold a licence in the area or adjacent areas). Therefore, it is appropriate to offer capacity with small lots (e.g. one tonne as in the previous allocation round) and allow bidders to specify the precise amount they would wish to acquire at given prices. Conversely, there does not appear to be an obvious way to define larger lots in a way that would not unduly restrict some bidders when expressing their demand.
- Aggregation risks are likely to be limited, most likely only arising in relation to achieving a minimum capacity in a given area. Given our recommendation to allow bidders to specify the number of tonnes they would want to acquire in each area, such aggregation risks should be addressed (if necessary) by the auction design, rather than by defining relatively large lots. Given that complementarities are likely to be limited, linear pricing is unlikely to be particularly problematic, and thus the additional complexity associated with formats that support non-linear pricing (combinatorial in nature) does not appear to be justified on this basis. However, there is potential for unsold lots at the end of a simple clock auction due to some bidders have minimum feasible capacities and dropping demand in a step. Therefore, we recommend adopting some features within the auction format to address this possibility, otherwise revenue will not be maximised.
- Capacity in different areas is likely to be substitutable to some extent: depending on relative prices, a bidder might be willing to acquire capacity in one or other area. Therefore, bidders can be expected to wish to switch their demand between areas in response to changes in the relative price of capacity in these areas. In order for the auction to be competitive in all areas, the auction rules should allow bidders to make such switches.
- Given the many possibilities for bidders to adjust their demand in response to price changes, either by progressively reducing demand or by switching demand across different areas, an open bidding process where prices are adjusted progressively and bidders are given an opportunity to revise their demand seems more appropriate than a sealed bid process where bidders would need to specify a large range of alternative options. Using an open process will also reduce strategic complexity, by allowing bidders to focus on their preferred option and only consider alternatives in response to the specific developments in the auction, rather than having to consider a wider range of alternatives.
- The clock auction format used in the previous allocation round would seem to meet many of the key requirements for the auction. However, to the extent that bidders may have a reasonable expectation that any unassigned capacity would be offered in a follow-up auction, this might distort bidding

incentives – for instance, bidders could attempt to reduce demand early to win capacity in key areas early on at lower prices, and only compete for additional capacity in other areas afterwards. Therefore, it may be preferable to collapse the allocation of capacity into a single process, rather than running a series of sequential auctions for unsold capacity. It is possible to use a clock-based mechanism, with special provisions to mitigate the risk of unsold capacity.

2.3 Identifying suitable auction formats

There are a number of existing auction formats for the simultaneous assignment of multiple lots, including:

- sealed bid processes where bidders make their best offers for the lots on offer and the auctioneer selects the highest bids it can accommodate with the available lots – with a number of variations depending on how bids are collected, evaluated, and how prices are determined (sealed bid auctions);
- iterative multi-round processes where bidders make and revise their offers, sequentially outbidding each other if there is competition for the lots on offer or switching across lots, until some bidders drop out and the remaining bidders win the lots (SMRA – Simultaneous Multi-Round Auctions);
- iterative multi-round processes where the auctioneer announces prices and bidders report their demand at those prices, with the auctioneer progressively increasing prices to resolve excess demand (clock auctions);
- combinatorial processes which complement a clock auction process (through which some information about demand at different clock prices is disclosed to bidders) with the possibility for bidders to make a wider range of bids for alternative 'packages' or combinations of lots, potentially expressing more complex demand structures to reflect synergies across lots (such as the CCA – Combinatorial Clock Auction – or the CMRA – the Combinatorial Multi-Round Auction).

When choosing an appropriate auction format, it is helpful to consider several broad choices in sequence, namely between:

- collecting bids for specific lots versus for generic quantities;
- single-round versus open multi-round processes;
- combinatorial versus non-combinatorial formats; and
- pay-as-bid versus second-price (where relevant).

These choices define a decision tree that allows us to narrow down the formats we may want to consider further.

Specific lots versus quantities

Where there are a manageable number of differentiated lots, bidders should be able to bid for specific lots…

Under the first approach, bidders would be presented with a list of lots on offer, and would make a bid by selecting which specific lots they wish to bid for, and then entering their offer for those lots (either entering separate offers for each of the lots, or by making an offer for a package of lots if a combinatorial format is used), so bidders need to consider the alternative selections of lots they may be interested in. Each lot or combination of lots will then be priced separately. This approach is appropriate when the different lots available in the auction are differentiated, or where only a manageable number of identical items are available (potentially across a number of categories). SMRA-type auctions collect bids using this approach.

… however, when offering a potentially large number of identical items, bidders should be able to simply bid for a quantity of lots

Under the second approach, lots are grouped into categories of identical items, and a price per lot is set for each of the categories. Bidders then specify the quantities they want to acquire at prevailing prices, so they only need to consider their demand across categories rather than alternative selections of specific lots. This approach is appropriate when we have identical items that can be grouped into categories, and especially where there could be a large number of lots in each of these categories. Prices are determined for different categories, reducing the scope for differences in prices paid for identical items – with the exception that combinatorial formats can implement differentiated prices for different combinations of lots, reflecting potential discounts or premiums associated with different quantities or specific combinations of lots. Clock-based auctions use this approach.

For the assignment of capacity for aquaculture licences the second approach seems more appropriate, which would only require bidders to specify the number of tonnes they wish to acquire in each area at given price. Under this approach, licence capacity will be specific to each production area, but within these areas, lots should be of one tonne. This provides complete flexibility for bidders to specify any quantity within a clock auction and does not create any additional complexity (relative to using larger or specific lots).

Single round vs. open multi-round processes

Open process allowing bidders to respond to price signals are better suited to meet the requirements identified above

Bidders may consider a wide range of alternative quantities in a given area, and the possibility to switch demand across different areas.

A sealed bid process does not provide an opportunity for bidders to revise their bids, or switch to different targets. Unless bidders are given an opportunity to express their potential flexibility to adjust demand and or switch across different areas, there is a risk that bidders' demand might clash in some specific areas, which could lead

to some bidders failing to win any capacity even if they might have been willing to reduce their demand in those areas. Therefore, the only reasonable option for running a sealed bid process would be a combinatorial sealed bid where bidders can bid for alternative capacity portfolios, expressing their flexibility to adjust demand if they fail to win with their preferred choice.

However, even if bidders were allowed to make bids for alternative options, there are several reasons why they may fail to identify the bids that could become winning, for instance:

- without any information about competitors' demand, bidders may easily fail to anticipate the need to reduce demand in some areas, or the price they may need to offer in order to be able to secure their desired capacity in different areas;
- bidders who have a relatively tight budget will face further challenges, as they will need to decide how much budget they want to dedicate to winning a basic quantity, and how much to acquiring additional capacity beyond this basic quantity. The complication is that dedicating a greater proportion of budget to winning a basic quantity reduces the chances of winning additional capacity, whilst dedicating a greater proportion of budget to winning additional capacity reduces the chances of winning anything at all;
- if a pay-as-bid pricing rule were to be used, this would create substantial challenges in terms of identifying optimal bid amounts. Trading off higher winning probabilities against lower surplus in case of winning is a formidable task even when bidding for a single lot. Finding optimal bid amounts for alternative portfolios will make the task disproportionately more difficult.

By contrast, open formats give bidders the opportunity to respond to changing prices that signal relative scarcity of capacity in different areas. Bidders may not only use these price signals to confirm or update their own valuations helping them to deal with common value uncertainty,[8] but more importantly will gain a better understanding of the outcomes that are likely to emerge. This allows them to discard target portfolios that become unaffordable given their budgets and adjust their demand progressively to levels they may be able to win. As a result, we are more likely to collect all the relevant bids in an open, multi-round process, than in a sealed bid, where we would rely on bidders' judgement of what the relevant bids might be.

8 To the extent that bidders' valuations are driven by common but uncertain factors, allowing bidders to observe each other's behaviour efficient outcomes are more likely in auction processes that help to mitigate such common value uncertainty. This is typically an argument used to support the use of open multi-round processes, potentially with the maximum amount of information about each bidder's bidding behaviour being made available at each point, as being able to observe each other's behaviour could help bidders with updating their own valuations.

Given the considerations above, open multi-round formats are likely to perform better than a single-round sealed bid process in this context.

Combinatorial vs. non-combinatorial formats

Non-combinatorial formats identify winning bids by simply selecting the highest bids (in terms of the price offered) made for the lots available. Conversely, combinatorial auctions perform a more complex, holistic evaluation of bids to identify the combination of bids that achieves the highest sum of winning bid amounts, typically with the possibility to select from a range of alternative bids from each bidder.

In general terms, the mechanics of combinatorial formats can be more complex, but may simplify bidding decisions where there are strong complementarities across the different lots, or if bidders are likely to need to express complex substitutability between alternative capacity portfolios. It is desirable to avoid unnecessary complexity in the auction in order to reduce the risk of mistakes.

As noted above, we consider that capacity in different areas is likely to be substitutable, without strong complementarities between areas. Therefore, the main reason that could justify the use of a combinatorial auction is that it would allow bidders to express their flexibility to switch between different portfolios, reflecting how they would adjust their demand at different prices.

The flexibility to make multiple alternative bids would seem to be crucial if a sealed bid process were used, as this would be the only way in which bidders would be able to express their willingness to adjust and switch demand at different prices. However, the additional flexibility provided by combinatorial processes is less important in the context of a multi-round process where bidders are confronted with different prices and are able to progressively adjust their demand in response to these. Thus, if a multi-round auction format is used, then we consider that there is no need for this to be combinatorial.

Pay-as-bid or second-price formats

Under the pay-as-bid rule, winners pay the amount of their bid, whilst under a second-price rule winners are only required to pay the minimum amount that is required to outbid competitors.

The choice between using a pay-as-bid rule or a second-price rule would be most relevant if a sealed bid or a combinatorial format where used, as the winning bids in these formats may be materially above the level that would be required to outbid competitors. In this

context, the pay-as-bid rule has the advantage of being simpler and more transparent, but the disadvantage, will create incentives for bidders to bid below their actual value; conversely, the second rule has the advantage of reducing incentives to bid below value, but the disadvantage of being more complex and less transparent, and increasing strategic complexity for bidders who face a tight budget.

However, there is little material difference between a pay-as-bid rule and a second price rule for non-combinatorial multi-round formats, as in these formats bid amounts are increased progressively and only if this is required to outbid competitors. Provided that bid increments are reasonably small, then the potential difference between bid amounts and the minimum amount that is required to outbid competitors should also be small. Thus, if a non-combinatorial format is chosen, the choice of pricing rule is of little importance and will not determine the choice of format. However, this can have some small implications when designing the specific rules for the auction under the chosen format, and may slightly affect incentives for bidders in the final rounds of the auction.

Summary

Figure 1 below summarises our decision tree for the selection of auction formats. In summary:

- we recommend that bids should be made for quantities, not specific lots – this eliminates SMRA-type formats where bidders would need to select specific lots;
- we recommend using an open multi-round format, rather than a sealed-bid process in order to allow bidders to adjust demand in response to price signals – this eliminates sealed-bid formats;
- provided that a multi-round format is used, then this should not be combinatorial, as the additional mechanical complexity of combinatorial formats does not appear to be justified – this eliminates more complex combinatorial formats such as the CCA and CMRA, leaving clock auctions as the preferred format; and
- provided that a non-combinatorial multi-round format is used, then the choice of pay-as-bid or second price rule is not crucial – in the context of a clock auction this only affects the design of specific rules.

In light of this, we recommend using a clock auction format, as in the previous allocation round.

Figure 1: identifying suitable candidate formats