CORNWALL INSIGHT

CREATING CLARITY

Appendix B: Long-list Assessments

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Getting to grips with the intricacies embedded in energy and water markets can be a daunting task. There is a wealth of information online to help you keep up-to-date with the latest developments, but finding what you are looking for and understanding the impact for your business can be tough. That's where Cornwall Insight comes in, providing independent and objective expertise. You can ensure your business stays ahead of the game by taking advantage of our:

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Contents

1 Appendix C: Long list evaluations

1.1 Introduction

In this Appendix we describe how we have developed a methodology for selecting, classifying and short-listing delivery models (DMs), including the assessment criteria we have used. In turn the short-listed DMs once approved by the client will be worked up into more detailed workplans.

1.2 Approach

CALE projects, like other businesses, require viable business models first to support their development and then for their financial sustainability. However, in most cases, they will be operating within complex regulated market and technical environments, which are currently subject to rapid and significant changes that are largely beyond the power of the community to influence.

In addition to this, the CALE project operates within very varied physical and geographical circumstances. In terms of physical characteristics, they can be rural or urban; integrated, constrained or remote; multi-fuel or heat or electricity only. Commercial options have tended to become more diversified, but a key variable is whether generation from a project or scheme is greater than the host demand, and if so whether it has unfettered access to the public system. Different social drivers are also evident: with different types of governance or participation; arrangements can be developed so that the benefits can be socialised or targeted on the fuel poor or vulnerable.

These factors make their assessment in terms of success or failure somewhat speculative, difficult to standardise and relatively dependent upon the point of view from which they are regarded.

Through our landscaping work, we have identified a wide range of schemes with shared features and models that are either operating or under trial in the market today. While each project has unique elements, they can be grouped according to the physical fundamentals of the scheme and the commercial arrangements that have been adopted irrespective of the support they have received.

We have developed a “long list” of twenty-five DMs from the case studies and examples. Our approach has been to decompose the DMs we have identified from our landscaping research into the essential features that are the concern of the regulated environments, to identify a typology (or taxonomy). The principal relationships of elements between the wider energy system on the other side of the consumer’s meter, the metering, generation and demand have all been disclosed. In some variants, we have also identified energy storage, transport and heat elements and third parties such as aggregators, supply intermediaries and specialist technology providers that are increasingly becoming involved.

This long list should probably be described more accurately as examples of types of arrangement, each of which has several variants. Six broad types of delivery model have been identified, each with a number of variations. The five types or grouping are:

- Self-consumption
- Private wires
- Virtual private networks, enabled by an intermediary
- Generator sales to market
- Micro-grids
- Supply based models.

We have considered the likely impact of storage in several of the DMs given the level of market interest in co-located solutions. Additionally, where appropriate, we have considered vehicular electrification and power to gas conversion, as this is likely to be a key component of schemes moving forwards.

1.3 Evaluation criteria

We have developed two sets of evaluation criteria to determine which models and variants we should focus on to determine delivery plans. We recognise that in some cases the models we have described are unlikely to be within the capability, or interest, of a CALE group to deliver and so will add our view on this as part of the individual model commentary. In our first set of assessment criteria, we have given weight to the following in order of priority:

- Fit with the existing market framework
  - Is the project possible and does it make sense under current market and regulatory conditions?
  - Is the project possible and does it make sense under future known or expected conditions?
- Track record
  - Are similar projects in existence already, and are these economically viable?
  - Are the revenue streams which the project will rely on sustainable for long enough to make the project viable? If not, are there other revenue streams, which could replace them?
- Ease of implementation/ practicability
  - What technical and market challenges or barriers will arise in establishing the project, and are these unique or have they been solved before for similar projects? Will a non-expert CALE group be able to solve these challenges?
  - What partner organisations will be required, and are they likely to buy in to the project, with time or financial resources? What will be the cost of accessing skills and knowledge to fill gaps in the CALE groups' abilities?
- Financial viability
  - Is the arrangement likely to be financially stable under current and likely future market conditions? Are the arrangement benefits sufficient to justify the cost, in terms of money and time, of the project?
  - What are the barriers to commercialisation? Are they addressable?
- Replicability and Scalability
  - How common are the conditions required to make the arrangement feasible?
  - How can the project be increased in size once implemented?
  - How repeatable is it?
  - Can the solution be scaled?
- Cost
  - What is the initial cost of setting up the arrangement, and could this be raised by the community group?
  - How will the technologies required by the project change in price and deployment in the future?
  - Will the project be able to identify and capture flexibility values? If so, how?
  - How will the arrangement be impacted by the expected shift to half-hourly metering assuming the availability of use tariffs?
- Other benefits
  - Will the arrangement build engagement? Social capital?
  - Are there other benefits? What are they?
    - This could be in terms of carbon abatement, fuel poverty alleviation and value redistribution, network resilience building etc

In the second assessment matrix, based on participant objectives and impacts, we have also given attention to the following criteria:

- Project viability under current market rules and conditions, and potential future viability under upcoming or probably future changes to conditions
- Consistency with current Scottish government energy policy, in two principal areas:
  - Increasing use of existing assets and improving the efficiency and cost-benefit ratio of the whole energy system
  - Promoting social inclusion and developing increased social equity and interest in the energy sector, including the effect of uptake of the delivery model on charges and costs to other market users
- The benefits and disbenefits to various involved and affected parties: the CALE group itself, energy suppliers, the network companies, and the general level of smartness and flexibility in the system
  - This is considered in terms of finances, competition, the carbon abatement agenda, the fuel poverty agenda, and efficient system operation
- The risk of regulator or government interventions to change market rules and the potential effect of these changes on the delivery model, whether positive or negative

Some of the judgements are at this stage high-level. What we have learned from the case studies and other example developments we have considered is that the sector has been (and will continue to be) subject to rapid change. Projects also exist on several dimensions, most notably ownership, scheme governance, market exposure and technological coverage. With policies around decarbonisation of heat and transport firming, and smart technology and digital capability subject to constant change, we expect an increasing number of interactions and variables influencing credible development pathways.

In our descriptions of the delivery models we have set out seven themes within each commentary:

- A diagrammatic representation and brief description of its principal commercial elements
- The overall conditions or scenario in which it is contextualised
- The revenues and associated benefits that could be derived by a CALE group operating the DM
- The variations within this model that could be possible within regulatory compliance
- Future developments of the regulatory (market and technical) environment that will impact the DM
- Critical assessment of the viability of this model moving forward under what we see as key developments in the regulated environment affecting the DM, and
- Relevance to CALE groups.

Arising from these analyses we have presented, using a 'traffic light' system, a colour-coded view on whether a particular DM is viable (green), possibly viable (yellow) or unlikely to be unviable (red).

1.4 Summary of delivery models

The tables on the following pages set out our view upon the different criteria when applied to each Delivery Model, with a summary score in the right-hand column. The scores represent the weighting we give to a particular DM under our multiple assessment criteria. We have scored each DM out of ten, with the higher the value representing the better the chance of 'success' of the DM. This gives a total project score out of 20 in the combined summary table presented in Section 4 of the Main report.

1.4.1 Evaluation: costs and benefits

Ref	Lead concept	Differentiators	Fit with market framework	Track record	Ease of implementation	Financial viability	Replicability	Scalability	Cost	Other benefits	Score
1.A	Self-consumption model	Demand greater than generation	Already viable	Tried and tested	Very easy	Very high if demand is matched to generation	High but site specific	Bespoke	Affordable and falling	Could result in system duplication and grid defection	7
1.B	Self-consumption model	Generation greater than demand				Lower return on exported power					6
2.A	Private wires model	Demand greater than generation			Requires added contractual arrangements	Very high if demand is matched to generation	Limited by availability of suitable partners				6
2.B	Private wires model	Generation greater than demand				Lower return on exported power					5
3.A	Virtual private wires (sleeving) model	Simple sleeving	Non-standard arrangement	Limited examples	Existing arrangement but complex negotiations	Better than wholesale poorer than direct supply		Highly scalable	Very low cost	Avoids grid defection; promotes low carbon generation	7
3.B.1	Virtual private wires (sleeving) model	Local Energy Club	Feasible with supplier partner		Easier for CALE group as implementation falls on supplier	Improves returns to local generator	High	Limited to generation capacity	Falls on supplier	Lower tariff to participants; builds interest in local LCG	7
3.B.2	Virtual private wires (sleeving) model	"Smart" Local Energy Club		Under trial	CALE group responsibilities more complex & demanding	Additional revenues from generator curtailment avoidance	Wide ranging scope	Limited to generation capacity; Trials encountered recruitment challenges	Costs falling as smart rollout progresses	High impact on fuel poverty	8
3.C	Virtual private wires (sleeving) model	Local Supply Community				Unproven; Will depend on local conditions	Requires wide engagement	Highly scalable	Low cost	Positive impacts for all participants	7
3.D	Virtual private wires (sleeving) model	Interposed meter			Demands high degree of participant interest and cooperation	High if demand is matched to generation	Limited to high density consumer contexts	Limited to specific user groups	Low cost once smart meters are deployed	Raises community energy awareness; positive impact on fuel poverty	6
4.A	Generator-only model	Unconstrained connection	Already viable	Tried and tested	Very easy	Probably marginal without subsidy		Highly scalable	Affordable and falling	Supports decarbonisation agenda	6
4.B	Curtailment avoidance market	Constrained connection		Under trial	Challenges of recruiting DSR and building market around services	Production payment by PPA to market and embedded benefits passed through; capacity market option to firm generation	Appropriate to sites under ANM	Limited	Limited application	DSR only brings revenue to service providers; avoided loss of generation	6
4.C.1	Generation consolidation	Aggregating generators for commercial advantage		Some brokers operating	Very easy	Advantage due to increased market power; Low returns for low costs; offers route to market for LCGs	Low; advantage comes from aggregating more generators and DSR	Highly scalable	Low cost to set up	Little value to social capital	7
4.C.2	Generation consolidation	Intermediated generation consolidation		One existing platform							7
4.D	Generation auction	Competitive procurement									6

<table>
<tr><th>Ref</th><th>Lead concept</th><th>Differentiators</th><th>Fit with market framework</th><th>Track record</th><th>Ease of implementation</th><th>Financial viability</th><th>Replicability</th><th>Scalability</th><th>Cost</th><th>Other benefits</th><th>Score</th></tr>
<tr><td>4.E</td><td>Heat & Power model</td><td>Heat with surplus power for export</td><td></td><td>Tried and tested</td><td>Extensive civil engineering required</td><td>High cost, high returns</td><td>Limited to high density consumer contexts</td><td></td><td>High Capex</td><td>Carbon abatement and fuel poverty benefits</td><td>8</td></tr>
<tr><td>5.A</td><td>Microgrid model</td><td>Grid-connected</td><td colspan="2" rowspan="3">Some pilots, but diverse</td><td rowspan="3">Not easy to implement: skills intensive</td><td rowspan="3">High cost, high returns</td><td rowspan="2">Highly replicable in areas of concentrated demand</td><td rowspan="2">Moderately scalable with additional local assets</td><td rowspan="3">Costs falling</td><td rowspan="3">Offers community and system resilience</td><td>6</td></tr>
<tr><td>5.B</td><td>Microgrid model</td><td>Constrained</td><td>7</td></tr>
<tr><td>5.C</td><td>Microgrid model</td><td>Islanded</td><td>Specific contexts only</td><td>Non-scalable</td><td>4</td></tr>
<tr><td>6.A</td><td>Energy supply company</td><td>Licenced supplier</td><td rowspan="2">Already viable</td><td>Some smaller new entrants failing</td><td>Very complex</td><td>Substantial backing with long term returns</td><td rowspan="3">Limited</td><td>Competitive environment limits scalability</td><td>High Capex and Opex</td><td rowspan="4">Potential positive impacts on fuel poverty and low carbon agendas</td><td>2</td></tr>
<tr><td>6.B.1</td><td>Energy supply company</td><td>Licence Lite supplier</td><td>Unproven</td><td>Complex</td><td rowspan="2">Requires large amount of generation and demand to be viable</td><td rowspan="2">Limited to existing demand assets</td><td rowspan="2">Unknown</td><td>3</td></tr>
<tr><td>6.B.2</td><td>Energy supply company</td><td>Enhanced licence lite</td><td colspan="3">Untested</td><td>7</td></tr>
<tr><td>6.C</td><td>Energy supply company</td><td>White Label supplier</td><td rowspan="3">Already viable</td><td rowspan="2">Tried & tested</td><td>Burden of implementation falls on licensed supplier</td><td rowspan="2">Low cost, low return</td><td>Very replicable for different interest groups and localities</td><td>Competitive environment limits scalability</td><td rowspan="3">Low cost</td><td>5</td></tr>
<tr><td>6.D</td><td>Energy supply company</td><td>Licence exempt supply</td><td rowspan="2">Relatively easy</td><td>Requires neighbouring generation and demand</td><td>Limited to demand and generation in local area</td><td>Supports LCG</td><td>5</td></tr>
<tr><td>7</td><td>Cooperative purchasing</td><td>Collective purchasing via CALE group</td><td>Limited</td><td>Small overheads</td><td>Reduces benefits, which arise from collective bargaining</td><td>Self-limiting to local environs</td><td>Supports community engagement and awareness</td><td>9</td></tr>
<tr><td>8</td><td>Peer-to-peer</td><td>Direct contractual arrangement via public network</td><td>Requires rules changes, technology development</td><td colspan="2">Largely unproven in UK</td><td>Potentially significant socialisation of benefits but requires rule changes and technology development</td><td>High for consumer-generator pairings</td><td>Highly scalable</td><td>Technology set up costs</td><td>Could democratise energy system but requires high customer engagement</td><td>6</td></tr>
</table>

1.4.2 Evaluation: participant objectives and impacts

<table>
<tr><th rowspan="2">Ref</th><th rowspan="2">Lead concept</th><th rowspan="2">Differentiators</th><th rowspan="2">Viability under current rules</th><th rowspan="2">Viability in 2019-20</th><th colspan="2">Consistent with Scottish energy policy?</th><th colspan="4">Benefits/ disbenefits</th><th rowspan="2">Risk of Intervention</th><th rowspan="2">Score</th></tr>
<tr><th>Existing asset usage</th><th>Social equity</th><th>To CALE</th><th>To supplier</th><th>To network</th><th>To smart, flexibility, conversion (power to gas)</th></tr>
<tr><td>1.A</td><td>Self-consumption model</td><td>Demand greater than generation</td><td colspan="2" rowspan="5">Already viable</td><td rowspan="2">Enables grid defection</td><td>Avoids full socialisation of charges</td><td>Low-cost power</td><td>No significant impact</td><td rowspan="2">Reduction in draw on network but lesser contribution to charges</td><td rowspan="4">Opportunity to use storage, power-to-gas to flex and maximise self-consumption and balancing</td><td>Change to network charges rules could be detrimental</td><td>3</td></tr>
<tr><td>1.B</td><td>Self-consumption model</td><td>Generation greater than demand</td><td>Some socialisation of charges</td><td>Reduced on-site benefits</td><td>Purchase opportunity</td><td>Diversity benefit in the event of likely intervention</td><td>4</td></tr>
<tr><td>2.A</td><td>Private wires model</td><td>Demand greater than generation</td><td rowspan="2">Encourages grid defection</td><td>Avoids full socialisation of charges</td><td>Sales of power</td><td rowspan="2">Reduction in customer consumption</td><td rowspan="2">Supports grid defection</td><td>Change to network charges rules could be detrimental</td><td>3</td></tr>
<tr><td>2.B</td><td>Private wires model</td><td>Generation greater than demand</td><td>Some socialisation of charges</td><td>Reduced on-site benefits</td><td>Diversity benefit in the event of likely intervention</td><td>4</td></tr>
<tr><td>3.A</td><td>Virtual private wires (sleeving) model</td><td>Simple sleeving</td><td rowspan="2">No impact on existing network assets</td><td>Limited social benefit</td><td rowspan="5">Local rate tariff</td><td rowspan="2">Avoids users going off-system entirely (still need balancing energy)</td><td rowspan="5">Preserves charging base, may avoid network reinforcement</td><td rowspan="2">Encourages smart metering, allows smart benefits from behaviour changes, opens up behind the meter smarter solutions</td><td rowspan="5">Rules change could enable markets</td><td>6</td></tr>
<tr><td>3.B.1</td><td>Virtual private wires (sleeving) model</td><td>Local Energy Club</td><td colspan="2" rowspan="4">Feasible but rules changes would enhance</td><td rowspan="4">Socialisation of benefits to club members
Potential to include heat and storage</td><td>7</td></tr>
<tr><td>3.B.2</td><td>Virtual private wires (sleeving) model</td><td>“Smart” Local Energy Club</td><td rowspan="3">Enhanced asset usage</td><td>Helps to retain green generation and demand customer base</td><td>Potential to offer rudimentary local balancing</td><td>9</td></tr>
<tr><td>3.C</td><td>Virtual private wires (sleeving) model</td><td>Local Supply Community</td><td rowspan="2">Avoids users going off-system entirely (still need balancing energy)</td><td rowspan="2">Encourages smart metering, allows smart benefits from behaviour changes, opens up behind the meter smarter solutions</td><td>8</td></tr>
<tr><td>3.D</td><td>Virtual private wires (sleeving) model</td><td>Interposed meter</td><td>8</td></tr>
<tr><td>4.A</td><td>Generator-only model</td><td>Unconstrained connection</td><td colspan="2" rowspan="4">Already exist/ viable</td><td rowspan="4">No impact on existing network assets</td><td rowspan="2">Socialisation of benefit possible in exchange for stakeholder consent
Potential to include heat and storage</td><td rowspan="2">PPA market at small-scale largely illiquid</td><td rowspan="4">Increasingly interested in PPA market, likely to favour scale</td><td colspan="2" rowspan="3">No significant impact</td><td rowspan="4">Minimal risk of intervention other than to support liquidity</td><td>5</td></tr>
<tr><td>4.B</td><td>Curtailment avoidance market</td><td>Constrained connection</td><td>7</td></tr>
<tr><td>4.C.1</td><td>Generation consolidation</td><td>Aggregating generators for commercial advantage</td><td>Benefits mainly to generators and suppliers</td><td rowspan="2">Better price for power and embedded benefit share from consolidation</td><td>7</td></tr>
<tr><td>4.C.2</td><td>Generation consolidation</td><td>Intermediated generation consolidation</td><td>Potentially greater socialisation of benefits through small generation schemes being able to negotiate better sales terms</td><td>Supports more green generation</td><td>More innovation in commercial arrangements</td><td>7</td></tr>
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<tr><th rowspan="2">Ref</th><th rowspan="2">Lead concept</th><th rowspan="2">Differentiators</th><th rowspan="2">Viability under current rules</th><th rowspan="2">Viability in 2019-20</th><th colspan="2">Consistent with Scottish energy policy?</th><th colspan="4">Benefits/ disbenefits</th><th rowspan="2">Risk of Intervention</th><th rowspan="2">Score</th></tr>
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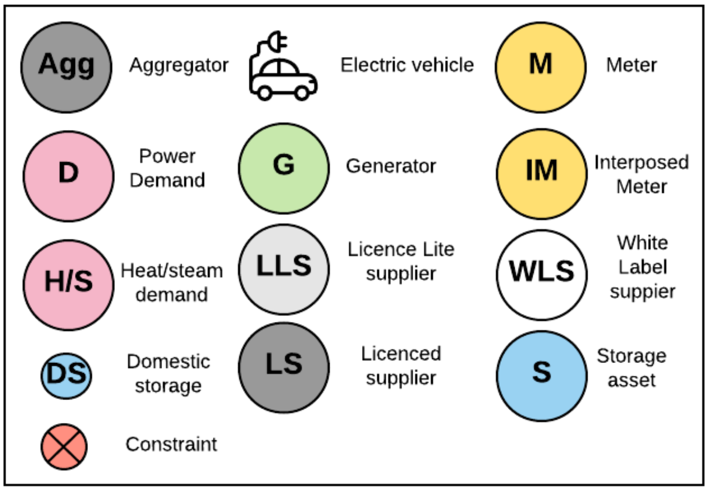
</thead>
<tbody>
<tr><td>4.D</td><td>Generation auction</td><td>Competitive procurement</td><td colspan="2">Already exist/ viable</td><td>No impact on existing network assets</td><td>Benefits mainly to generators and suppliers</td><td>Better price for power and embedded benefit share from consolidation</td><td rowspan="2">Increasingly interested in PPA market, likely to favour scale</td><td colspan="2">No significant impact</td><td>Minimal risk of intervention other than to support liquidity</td><td>7</td></tr>
<tr><td>4.E</td><td>Heat & Power model</td><td>Heat with surplus power for export</td><td colspan="2">Already exist/ viable, but site specific</td><td>Aligns with policy for local heat</td><td>High capital costs may reduce number of eligible participants</td><td>Sale of heat and power, guaranteed heat customers/ revenue certainty</td><td>No significant impact</td><td>Controllable CHP plus thermal store allows operation to maximise power revenue</td><td>Heat may be brought into regulator’s purview</td><td>8</td></tr>
<tr><td>5.A</td><td>Microgrid model</td><td>Grid-connected</td><td colspan="2" rowspan="3">Viable but expensive to set up (private wires, generation, storage, microgrid controller)

Skills intensive</td><td rowspan="3">Positive impact on existing network assets</td><td rowspan="3">Can offer greater community energy resilience and shared benefits</td><td rowspan="3">Local tariff rate and incentive to innovate</td><td rowspan="2">Avoids users going off-system entirely (still need balancing energy)</td><td rowspan="2">Reduces charging base, but may avoid network reinforcement</td><td rowspan="3">Strong incentives to balance and innovate</td><td rowspan="3">If rules change, could enable markets, but lack of policy clarity</td><td>6</td></tr>
<tr><td>5.B</td><td>Microgrid model</td><td>Constrained</td><td>7</td></tr>
<tr><td>5.C</td><td>Microgrid model</td><td>Islanded</td><td>Loss of customers</td><td>Grid defection spiral</td><td>8</td></tr>
<tr><td>6.A</td><td>Energy supply company</td><td>Licensed supplier</td><td colspan="2">Very expensive to set up and unlikely to deliver returns</td><td rowspan="5">No significant impact</td><td>Returns could be passed to local users via low-cost tariff</td><td>Likely to lead to socialisation of costs</td><td>Competition</td><td rowspan="2">No significant impact</td><td>New suppliers more incentivised to be innovative</td><td>End of supplier hub model may ease market entry</td><td>2</td></tr>
<tr><td>6.B.1</td><td>Energy supply company</td><td>Licence Lite supplier</td><td colspan="2">Lower cost of market entry</td><td rowspan="2">Lower costs grant higher returns to share with the community</td><td>Unproven and considered to be complex and high-cost</td><td>Collaborator with one supplier, competition with others</td><td>Negligible uptake therefore unproven</td><td>Ofgem expected to open up supplier hub</td><td>3</td></tr>
<tr><td>6.B.2</td><td>Energy supply company</td><td>Enhanced licence lite</td><td>Not viable under current rules</td><td>Yes, if rule changes occur</td><td>Should create first-resort market for supply</td><td>Suppliers won’t like any requirements to offer terms</td><td rowspan="4">No significant impact</td><td rowspan="2">Should enable innovation</td><td>Ofgem expected to open up supplier hub</td><td>7</td></tr>
<tr><td>6.C</td><td>Energy supply company</td><td>White Label supplier</td><td colspan="2">Low cost of market entry, viable under current rules</td><td>Low returns, little ongoing revenue to share</td><td>Customer acquisition fee from supplier</td><td>Low-cost customer acquisition</td><td>No significant impact</td><td>5</td></tr>
<tr><td>6.D</td><td>Energy supply company</td><td>License exempt supply</td><td colspan="2">Already viable at small scale, limited scope</td><td>Returns mostly shared with connectee</td><td>Valid option for small schemes</td><td>Supplier likely to prefer more formal arrangement</td><td>Non-standard approaches could deter innovation</td><td>Examples under scrutiny</td><td>5</td></tr>
<tr><td>7</td><td>Cooperative purchasing</td><td>Collective purchasing via CALE group</td><td colspan="2">Already viable</td><td>No significant impact on existing network assets</td><td>Benefits socialised as a cooperative</td><td>Sale of energy assets (fuel, boilers, smart tech) to members</td><td>Discharge of ECO obligations through CALE group</td><td>Lower cost of access to smart technology</td><td>Incentives could depend on reform to ECO/ FPO</td><td>8</td></tr>
<tr><td>8</td><td>Peer-to-peer</td><td>Direct contractual arrangement via public network</td><td>Requires rules changes, technology development</td><td>Requires rules changes</td><td>Positive impact on existing network assets</td><td>Potentially significant socialisation of benefits but requires rule changes and technology development</td><td>Direct sales of energy (better price)</td><td>Reduction in customer consumption and disintermediation</td><td>New network charging model required</td><td>Encourages matching of consumption to generation, smart settlement

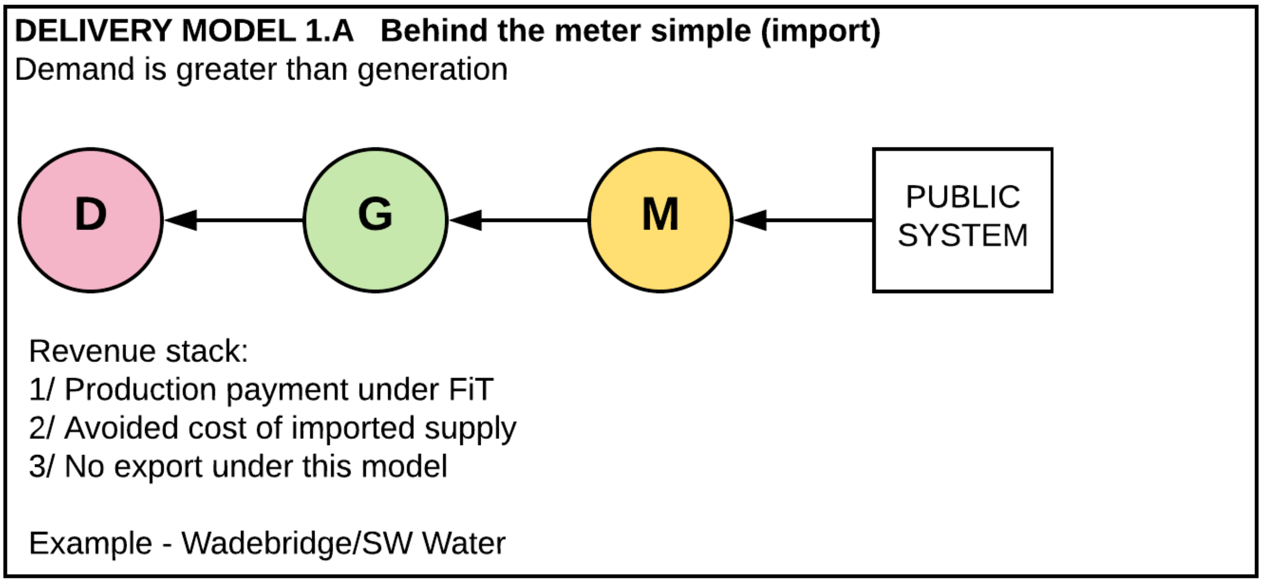
Delivers market innovation</td><td>No policy framework exists</td><td>4</td></tr>
</tbody>
</table>

Key to diagrams



2 Long-list models

2.1 Self-consumption model – demand greater than generation



2.1.1 Description

Self-consumption of power generated behind the meter. All of the power produced is consumed onsite, and additional power must be imported to top up onsite generation.

2.1.2 Conditions/ scenario

This model will suit users with a load profile matching the generation profile of the technology chosen to minimise input costs.

2.1.3 Revenue stack and benefits

Power generated is valued at the cost of avoided supply, so for sites which are using all power generated, this could range from as much as 15-18p/kWh (domestic and small non-domestic users) to as little as 5-6p/kWh (large and extra-large non-domestic users).

Installations up to 5MW (dependant on technology) could be subsidised under the FiT until March 2019.

2.1.4 Variations

The primary variation is between a firm or dispatchable generator, which could be run as required to match the load profile of the customer precisely, and an intermittent generator which generates according to the availability in the natural environment of its energy source. The former could include technologies such as AD, biomass and bio liquids which will have higher fuel costs but may derive higher benefits; the latter could include technologies such as solar, wind, hydro and tidal/ wave and have essentially nil marginal costs, but may derive lower benefits.

This model would also be suitable for heat, potentially generated with a CHP engine, if there was sufficient demand for heat onsite. Usually heat is sized against the heat load, often meaning there is a need for export arrangements (see DM 4D).

Options discussed in other models include energy storage and/or EV charging to maximise self-consumption of power, which will increase effective value. The additional equipment required does come at a cost, but – particularly in the case of EV charging – may derive additional revenues or grant funding for the cost of installations.

2.1.5 Future developments

The FiT regime is likely to be withdrawn in April 2019, so the rate of return will rely on avoided cost of electricity imports alone. This will severely damage the viability of the scheme unless costs of generation fall or the costs of policy materially increase.

Ofgem is currently undertaking a review of network charging: the TCR SCR. This is, in part, considering the effects which behind the meter generation is having on allocation of network charges, and therefore any changes made to these charges will impact on the avoided cost of generation. This workstream is expected to deliver results in the next 2-3 years.

2.1.6 Critical assessment

This model is viable with FiT-subsidy, with a payback period of usually 8-12 years depending on technology and cost of installation.

Assuming that the site consumes all of the power generated, this could be viable in a post-FiT world, depending on the cost of the imported power. There is no long-term certainty on what power will cost over the payback period.

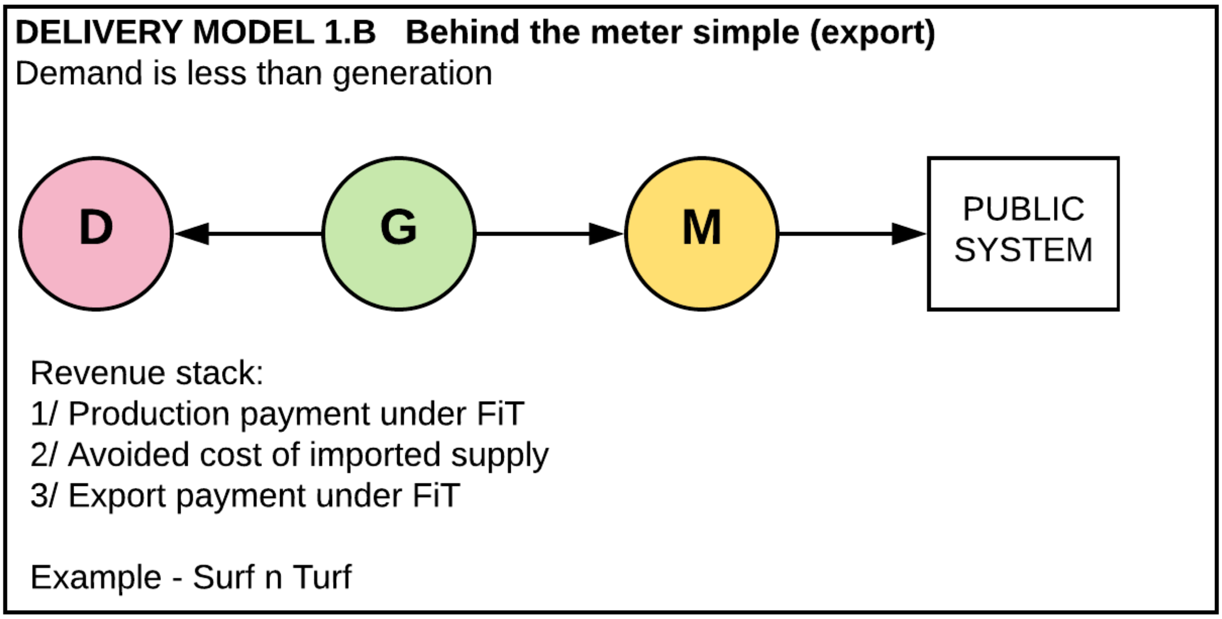
The trend is also for decreasing cost of generating technologies, particularly solar arrays, which will improve the viability of adopting this model in the future.

If the model included heat, generated renewably, it could be eligible for support under the RHI.

2.1.7 Relevance to CALE groups

Our view is that this model is replicable and well within CALE group capabilities. It has already been proven in the Wadenbridge renewable Energy Network (WREN) project in association with SW Water. It offers predictable revenue for the CALE group, carbon abatement and benefit to the wider network in terms of load reduction as long as the arrangement is sustainable.

2.2 Self-consumption model – generation greater than demand



2.2.1 Description

Self-consumption of power generated behind the meter. Some of the power produced is exported to the public networks.

2.2.2 Conditions/ scenario

Higher value is obtained by self-consumption than export of power, avoiding the cost of power imports.

2.2.3 Revenue stack and benefits

Power generated and used onsite is valued at the cost of avoided supply, so for sites which are using all power generated, this could range from as much as 15-18p/kWh (domestic and small non-domestic users) to as little as 5-6p/kWh (large and extra-large non-domestic users).

Installations up to 5MW (dependant on technology) could be subsidised under the FiT until April 2019.

Generation that is not used onsite is exported to the public system. This is remunerated at a default rate under the FiT, currently 5.03p/kWh though this is subject to change in the future. The generator has the option to negotiate a Power Purchase Agreement (PPA), which would replace the FiT export rate. Usually this would include some recognition of the value of embedded benefits.

2.2.4 Variations

The primary variation is between a firm or dispatchable generator, which could be run as required to match the load profile of the customer precisely, and an intermittent generator which generates according to the availability in the natural environment of its energy source. The former could include technologies such as AD, biomass and bio liquids, which have higher fuel costs but may derive higher benefits; the latter could include technologies such as solar, wind, hydro and tidal/ wave, which have essentially nil marginal costs but may derive lower benefits.

This model would also be suitable for heat, potentially generated with a CHP engine, if there was sufficient demand for heat onsite.

Options discussed in other models below include energy storage and/or EV charging to maximise self-consumption of power, which will increase effective value. The additional equipment does come at a cost, but particularly in the case of EV charging may derive additional revenues or grant funding for the cost of installations.

2.2.5 Future developments

Installations could currently be subsidised under the FiT regime, but this is to be withdrawn in April 2019 for new projects, so rate of return will rely on avoided cost of electricity imports for on-site use, supplemented by the value of exported energy. This will severely damage the viability of the scheme unless costs of generation fall.

Ofgem is currently undertaking a review of network charging. This is, in part, considering the effects that behind the meter generation is having on allocation of network charges, and therefore any changes made to these charges will impact on the avoided cost of generation. This workstream is expected to deliver results in the next 2-3 years. In this example, the export revenue would provide some risk mitigation relative to DM 1A.

2.2.6 Critical assessment

This model is viable with FiT-subsidy or long-term PPA for surplus power, with a payback period of 8-12 years depending on technology and cost of installation.

Assuming that the site consumes most of the power generated, this could be viable in a post-FiT world, depending on the avoided cost of imported power. There is no long-term certainty on what power will cost over the payback period without a PPA.

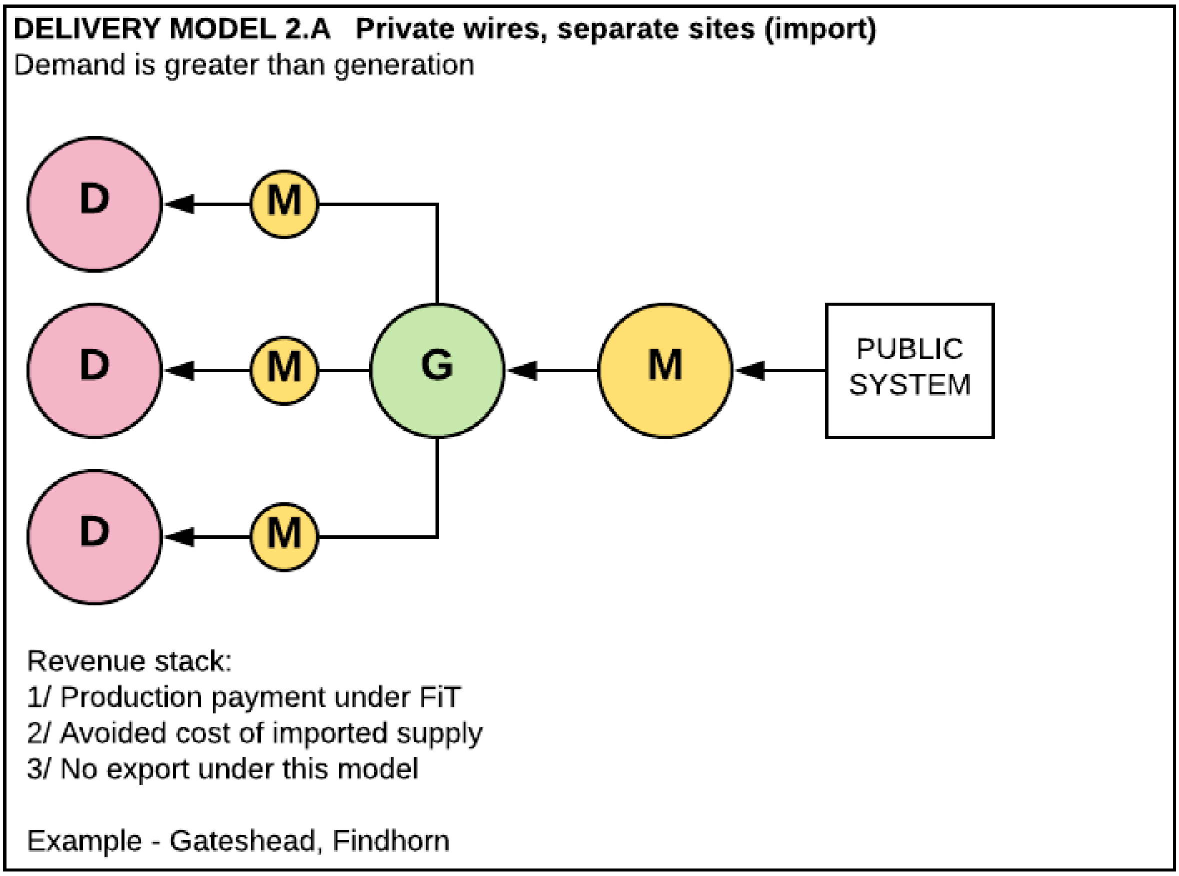
Any generation exported to grid will be valued at a much lower level than power consumed onsite; wholesale prices currently make up approximately one-third of bills, so exports are likely to be worth only one-third of the value of avoided cost of imports. The main reason to export power is if the generation and consumption profiles don't match. This is likely to happen systematically with operation of CHP.

If the model included heat, generated renewably, it could be eligible for support under the RHI.

2.2.7 Relevance to CALE groups

Existing self-supply arrangements are highly location-specific and in rural areas likely to be remote. A simple FiT/PPA export arrangement is unlikely to meet the aspirations of communities, which is to highlight a pathway that evolves to VPN models.

2.3 Private wires model – demand greater than generation



2.3.1 Description

A generator, connected to one or more local demand users via private wires. The total or peak level of demand is greater than the level of generation, so top-up generation is imported to the sites via their existing grid connections when needed. Energy production could include heat production, for example with a CHP or renewable-fuelled boilers, which could be exported to neighbours with a private heat network.

2.3.2 Conditions/ scenario

This model relies on one or more demand users in close proximity to a suitable site for a generator. This will minimise the cost of the necessary private wires, and also reduce the difficulties in obtaining wayleaves and so on for installing the wire.

The exemptions for operating a distribution network are higher for non-domestic than domestic customers. These exemptions allow a 1MW supply to domestic customers but are unlimited for non-domestic customers. Similarly, the rules for being a licence-exempt electricity supplier allow up to 5MW supply to customers, providing a maximum of 2.5MW is supplied to domestic customers, or allow electricity generated onsite of unlimited quantity. If the project is aiming for greatest scale, therefore, it should look to generate on the same site as the consumers, and supply to non-domestic users.

The combined consumption profile would in this example match or exceed the peak generation profile of the selected generating technologies.

Projects should also consider the longevity of the tenure of customers. This will be especially important when only one large consumer is being supplied.

2.3.3 Revenue stack and benefits

Post FiT, in addition to the self-supply benefit, revenues will rely on sale of energy to the connected users. It is also possible to charge the costs of the private wire network to these consumers. In order to attract customers to the network and encourage them to take supply from the onsite generator rather than the public network, total costs should be below the avoided cost of import. The economics of private wires, as understood by Cornwall Insight research, suggest that this is easily accomplished, as avoided network charges and final consumption levies reduce the cost-to-supply by up to fifty percent, though this will be on a case-by-case basis.

CALE organisations may be able to negotiate higher prices from end-users than an equivalent commercial organisation could, due to the social and local credentials offered by the group. Equally, green generation could potentially be priced at a premium to some companies.

There may also be scope for offering DSR services behind the meter.

2.3.4 Variations

The primary variation is between a firm or dispatchable generator, which could be run as required to match the load profiles of the customer precisely, and an intermittent generator which generates according to the availability in the natural environment of its energy source. The former will include technologies such as AD, biomass and bioliquids, which have higher fuel costs but may derive higher benefits; the latter include technologies such as solar, wind, hydro and tidal/ wave, which have essentially nil marginal costs but may derive lower benefits.

If fuelled technologies are used for generation, consideration should be given to using a CHP-enabled generator which could produce heat for use onsite or export to local users via a heat network. A pure heat network could also be used to alleviate fuel poverty in specific locales or provide heat to non-domestic customers, for example around a business or industrial park.

Options discussed in other models below include energy storage and/or EV charging to maximise self-consumption of power, which will increase effective value.

2.3.5 Future developments

There are two main risks to this model. The stability of the customer base is crucial, as significant revenue is derived from them. If a large number of companies with stable demand are connected, this risk will be minimised; smaller numbers of companies which are likely to change their use profiles – or indeed go out of business or move away entirely – will increase the risk.

Furthermore, Ofgem is currently undertaking a review of network charging. This is, in part, considering the effects which behind the meter generation is having on allocation of network charges, and therefore any changes made to these charges will impact on the avoided cost of generation. This workstream is expected to deliver results in the next 2-3 years.

Installations could currently be subsidised under the FiT regime, but this is likely to be withdrawn in April 2019, so the rate of return will rely on the avoided cost of self-supply arrangements and payments from consumption partners alone.

2.3.6 Critical assessment

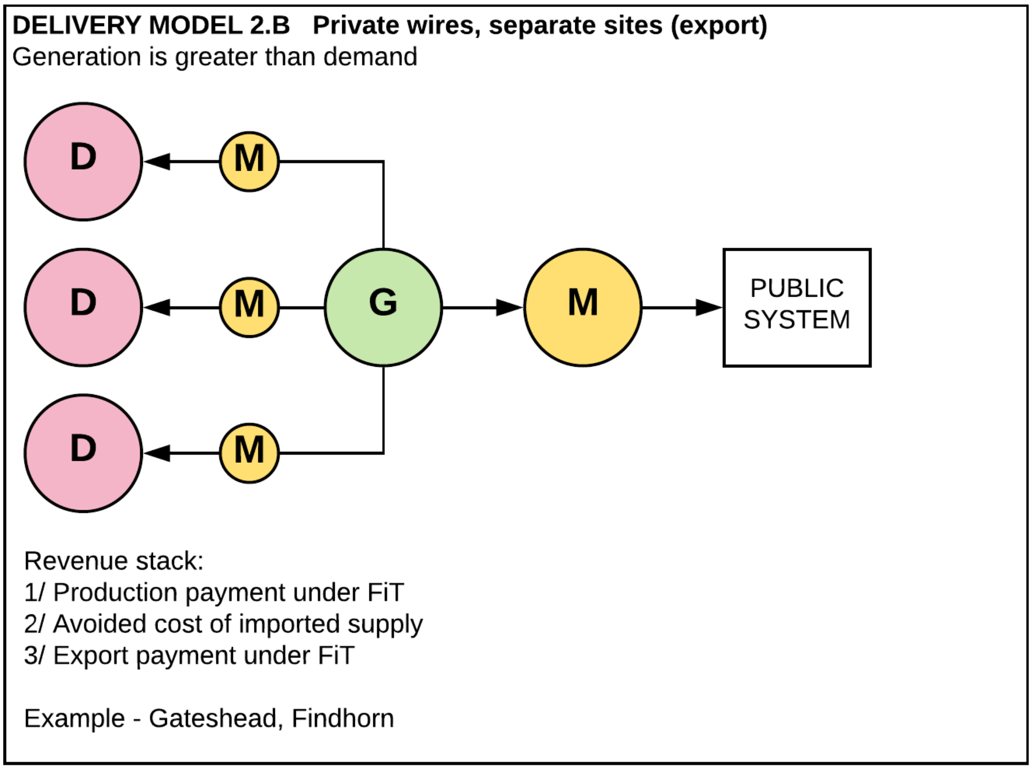
This model is currently viable with FiT subsidies. With the withdrawal of the FiT and the loss of generation tariff revenue, payback periods will be much longer. Depending on the technology chosen, the model may or may not be viable in the short-term: for example, stand-alone solar arrays receive 0.19p/kWh under the generation tariff (for installations commissioned 1 January 2018 to 31 March 2018) and loss of this revenue would be negligible. On the other hand, AD plants with capacity 0.25-0.5MW receive 4.22p/kWh, a much more significant revenue stream.

We believe that, if a suitable customer or customers can be located, then most generating technologies could be supported by this model. Suitable customers are exemplified by water companies: large, established brands will high onsite use which is unlikely to change in amount or location in the future, which have guaranteed stability due to being government regulated, and which have green agendas and an incentive to engage with local communities.

2.3.7 Relevance to CALE groups

The Findhorn, Gateshead District Energy and Wadebridge/SW Water case studies show the scope for private wires, and other development sites will exist. We suspect few have household connections but there will be scope to incorporate DNO systems, especially when generation is in significant surplus. In an island system the arrangement can quickly transpose to a micro-grid (where the local system is privately owned) or a VPN (where it is possible).

2.4 Private wires model – generation greater than demand



2.4.1 Description

A generator, connected to one or more local demand users via private wires. The total or peak level of generation is greater than the level of demand, so surplus electricity is exported. Energy production could include heat production, for example with a CHP or renewable-fuelled boilers, which could be exported to neighbours with a private heat network.

2.4.2 Conditions/ scenario

This model relies on one or more demand users in close proximity to a suitable site for a generator. This will minimise the cost of the necessary private wires, and also reduce the difficulties in obtaining wayleaves and so on for installing the wire.

The exemptions for operating a distribution network are higher for non-domestic than domestic customers. These exemptions allow a 1MW supply to domestic customers but are unlimited for non-domestic customers. Similarly, the rules for being a licence-exempt electricity supplier allow up to 5MW supply to customers, providing a maximum of 2.5MW is supplied to domestic customers, or allow electricity generated onsite of unlimited quantity. If the project is aiming for greatest scale, therefore, it should look to generate on the same site as the consumers, and supply to non-domestic users.

The combined consumption profile would in this example match or exceed the peak generation profile of the selected generating technologies.

Projects should also consider the longevity of the tenure of customers. This will be especially important when only one large consumer is being supplied.

2.4.3 Revenue stack and benefits

Post FiT, in addition to the self-supply benefit, revenues will rely on sale of energy to the connected users. It is also possible to charge the costs of the private wire network to these consumers. In order to attract customers to the network and encourage them to take supply from the onsite generator rather than the public network, total costs should be below the avoided cost of import. The economics of private wires, as understood by Cornwall Insight research, suggest that this is easily accomplished, as avoided network charges and final consumption levies reduce the cost-to-supply by up to fifty percent, though this will be on a case-by-case basis.

CALE organisations may be able to negotiate higher prices from end-users than an equivalent commercial organisation could, due to the social and local credentials offered by the group. Equally, green generation could potentially also derive higher returns from some companies.

Some installations will be eligible for FiT payments for production; these will depend on technology and size of generator. Excess generation exported to grid may be remunerated by FiT export payments, currently set at 5.03p/kWh, but we would expect a site operator to seek a PPA.

There may also be scope for offering services behind the meter. With controllable generation the site could offer balancing services, especially if DSR capability exists on site.

2.4.4 Variations

The primary variation is between a firm or dispatchable generator, which could be run as required to match the load profiles of the customer precisely, and an intermittent generator which generates according to the availability in the natural environment of its energy source. The former include technologies such as AD, biomass and bioliquids, which have higher fuel costs but may derive higher benefits; the latter include technologies such as solar, wind, hydro and tidal/ wave, which have essentially nil marginal costs but may derive lower benefits.

A long- or short-term PPA could be obtained to value the power exported to the public network more highly and obtain a share of embedded benefits revenue.

If fuelled technologies are used for generation, consideration should be given to using a CHP-enabled generator which could produce heat for use onsite or export to local users via a heat network. A pure heat network could also be used to alleviate fuel poverty in specific locales or provide heat to non-domestic customers, for example around a business or industrial park.

Options discussed in other models below include energy storage and/or EV charging to maximise self-consumption of power, which will increase effective value.

2.4.5 Future developments

There are two main risks to this model. The stability of the customer base is crucial, as significant revenue is derived from them. If a large number of companies with stable demand are connected, this risk will be minimised; smaller numbers of companies which are likely to change their use profiles – or indeed go out of business or move away entirely – will increase the risk.

Furthermore, Ofgem is currently undertaking a review of network charging. This is, in part, considering the effects which behind the meter generation is having on allocation of network charges, and therefore any changes made to these charges will impact on the avoided cost of generation. This workstream is expected to deliver results in the next 2-3 years.

Installations could currently be subsidised under the FiT regime, but this is likely to be withdrawn in April 2019, so rate of return will rely on the avoided costs of self-supply and payments from consumption partners alone.

2.4.6 Critical assessment

This model is currently viable with FiT subsidies. With the withdrawal of the FiT and the loss of generation tariff revenue, payback periods will be much longer. Depending on the technology chosen, the model may or may not be viable in the short-term: for example, stand-alone solar arrays receive 0.19p/kWh under the generation tariff (for installations commissioned 1 January 2018 to 31 March 2018) and loss of this revenue would be negligible. On the other hand, AD plants with capacity 0.25-0.5MW receive 4.22p/kWh, a much more significant revenue stream.

We believe that, if a suitable customer or customers can be located, then most generating technologies could be supported by this model. Ideal customers are exemplified by water companies: large, established brands will high onsite use which is unlikely to change in the future, which have guaranteed stability due to being government regulated, and which have green agendas and an incentive to engage with local communities.

Given that generation will be exported to the grid, the generator will have to arrange a PPA. As power exported in this way will be less highly remunerated than power sold to private wire customers, the more power exported, the more marginal the model becomes. However if cost allocation rules change or customers move, there is a diversification benefit.

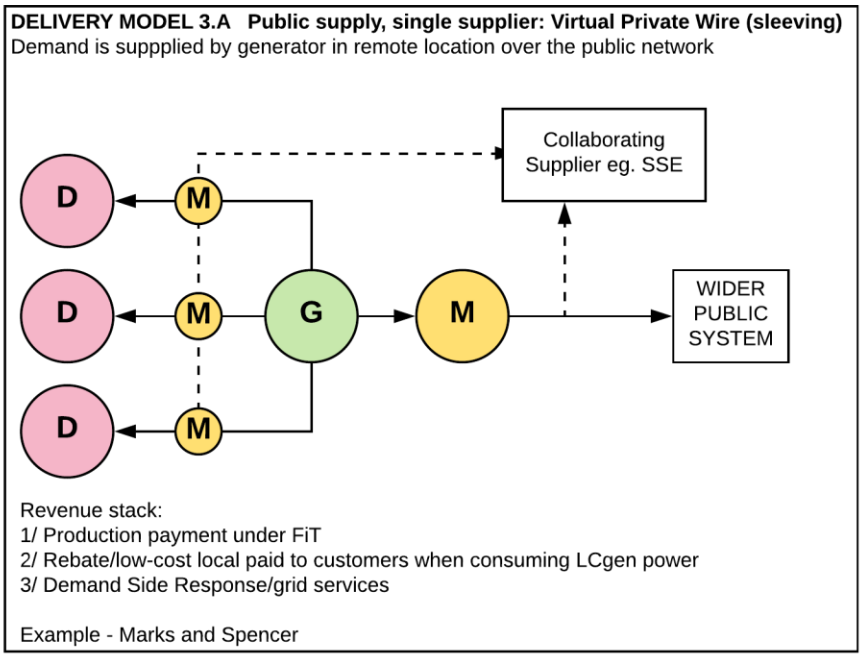
2.4.7 Relevance to CALE groups

The Findhorn, Gateshead District Energy and Wadebridge/SW Water case studies show the scope for private wires, and other development sites will exist. We suspect few have household connections but there will be scope to incorporate DNO systems, especially when generation is in significant surplus. In an island system the arrangement can quickly transpose to a micro-grid (where the local system is privately owned) or a VPN (where it is possible).

2.5 Virtual private wires (sleeving) models

2.5.1 Description

The generator(s) and consumption meter(s) in a **traditional "sleeving"** arrangement are owned by a single entity and/or its affiliates (**Model 3.A**). This is exemplified by the Marks and Spencer arrangement with npower); Smartest Energy also offers a range of smaller arrangements with corporate players. The initiating business usually wants to optimise its benefit from developing renewable assets, usually for CSR purposes.



The corporate notionally links its generation to consumers over the public network, but elects not to become its own supplier. It strikes an agreement with a third party licensed supplier responsible for the meters then nets off generation from the consumption meters. The value to the business is the avoided cost of the supply effectively provided from its generation assets to its consumption sites.

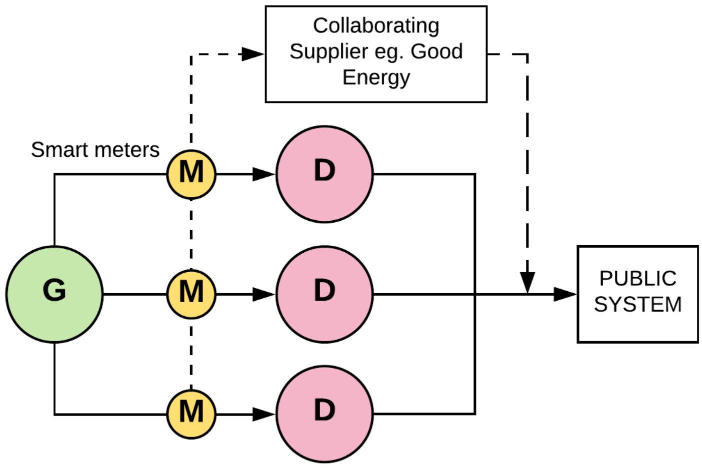
The enabling supplier, as well as registering and reconciling the meters in settlement, provides a balancing tariff for top ups and spills, collects network and policy costs, as well as charging a fee for its services.

Although we are not aware of any such arrangements, we can see a pathway whereby the traditional sleeving model could be readily adapted for local authorities or social housing groups.

This arrangement could also function between a generator and consumption partners (as it does at Bethesda (Coop) and Smart Fintry (Good Energy)) as some form of "**local energy club**" (**Model 3.B1**)), though the contract would be different from Model 3.A. The generator is notionally linked to consumers over the public network, again with a supplier responsible for the meters netting off generation from the consumption meters. The generator can be paid above the wholesale or export rate for its exports and the consumer is charged a lower rate for the locally sourced power, in effect based on a local tariff. The payments reflect a benefit share between the generator and its customers.

Again, the enabling supplier, as well as registering and reconciling the meters in settlement, provides a balancing tariff for top ups and spills, registers the meters in settlement and collects network and policy costs, as well as charging a fee for its services. It would be between the generator, the club members and the supplier as to how each meter was billed.

DELIVERY MODEL 3.B.1 Public supply, single supplier: Virtual Private Wire (local energy club)
Demand is turned up to avoid generation losses during period of curtailment



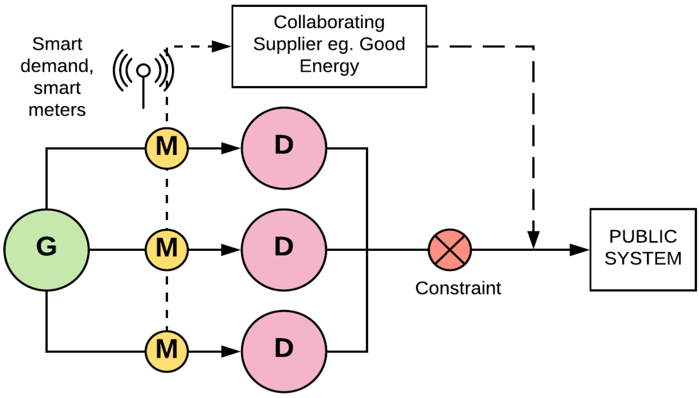
Revenue stack:
1/ Production payment under FiT
2/ Avoided cost of curtailed export
3/ Rebate/low-cost local tariff paid to customers when consuming LCgen power
4/ Demand Side Response/grid services

Example - Mull ACCESS

A More sophisticated version of this is the "**smart local energy club**" (Model 3.B.2). In this generator partners with a supplier to offer a Time of Generation and Use (ToGU) tariff. This looks to allocate the power produced amongst those on the tariff, according to how much they consumed in that particular half hour. Each unit of generation allocated to those on the tariff is priced to consumers at a lower rate than the normal cost of supply, and more of this revenue is passed through to the generator than the usual wholesale price.

DELIVERY MODEL 3.B.2 Public supply, single supplier: Virtual Private Wire ("smart" local energy club)

Demand is turned up to avoid generation losses during period of curtailment



Revenue stack:
1/ Production payment under FiT
2/ Avoided cost of curtailed export
3/ Rebate/low-cost local tariff paid to customers when consuming LCgen power
4/ Demand Side Response/grid services

Example - Bethesda

Due to the pseudo-half hourly settlement nature of the tariff, customers will need to have smart meters fitted, which are capable of reading and transmitting half-hourly energy consumption.

Incentives to embed smarter solutions would increase in the event of the existence of local transmission constraints.

The supplier provides a top-up tariff to supply the remainder of the energy the tariff customers use. Customers can also be provided with a portal forecasting likely power production, and outage times, of the generator, so they can fit their consumption to maximise access to the lower, local rate.

A typical benefit share under this type of arrangement is shown in the box below.

Benefit sharing under a smart local energy club – example Bethesda

Under the current implementation, the payments from consumers matching generation are passed through in their entirety (7p/kWh). This means that the generator gets a higher benefit from the power it exports than it would if selling onto wholesale markets or accepting FiT export payments. As generation is greatly outweighed by consumption (100kW generator, versus 100 households with around 2kW average demand each), most or all generation will be consumed by tariff participants.

However, this is a cost to the supplier, which bear responsibility for the non-wholesale cost of supplying this energy. Part of this cost will be factored into setting prices for the top-up tariff. It will also benefit from the route to market into the local community, with the cost of customer acquisition onto a one-year fixed tariff priced at about £50.

The DNO may receive indirect benefits, as the peak load on the distribution grid is reduced due to load shifting to match peak generation. This benefit will be socialised across all local users in the long term with reduced distribution charges.

There are sharper incentives to test this sort of arrangement where there are local network constraints, and possibly the existing generator has an ANM contract with the local DNO, resulting in risks of significant levels of generator curtailment and lost revenue.

In this situation, flexible demand users can be created on the generator's side of the constraint, which can be turned up centrally to soak up power on the same side of the constraint as the generator, allowing it to run more of the time and earn more revenues. A share of the additional revenue is paid to the flexible demand either as a payment to offset against their higher bills or as a rebate on the tariff. Typically, electric domestic heat production has been used in existing trials (Mull ACCESS, HSO).

2.5.2 Conditions/ scenario

The arrangement presupposes proximity between local or regional generation assets and points of consumption. From an electricity system perspective, there is no reason why it could not be applied within multiple generation assets and consumption points within a single settlement zone (to maximise the embedded benefits).

Traditional sleeving is becoming a more popular arrangement due to a number of perceived benefits, especially in the light of the rise in low-carbon generation at the local level owned by corporates. It supports CSR agendas, as power is purchased from specific green generators which can be identified and tagged. Suppliers are also becoming more willing to offer the arrangement, as there is more customer demand and competitive pressure to offer it as mostly newer suppliers seek innovation opportunities.

As noted, there are sharper incentives to test this sort of arrangement where there are local network constraints, and possibly the existing generator has an ANM contract with the local DNO, resulting in risks of significant levels of generator curtailment and lost revenue.

2.5.3 Revenue stack and benefits

Under the traditional sleeving model, the owner would capture the value of its asset. Delivery and other third party charges would be negotiated

Under the local club approach this arrangement provides a route to market for power generated locally, usually at rates higher than export or wholesale rates. The consumption partners will usually receive lower cost power than grid supply through conventional supply arrangements. A good example of this on a flat tariff is illustrated by Bethesda, where the power produced by the hydro scheme is priced at 7p/kWh to local participating consumers. The net benefit could be construed as savings reflecting the supplier's margin, plus a share of embedded benefits, less the fees paid to the supplier for facilitating the arrangement and providing top-up and spill.[1]

The arrangement is more efficient where both are connected to the same settlement zone to capture embedded benefits.

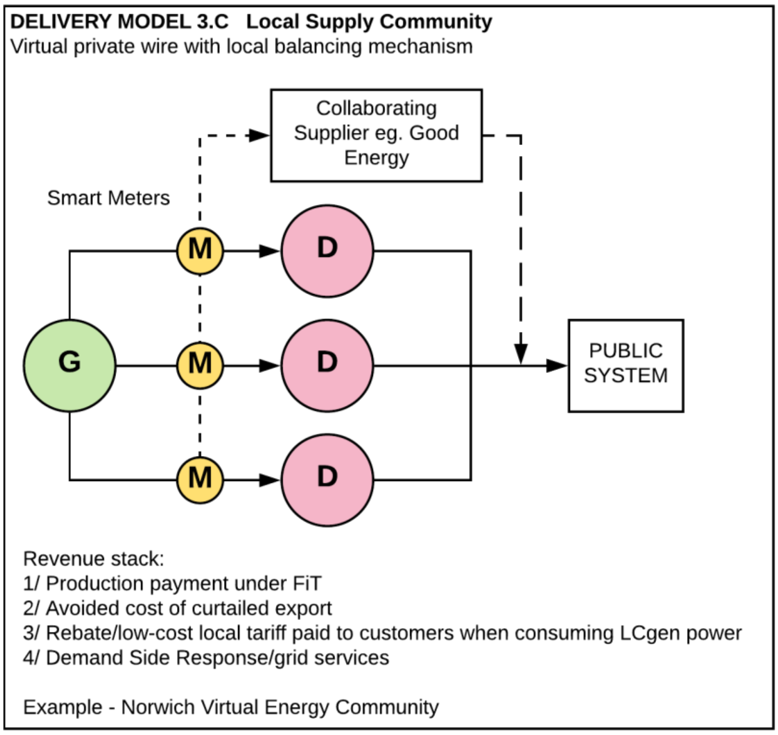
According to studies, such as that conducted by CitA in 2017 and the Wadebridge Sunshine Tariff trial, consumers with access to automated demand-control, such as storage heaters and electricity storage (e.g. batteries) can access more value from ToU pricing than others. Savings to the consumer will depend on engagement with the forecasting system.

2.5.4 Variations

Two noteworthy variations should be noted here.

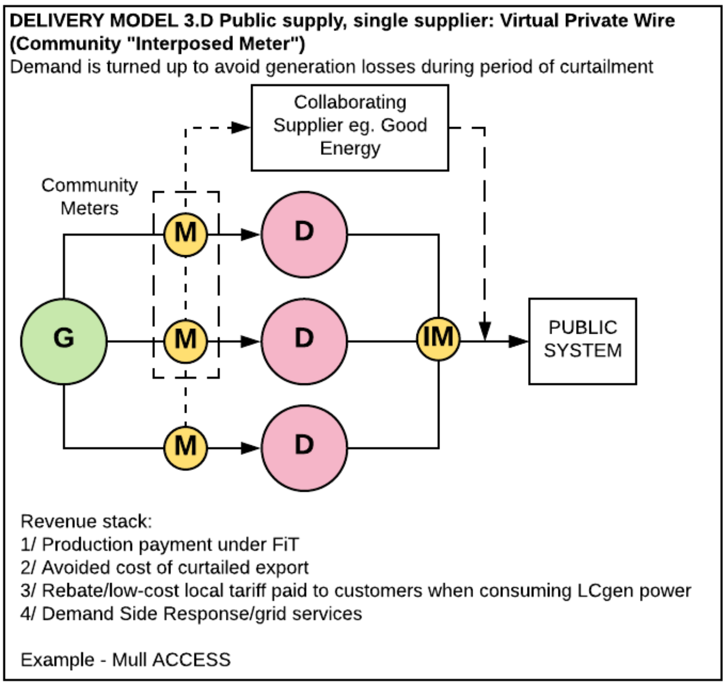
The first is what we have termed the **local supply community** {**Model 3.C**) This is effectively a VPW arrangement, but one where a supplier groups the local meters that constitute the community scheme in the interests of transparency in a separate BSC registration from its own meters in the settlement zone. In itself this would allow the participants to accurately calculate the embedded benefits their matching would give rise to[2]. We show this arrangement below.

[1] In the case of Bethesda, there is a relatively complex ToU tariff with rates between 7.25p and 14p/kWh applied by Coop Energy.
[2] In some previous work we have done a technical critique of the settlement rules and how they could be improved to support community trading.



The diagrammatic representation of Model 3.C is the same as Model 3.B.1; the only difference is the way the meter data is classified and grouped in industry settlements.

A further enhancement we have explored is use of an "**interposed meter**" (**Model 3.D**). The idea here is that a separate settlement meter is installed on the boundary to the local distribution system which aggregates all meters in the immediate electrical area. If a consumer within the area is not part of the community arrangement or opts out of it. In such an instance the opting out part would need to have its own settlement meter whose reading/s could be subtracted from the interposed meter.



Depending on the physical configuration of the production and consumption meters, the arrangement could effectively develop as a rudimentary form of **micro-grid** (**Model 5.A**). This is likely to be stimulated where either the meters in total are amenable to self-balancing, or perhaps where there is some physical limitation on the import of top-up power or the export of surplus power. Localities and generators subject to ANM contracts with DNOs would again be a prime candidate. In certain respects, a local energy club would become a micro-grid where it was commercially or physically balanced through the increased application of technology. in such a circumstance it would not be significant if any network constraint was relieved.

In this scenario, choosing technology to match generation and consumption profiles will maximise the benefit of the model, as more power would be sold at low/local rates, and less energy imported at high rates or exported at lower rates.

2.5.5 Future developments

Model 3A and 3B already exist (albeit with derogations in the case of some examples of 3B). Models 3C and 3D would require changes to settlement rules to operationalise and implement. Smart metering would be mandatory.

Incorporation of additional technology to help match demand and generation profiles, including EVs, flexibility demand, electricity storage, will assist this. Assuming installation of smart meters and time of use tariffs, the benefits of this pathway could be mutually reinforcing. Domestic and small commercial heat production and heat storage is the primary route to market for existing trials. However, other options could include EV charging, desalinisation plants (more useful perhaps in the water-constrained South and East of England than in water-rich Scotland), hydrogen production (for energy storage, heat, grid injection or transport fuel) and electricity storage.

Given the structure of the arrangement and depending on size of aggregation opportunities, it could well be possible to enter generators into National Grid and DSO flexibility offerings, and potentially the Capacity Market as well, dependant on generation technology. However, there are under current industry rules, threshold issues that will restrict the applicability of these to CALE schemes.

The roll-out of smart meters – particularly SMETS2 meters with advanced connection technology – will support these projects, as demand-side technologies will be able to connect directly to existing industry communication channels, reducing implementation costs. This may lead to greater development of commercial organisations, including suppliers, engaging in this sort of project.

As electricity storage becomes cheaper, other demand-side interventions could become less cost-effective compared with storage, unless the primary aim of the project is alleviating fuel poverty or heating constraints rather than alleviating generator curtailment. Other technologies, such as hydrogen production are also becoming cheaper, and could offer more value for the cost of investment, compared to domestic heat.

CALE groups may be able to take a role in local community building, raising awareness and engagement, rather than in leading projects from a technology implementation side.

2.5.6 Critical assessment

Sleeved solutions are becoming mainstream. Their roll-out is likely to be combined with a range of smart applications and processes, encouraging more optimal balancing with generation availability and output. The Bethesda case study is an example of this (though it's not very smart, relying on price signals and a ToU tariff to alter behaviour). Here production forecasts are also made available that allows consumers to move their consumption to periods of higher production allowing them to access the lower tariff rate.

Against this, the contractual arrangements are complex requiring a supplier to offer commercial innovation and rely on having a supplier to manage the process.

As far as we are aware local energy hub pilots are also dependent on (i) the supplier managing the settlement risks that arise between the fixed charges they receive based on standard settlement classes (SSCs) or (ii) settlement derogations at present, though we would expect a successful trial potentially to lead to rule change proposals. For reasons we set out elsewhere there is a need for modernisation of the SSCs more generally to allow individual meters to be allocated cost-reflective charges.

It is very unlikely that a supplier would offer a long-term arrangement that would allow investment in new generation assets to be underwritten.

2.5.7 Relevance to CALE groups

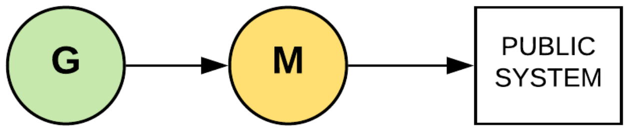
We see limited scope for conventional sleeved solutions owing to the lack of scale and scope associated with most community developments. Local participants also lack the negotiating weight to extract favourable terms.

In circumstances where there is a pre-existing constrained supply, and a coherent group of customers, some suppliers would be prepared to participate in innovation schemes. As HHS approaches these incentives will increase.

Due to the existence of significant number of existing constrained generators in Scotland, especially on the Isles, and the fact that withdrawal of the FiT for future generators will not affect those already commissioned, this sort of project will continue to be viable. However, we question the viability of the model relating to domestic heat loads over the longer term, especially in comparison to other models such as electricity storage, including domestic behind the meter storage, or hydrogen production.

2.6 Generator-only models

DELIVERY MODEL 4.A Generation connected to unconstrained grid connection
Export to grid with short-term PPA (current)



Revenue stack
1/ Usually linked to ROCs
2/ Production payment from long-term (10-15 years) PPA to market
3/ Share of embedded benfits passed through

Example - Smart Wind Co-op (FiT)

Description

A generator is connected to the grid with a firm connection agreement for the full amount of its potential generation. It is presently remunerated with a series of short-term PPAs, backed by ROC or FiT revenues, which guarantee returns for a 20--year term.

With the abolition of new FiTs and close out of ROCs, the project will need to secure a 7 to 10-year PPA to be viable (even where funding has been obtained, a firm revenue stream would be required to reassure investors). This is different to the previous baseline where surety of ROC or FiT revenue enabled the developer to rely on short-term contracts or the FiT export rate.

2.6.1 Conditions/ scenario

With the penetration of high levels of generation onto the distribution network, unconstrained connections are less available than would have been the case a decade ago. Some regions do have availability for new generation. Obviously, a wind project would need to be located in an area with good wind availability; hydro would locate where there was good run of river hydro resource; and AD and biogas would locate where there were good fuel sources.

The typical geographical setting will be on an island with a limited connection to the wider grid, but examples also exist onshore. In addition to the generator and consumption parties, cooperation of an energy supplier and the local DNO will be required to make the project feasible.

The CALE group would develop and finance the project and ensure that the local community bought in to the idea, in principle even if not financially. This could result in a smoother road to delivery than experienced by some commercial projects, which have historically encouraged significant local protest.

2.6.2 Revenue stack and benefits

Exports to the wider system are remunerated through a PPA, which includes a share of embedded benefits. Additional revenue streams potentially include offering National Grid services, and particularly offering services to the local DSO for constraint alleviation, though such arrangements have yet to be properly defined and commercialised. This is as a result of the avoided cost of reinforcement, which is not necessary as the generator could be supporting the consumption behind the constraint. These revenues will be higher for dispatchable generators.

Generators typically presently secure a series of short-term PPAs, which enable access to a share of embedded benefits, improving revenues above subsidy and/or simplifying trading arrangements for the generator. The market for such contracts is now fairly liquid, though less so at smaller capacities.

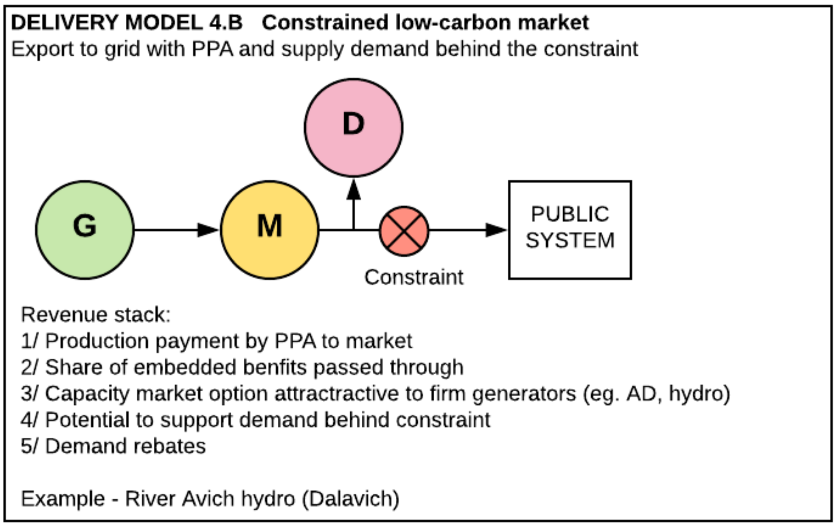
A PPA but not a FiT arrangement would also allow negotiated prices to link to wholesale market prices and also to achieve a share of embedded benefits. Current levels of both of these are summarised in Appendix A.

Payments would be linked primarily to MWh production, perhaps with differentiation between baseload and peak periods and perhaps with seasonal differentials (in practice the pricing is likely to be tied to seasonal contract prices quoted on the market. If the generator were subject to constraints, for instance through operation of an ANM scheme imposed by the local DNO, these are unlikely to be considered relevant by the counter-parties. However, the PPA is also likely to impose conditions with regard to notifying outages and the making of availability declarations, along with non-performance outside of stated tolerance bands.

2.6.3 Variations

There are a number of variations we have considered.

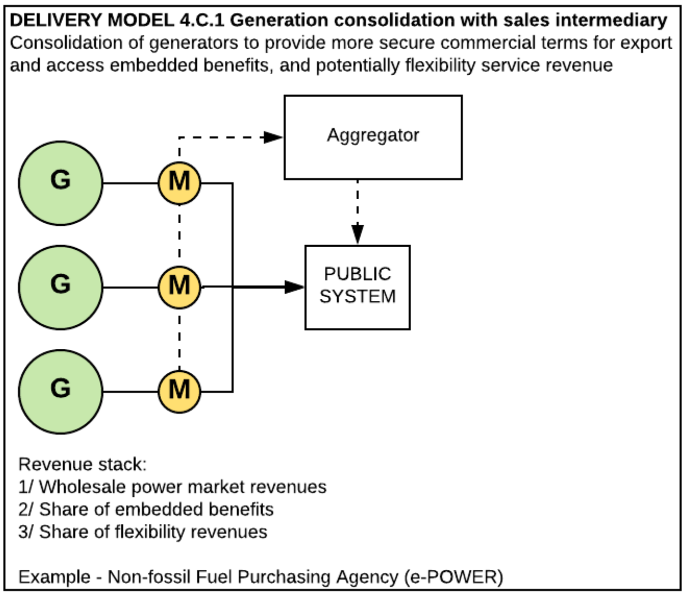
The generator may be connected to the system behind a constraint. This **constrained generator** model is shown as **Model 4.B** below.



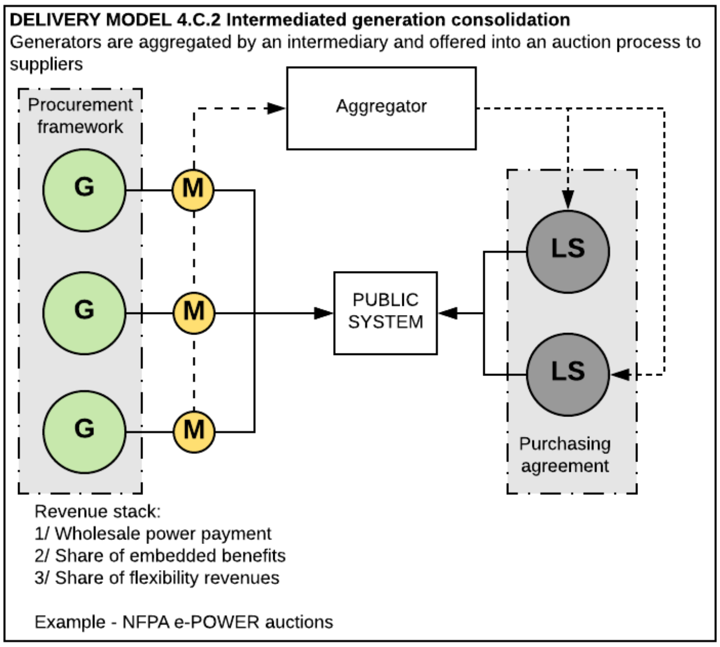
This relationship may be managed by an ANM agreement, which will entail curtailment at certain times. There may be scope for the generator negotiating demand turn up. Demand-users could be offered a rebate of part of the cost of the additional energy which they use as a result of efforts to increase consumption and alleviate curtailment. This is one element of the Mull ACCESS scheme. In that case the community managers administer the payments, but usually we would expect a partnering supplier to be involved (this would then become a VPN).

However, that does not have to be the case, and revenue splitting mechanisms are likely to emerge that could be managed by the generator.

The second variation we have considered is **generation consolidation**, which has a number of variants. The simplest variation is based purely on energy aggregation (**Model 4.C.1**). This is shown below. Generator meters are aggregated and offered to the market. We are not aware of any such arrangements in the market today under split ownership or with communities.



A further iteration we have developed is an **aggregation model where an intermediary makes a market** (**Model 4.C.2**) for the generator exports and takes these to market and sells the output to suppliers. This could be done through a specially formed agent.



In our examples a designated administrator or agent agrees umbrella terms with participating CALE groups and new sites can be added within defined parameters. Suppliers could enter into the framework individually or in combination. If there were more than one purchaser, they would have the option to purchase on minimum defined terms. Ideally there would be some locational element to encourage suppliers to bid for parcels of power. This is very similar to the e-POWER process but obviates the need for the CALE group to be a licensed supplier to market their power to the end customer.

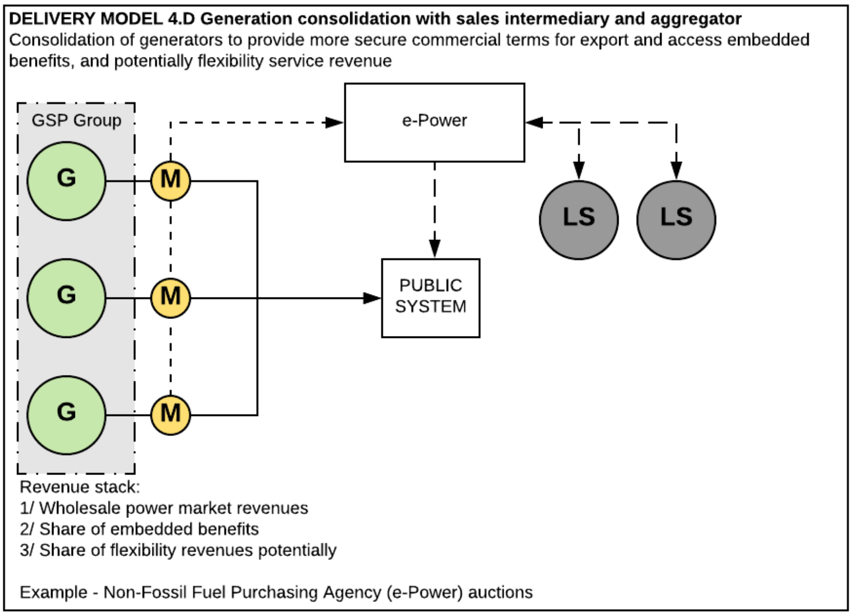
With the removal of FiTs, CALE developers will need to approach the market for a purchaser, which means seeking a PPA. Even with crowd-funded projects, investors will need to know what the route to market is and the floor price for revenues as guaranteed returns. This is very similar to the e-POWER process (see below), but could address the problem of an absence of a long-term contract. The terms of trade through e-POWER are in effect a short-term PPA; the generator knows it can resubmit after the tendered period expires – usually they are for six or 12 months.

If there were more than one purchaser, they would have the option to purchase on minimum defined terms. Ideally there would be some locational element to encourage suppliers to bid for parcels of power. This obviates the need for the CALE group to be a licensed supplier to market their power.

A further evolution of this model might be where the agent perhaps creates **a market with public sector purchasers** (**Model 4.C.3**) in Scotland. A supplier would need to be involved if the relationship involved delivery of power to the customer. This is the same as the previous model (4.C.2) but with a specially constituted entity carrying out consolidation, then under a supply licence, selling to public sector customers.

A separate variant is a **generation auction** (**Model 4.D**) where licensed suppliers bid to acquire it for short periods (typically 6 or 12 moths). One example of this exists today, and this is the NFPA managed e-POWER auction. A graphical representation of this is shown below.

Any generator exporting power onto the market can join and the NFPA is seeking to encourage aggregation; lots would then be auctioned by technology and distribution region to the highest bidder. Mixed-technology lots have been trialled, but do not typically deliver higher revenues due to the added complexity.



The auction process can improve the commercial terms which are offered for existing generation schemes, especially if they can be aggregated within the same settlement zone. It could also provide a route to market for new schemes that have already been financed.

The result of an auction would be a short-term PPA, which would result in pass-through of an element of embedded benefits and could in the future offer a pass-through of flexibility revenue. This model offers relatively small returns for a small amount of work. The main benefit is to the generators, who will be able to secure higher returns for wholesale power and a share of the embedded benefits. A CALE group may therefore be keen to aggregate its own assets for sale, as well as any other local generators it is able to develop contacts with.

2.6.4 Revenue and benefits

At present any generator or generators entering the market would have to rely on their PPA revenues. This should include some credit reflecting the embedded value the offtake arrangements to the supplier counterparty, who would be able to offset the generation output against its demand in the same settlement zone.

Unless there was some specific locational issue, it is unlikely that network operators under current incentive structures would be prepared to enter into balancing service agreements with community operators unless they could be formed into a portfolio with 3MW or more.

2.6.5 Future developments

Capacity market payments may well be available into the future for subsidy free generators.

Options to stack revenues, e.g. selling flexibility into the balancing service may become available as aggregators emerge and/or as thresholds are lowered.

Smart developments and more granular settlement would not have an impact.

2.6.6 Critical assessment

The withdrawal of the RO and forecast closure of the FiT makes this model and any of the variants very difficult from April 2019. Any new CALE projects would need to negotiate a PPA if they opted for a generation only model.

While there is a bias in the market around scale and critical mass, we expect this will quickly be offset by the appetite for green power. Commercially the intermediary on behalf of the generators would need to ensure it contracted with credit worthy counter-parties.

We would expect that subsidy free generation would be able to participate in the Capacity Market in the foreseeable future, and there could well be arrangements for consolidating regional generation (the current generation threshold is 3MW). Similarly, reform is imminent for National Grid to introduce forward auctions for balancing services, with the possibility of week ahead auctions for frequency and fast response services. We expect many existing sites will need a sales round as NFFO contracts expire and RO sites re-enter the market post 2022.

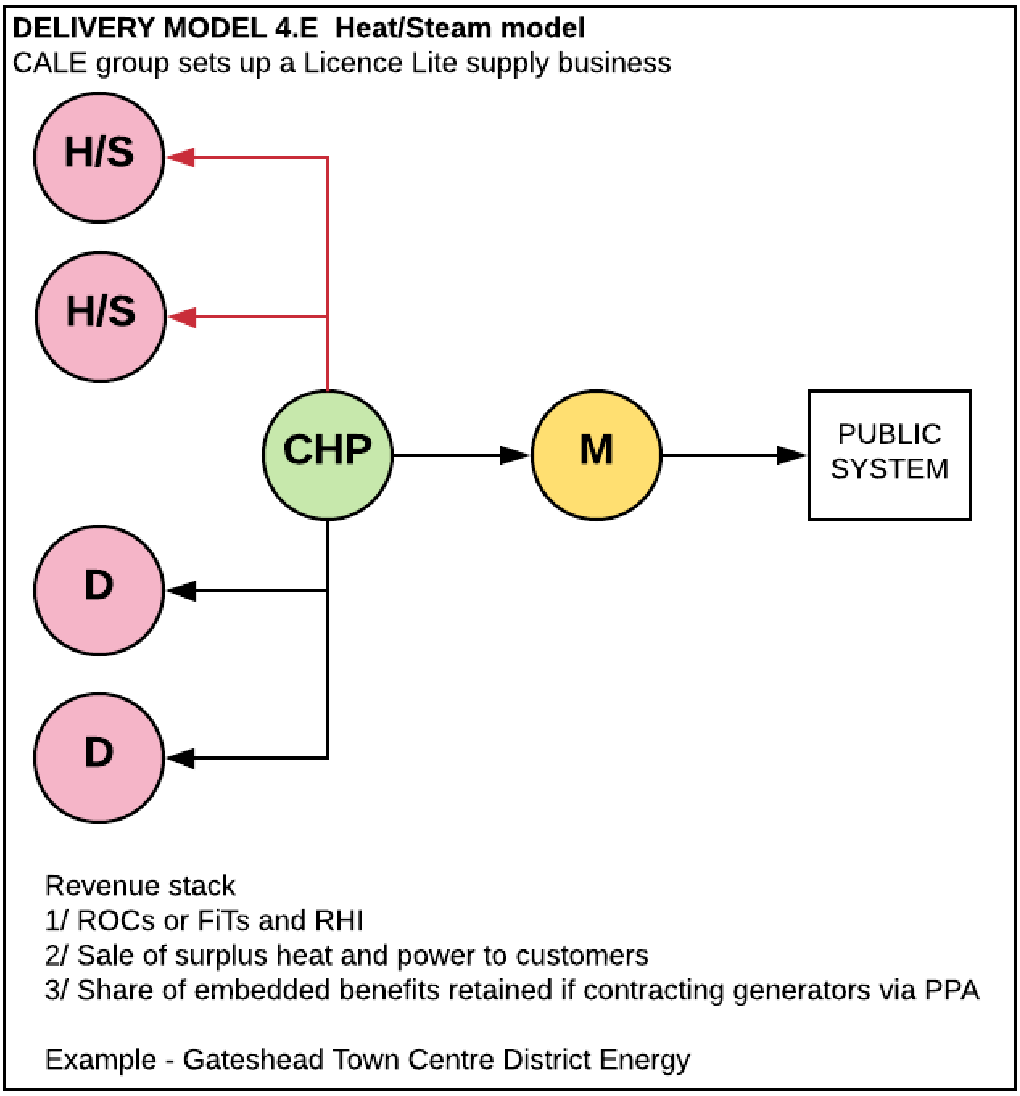
New generators securing Capacity Market agreements will be subsidised for 15 years, but at the time of writing, the Capacity Market was suspended pending review, due to a European General Court ruling on State Aid. It is expected to return once State Aid requirements have been met. In addition, prices coming out of T-4 auctions were lower than originally forecast. The 2018 T-4 auction, for example, delivered a price of £8.40kW/year. With de-rating, this could add around £0.50/MWh to an average wind farm's revenue[3]. The 2017 T-4 auction delivered a price of £22.50/kW/year, which would add £1.24/MWh; the price estimated as needed to deliver a new gas-fired CCGT, £35/kW/year, would add £1.94/MWh to revenues. None of these prices alone would underpin the investment, but could form part of a revenue-stack.

The presence of the constraint will reduce the ability of the generator to offer services to the national market but will increase the likelihood of the DSO offering a tender for services in the area.

We believe going forward that aggregation models will develop, and a market could be developed in green Scottish power where it was not used by the local community.

[3] Assuming that the wind farm operates with a load factor of 35% and the Capacity Market de-rating factor for wind is 17% (this has not yet been set, though a modification is in hand to do so)

2.7 Heat and Power model - heat with surplus power for export



2.7.1 Description

This Delivery Model is similar to other generator export models, but in this case there is a Combined Heat and Power co-generator that provides heat as well as electricity. Community CHP units are typically sized between 500kW to 1MW, exporting surplus power to the grid. The constraint in this instance arises from limitations imposed by optimizing the heat and/or steam with the power demand. We treat this variant as a separate category here because of the size of the electrical export.

2.7.2 Conditions/ scenario

The CALE groups owns a renewable fuelled CHP plant. Usually cogen facilities are sized to deliver a defined heat (domestic) or steam (industrial) profile, producing surplus energy. Where there is surplus power to demand (which is often the case), this may be exported to the wider network.

Heat in this pathway is a major driver of project structure. It is possible in a network constrained area, some portion of the off-take could be redirected towards on-site conversion from power to gas.

2.7.3 Revenue stack and benefits

There are two main sources of revenue - from heat and power sales.

The heat would usually be consumed by the site owner, or subject to a bilaterally negotiated tariff where there was a local shared network.

Where the site has used renewable fuel, until now the FiT export rate has usually been available (or they have entered the PPA market where the output is above 5MW). The difference between the administered FiT export rate and PPA rates is normally wider than for other renewable technologies recognising its controllability and higher load factors.

The e-power auction also provides a route to market for an increasing number of stations[4].

New sites will need to enter into a PPA if they seek the simplest route to market for the power and wish to underwrite the investment.

2.7.4 Variations

With many CHPs, the electrical output surplus can usually be significant. To maximise the value, it is likely that some form of sleeving or supply solution would be considered. If the sleeving route were followed, this would take us back to Model 3.B.1.

In our pathways work, we have combined a significant electricity export with licence-lite supply (this takes us Model 6.B). Even where exempt supply can be used, the operator needs to be able to demonstrate compliance with industry codes and have its transactions settled. This means working alongside an established licensed supplier.

2.7.5 Future developments

While subsidies for power are being phased out, those for renewable heat are set to continue (though there are not presently any specific capital funding available). We also expect that specific policies to boost decarbonized heat will be given greater emphasis given the shortfall against stated targets and the targets set out in carbon budgets. Opportunities are also likely to exist from decarbonizing gas being burned in CHP or moving from fossil to non-fossil fuels.

Where they do not receive subsidy, CHPs would be eligible to participate in the CM.

2.7.6 Critical assessment

This model offers relatively secure near-term future for a CALE delivery model due to the ongoing subsidy for renewable heat. However, CHP and provision of heat networks are very capital intensive. The size of typical developments with exportable volumes also tends to be bigger than many other community schemes, meaning they are complex and expensive. Conversely, their scale and controllability means they are likely to be valued more by the market.

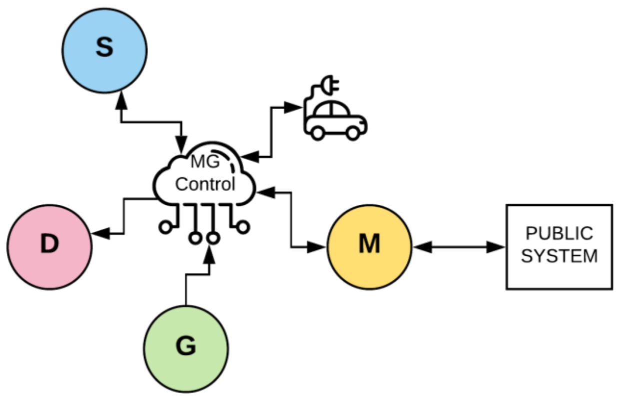
[4] 65 Stations participated in the January 2018 auction

2.7.7 Relevance to CALE group

Larger scale CHP sites are associated with business park and industrial operations, and are of limited relevance to CALE groups. However, new build district and community heating schemes could result in the production of surplus energy, including electricity which would need to be directed at existing electric heating, exported to neighbouring sites or put onto the grid.

2.8 Micro-grid model – Grid-connected

DELIVERY MODEL 5.A Grid-connected microgrid (new or network replicating private wire)
Demand, storage and generation connected to public system (unconstrained)



Revenue stack:
1/ Avoided cost of imported supply
2/ Sale of energy to onsite tenants
3/ Energy price arbitrage
4/ Curtailment avoidance if generator already installed
5/ Backup power/ increased resilience
6/ TRIAD/peak charge avoidance (load shifting)
7/ Avoidance of connection charges for additional generation or demand
8/ Long/short-term PPAs with embedded benefits for exports
9/Carbon/ petrol displacement

Example - Findhorn, Feldheim, Gateshead District Energy Scheme, Levenmouth

2.8.1 Description

A micro-grid including onsite demand, generation, and potentially energy storage and EVs. This may or may not include a heat network. This differs from a private wires set up or VPN in that a micro-grid controller attempts to balance generation and consumption onsite, by adjusting flexible generation and demand, energy storage and EV smart charging and V2G services. If the site cannot be balanced, or it would be economically superior to be in imbalance, energy is imported or exported via the grid connection.

2.8.2 Conditions/ scenario

Current implementations are early stage or pilots, and tend to be in locations such as university or high-tech business campuses. Micro-grids can be implemented anywhere a cluster of demand and generation exists, though some applications will be more suitable than others: typically, in the GB market, non-domestic implementations will be more viable.

2.8.3 Revenue stack and benefits

Revenue is derived from onsite tenants, paying for energy. The CALE group’s own onsite energy needs can be met by its generation, avoiding the cost of power imports.

By balancing consumption to generation, the micro-grid can minimise import of power, avoiding costs. The micro-grid can operate to draw energy in at times of low costs, and export during high values, benefiting from energy price arbitrage and minimising network charges. It would need to establish a PPA for these purposes. Export via a PPA gives access to a share of embedded benefits.

Generator run-time will be maximised by avoiding potential curtailment, increasing flexible energy use when the generator would be curtailed.

There is a resilience benefit to having flexible energy resources onsite, as any failure of the wider public network will not take down the micro-grid immediately.

There may also be the option to take the grid to a less-firm connection standard in the future, adding additional generation or demand assets which are supported onsite, avoiding the costs of reinforcing the connection to the wider network.

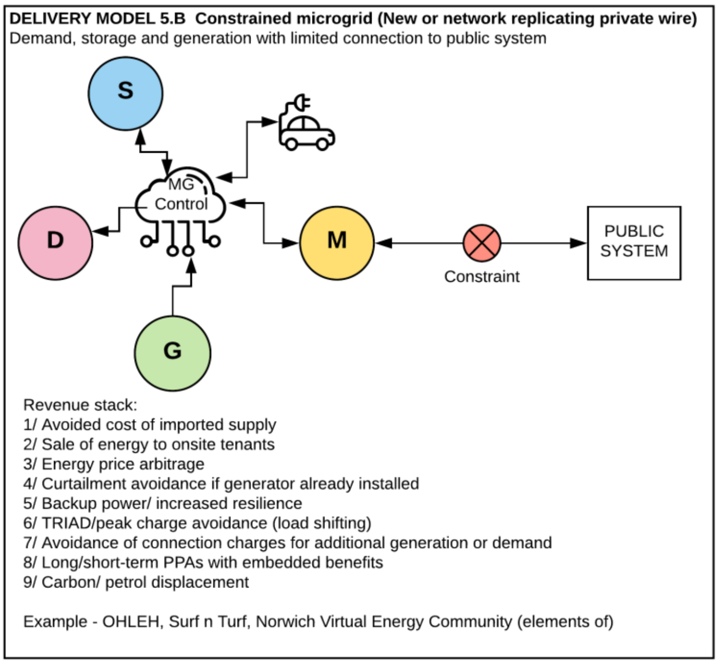
2.8.4 Variations

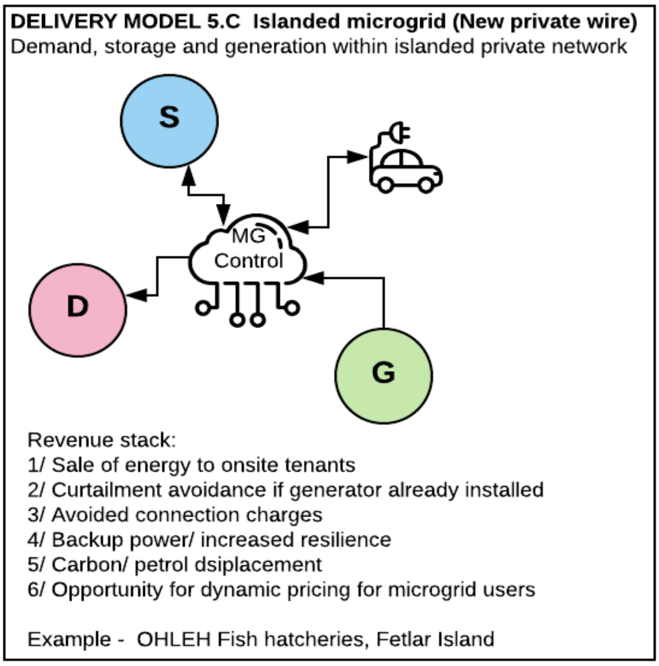
Grid connected micro-grids can be run to maximise economic benefit or minimise carbon emissions. The connection makes flexibility resources valuable to the micro-grid, rather than essential to maintain frequency and voltage stability.

Sources of flexibility will include fuelled generation, various energy storage assets, including heat and hydrogen, and demand turn-up and turn down.

Where a **grid constrained micro-grid** exists (**Model.5.B**), the flexible capability might be operationalised in a different way. On the plus side demand response and storage can be called on; conversely it is important not to let the local grid get too far out of balance, as import or export of the full level of demand or generation is not possible.

They can also be implemented where there are **no grid connections** (**Model.5.C**). Again in this instance distributed energy resources can be optimised for local benefit.





2.8.5 Future developments

Ofgem is currently undertaking a review of network charging: the TCR SCR. This is, in part, considering the effects which behind the meter generation is having on allocation of network charges, and therefore any changes made to these charges will impact on the avoided cost of generation. This workstream is expected to deliver results in the next 2-3 years.

As the costs of technology options for flexibility changes, this will affect the economics of future micro-grid implementations and the preferred technologies.

The Capacity Market is currently being modified to add a de-rating factor for “other” generation technologies. This may allow micro-grids to bid into future auctions as a unit, rather than as separate technologies. It may also be able to access DSR revenues.

2.8.6 Critical assessment

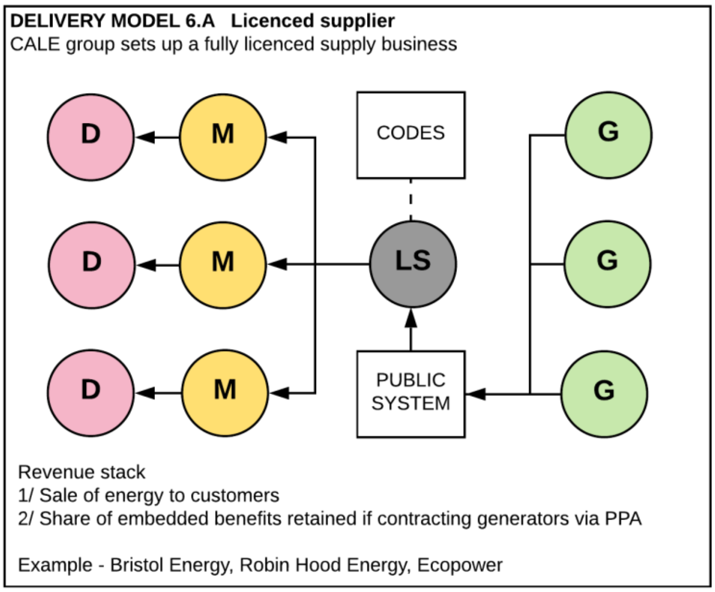
The micro-grid combines the benefits of a number of other models, including self-consumption, private wire supply, avoidance of generation curtailment and attainment of grid services revenue. If micro-grid operators are flexible to capture as many of these revenues as possible and move between options as the relative economic benefits change, this model is viable.

However, obtaining investment may be challenging as setting up a micro-grid from scratch is a capital-intensive process and there are no long-term guaranteed funds available for most of the technologies needed.

2.8.7 Relevance to CALE group

Micro-grids are clearly very location specific, but relevant to CALES in a number of different scenarios, especially on physically or electrically islanded parts of the system. The use of smart applications will increase their dexterity and also increase their viability in new locations. The commercialisation of battery storage and EVs is likely to be transformative in such situations.

2.9 Energy supply company – Licensed supplier



2.9.1 Description

A full **licensed energy supplier** (**Model 6.A**), buying electricity from the wholesale markets or via PPAs with generators, or operating its own generators, and selling electricity (and gas) to domestic and/or non-domestic customers. The 500+ page licence requires compliance with a suite of dense industry codes (which all have extensive subsidiary documentation). Suppliers must also operate within wide-ranging arrangements for setting and collection of policy costs mostly from domestic customers. They would need to establish trading arrangements with a third party player for trading and balancing services to the extent they were unable to procure their own generation.

2.9.2 Conditions/ scenario

"Supplier-in-a-box" models are available from several commercial providers, who will also provide assistance to accede to industry codes. Even with supplier in a box, the costs of market entry are simply not affordable for communities, even if some form of aggregation model were found to build critical mass. The cost of this model is prohibitive to community groups (upwards of £500,000 for domestic market entry), and market complexity especially on the electricity side requires deep knowledge of market and regulatory arrangements. There is no set formula but new suppliers entering the market would ordinarily look to exceed 50,000 customers quickly to recover costs, with most going on to build scale within two to three years.

2.9.3 Revenue stack and benefits

Revenues arise as payments from customers for the energy which they purchase. The gap between wholesale export and retail sale is around 10-20p/kWh but much of the gap is accounted for by network and policy costs. Up to 20% of the domestic market will be subject to some form of price regulation by the end of 2018.

Additional revenue may arise as a share of embedded benefits, retained via PPAs, but the bulk of this (90% plus) by convention would vest in the generator/s.

2.9.4 Variations

Domestic or non-domestic customer focus, electricity or gas are the primary options.

Current energy suppliers may choose to focus on a particular customer type, for example Utilita target pre-payment customers, Ecotricity have a green, eco-friendly brand, and existing CALE energy suppliers Bristol Energy and Robin Hood Energy target specific regions, Bristol and Nottingham respectively. As yet, however, local focussed suppliers in aggregate are exclusively domestic in their focus and have fewer than 300,000 accounts (about 200,000 customers) between them.

2.9.5 Future developments

Ofgem launched a call for evidence on the continuing suitability of the supplier hub principle in November 2017. The supplier hub principle sees the supplier sitting in the middle of the market, responsible for all customer interface with the wider markets. This includes passing through network charges, final consumption levies and taxes, arranging and funding metering. The result is that a supplier must accede to all industry codes, which can be a complex and expensive process. If the supplier hub principle was abandoned, this may allow innovative business models for suppliers such as peer-to-peer supply. It could also reduce cost and complexity of market entry. We do not, however, Ofgem to reach a landing on this quickly, and it has talked in terms of enabling reforms to open up the market in 5-10 years' time.

Smart meters have to be offered to all domestic and small business customers by end 2020. To date, however, less than 10% roll-out has been achieved.

2.9.6 Critical assessment

We have written extensively previously on the supply options open for new entrants, and have concluded at various times that cost to CALE operators are simply prohibitive.[5]

The cost of a "supplier-in-a-box" and market entry is currently lower than ever, and Cornwall Insight research indicates that market entry can be achieved for as little as £100-150,000, with another £100-150,000 costs for managed service over the first year in the business markets. Comparable costs for domestic entry are around

[5] See our 2014 report carried out for Community Energy Scotland that we have provided to EST.

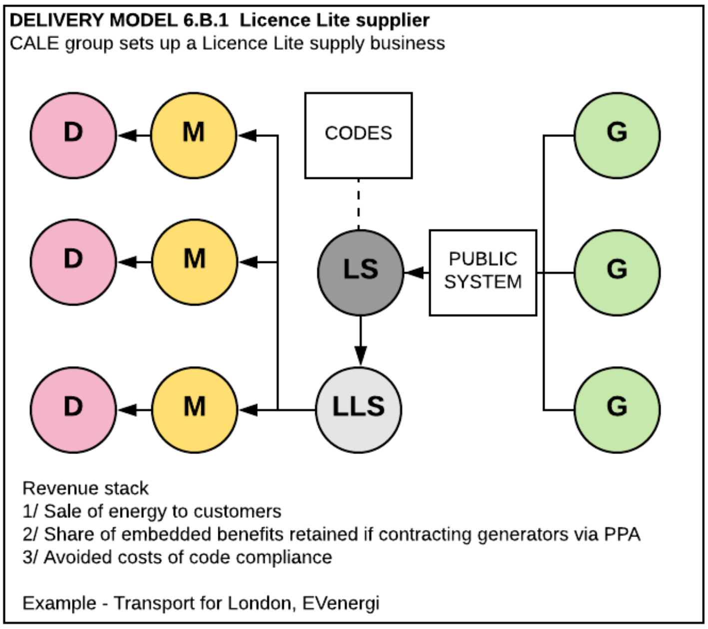
£500,000. However, there are other costs to take into account. Taking Bristol Energy as a case study, the city council has invested around £17.3mn in the supplier. It had expected to enter profitability in 2019, having launched in 2015, but in 2017 pushed back this target date to 2021.

At some stage we would expect bespoke service providers to emerge targeting CALE projects, and we are seeing the beginnings of the emergence of some relationships under white label approaches (see 2.11 below), but these are alternatives to, not variations on, full licence supply.

2.9.7 Relevance to CALE groups

Setting up an energy supplier is an expensive and high-risk venture and is not a practical option for a CALE group.

2.10 Energy supply company – Licence Lite supplier



2.10.1 Description

The model centres on a Licence Lite electricity supplier, working with a fully licensed energy supplier. The fully licensed, or senior, supplier buys electricity from the wholesale markets or via PPAs with generators, then on-sells this to the local supplier, and then manages the code requirements of the business. As part of this it registers meters on behalf of the Licence-lite or junior supplier. The junior supplier sells the energy to domestic and/or non-domestic customers.

The two establish a Supplier Services Agreement between them, in a form acceptable to Ofgem. This will define the compliance services being sourced by the senior supplier and the terms on which they will be provided. It is also necessary for the two to agree a netting agreement, which specifies the terms on which the senior supplier will provide balancing energy.

The junior supplier then sets its tariffs and signs up its customers. They are owned by the junior supplier under its lite licence.

2.10.2 Conditions/ scenario

The Licence Lite model is not new to the market (being implemented in 2009) but still relatively untested. It was designed specifically to allow decentralised operators to supply local customers while delegating expensive and complex compliance requirements.

The primary requirements are expected to be a reasonably large energy demand base, as the arrangement for Transport for London demonstrated: it intended to cut the costs of purchasing energy to meet its rail network demand. It did this through GLA negotiating a licence lite agreement with npower.

However, the other extant partnership, between Corona Energy as senior supplier and EVenergi as junior supplier, is looking to provide electricity to charge for EVs, and arguably is more representative of the type of arrangement that could benefit communities.

2.10.3 Revenue stack and benefits

Revenues arise as payments from customers for the energy which they purchase. Again the gap between wholesale export and retail sale is around 10-20p/kWh but much of the gap is accounted for by network and policy costs. Up to 20% of the domestic market will be subject to some form of price regulation by the end of 2018.

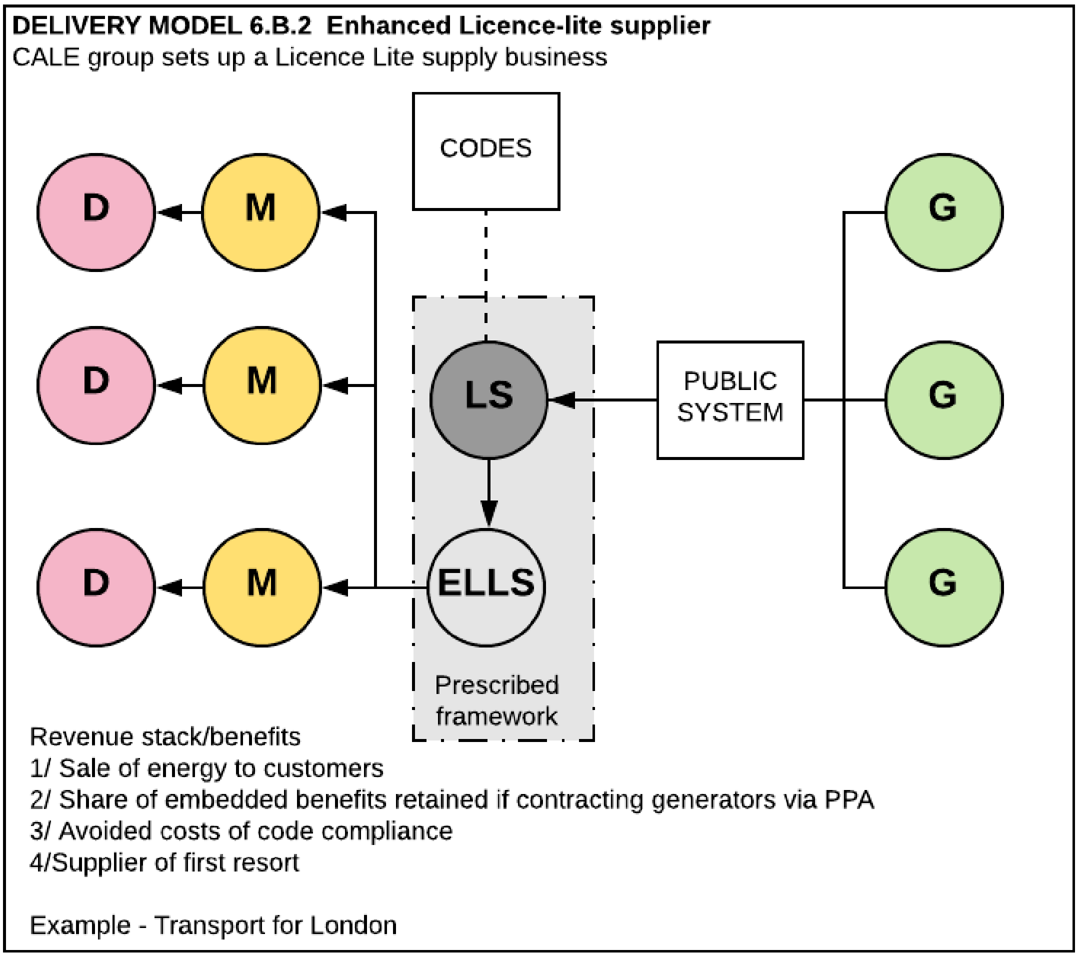
The Licence Lite model avoids significant costs in cost accession and compliance, as these are contractually deferred to the senior supplier, for a fee.

While it is not a financial benefit, one of the primary drivers behind Licence-Lite was the ability to enter the electricity market without having to develop deep sectoral or process knowledge (i.e. it was intended as a lower cost route to direct supply).

2.10.4 Variations

The same choices exist in terms of target customers as for the fully licensed supplier.

We have scoped in a submission to Ofgem in its recent call for evidence on the supplier hub “**an enhanced Licence-lite model**” (**Model 6.B.2**). The main enhanced features include: obligation on energy supplier to offer reasonable terms, standardisation of acceptable documentation, support bureau for prospective applicants.



2.10.5 Future developments

Ofgem launched a call for evidence on the continuing suitability of the supplier hub principle in November 2017. The supplier hub principle sees the supplier sitting in the middle of the market, responsible for all customer interface with the wider markets. This includes passing through network charges, final consumption levies and taxes, arranging and funding metering. The result is that a supplier must accede to all industry codes, which can be a complex and expensive process. If the supplier hub principle was abandoned, this may allow innovative business models for suppliers. It could also reduce cost and complexity of market entry. We do not, however, Ofgem to reach a landing on this quickly, and it has talked in terms of enabling reforms to open up the market in 5-10 years' time.

Smart meters have to be offered to all domestic and small business customers by end 2020. To date, however, less than 10% roll-out has been achieved.

2.10.6 Critical assessment

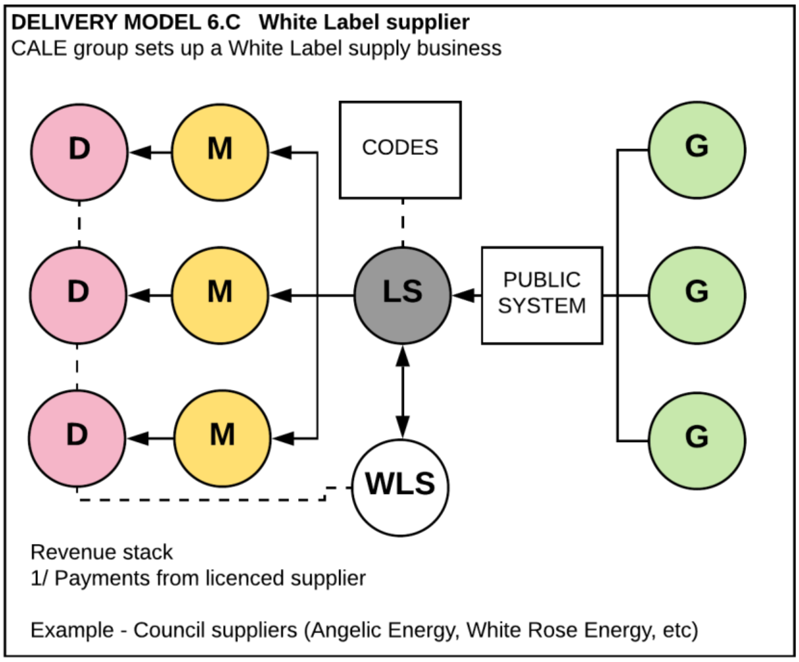
The Licence Lite model is not proven, and certainly not at community level. The current arrangements are complex, and not properly named as all the licence-lite intervention allows is the switch off the requirement to comply with industry codes. All other requirements under the licence, some 500+ pages of it, must be adhered to.

The enhancements we are proposing on enhanced Licence Lite should increase its attractiveness.

2.10.7 Relevance to CALE groups

Licence lite as it currently standards achieves little that cannot be achieved under a negotiated deal. A more tightly defined regulatory framework that required the supplier to offer terms in a prescribed form with the supporting standardised document could make a difference but it remains to be seen whether Ofgem is prepared to revisit this area.

2.11 Energy supply company – White Label supplier



2.11.1 Description

A full licensed energy supplier buying electricity from the wholesale markets or via PPAs with generators, or operating its own generators, and selling electricity (and gas) to domestic and/or non-domestic customers. The White Label supplier operates as a trusted brand to acquire customers in a targeted locale and in some instances offer its own tariffs into the marketplace.

2.11.2 Conditions/ scenario

White Label models range from the simplest (using a trusted or recognised local brand, typically a local authority in current iterations, as a device to recruit customers to an existing supplier), to more complicated (where the white label supplier may also provide customer service support, offer billing services, and may take some responsibility for setting tariffs).

2.11.3 Revenue stack and benefits

The licensed supplier will make payments to the white label supplier, typically based on customer acquisition and retention to the branded tariffs. Higher revenues could be paid to the white label supplier where it takes more responsibility for customer services and billing.

2.11.4 Variations

Current white label suppliers are typically in partnership with local authorities and have ambitions to reduce the costs of energy supply, thereby reducing fuel poverty, and increase green energy consumption, cutting carbon emissions.

2.11.5 Future developments

Ofgem launched a call for evidence on the continuing suitability of the supplier hub principle in November 2017. The supplier hub principle sees the supplier sitting in the middle of the market, responsible for all customer interface with the wider markets. This includes passing through network charges, final consumption levies and taxes, arranging and funding metering. The result is that a supplier must accede to all industry codes, which can be a complex and expensive process. If the supplier hub principle was abandoned, this may allow innovative business models for suppliers. It could also reduce cost and complexity of market entry. We do not, however, Ofgem to reach a landing on this quickly, and it has talked in terms of enabling reforms to open up the market in 5-10 years' time.

Smart meters have to be offered to all domestic and small business customers by end 2020. To date, however, less than 10% roll-out has been achieved.

2.11.6 Critical assessment

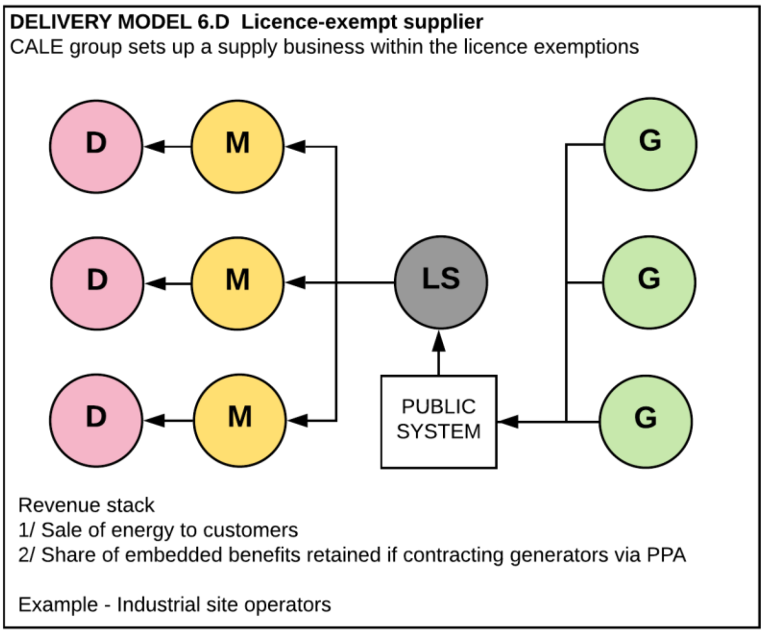
Setting up an energy supplier is an expensive and high-risk venture, but the white label supply option is the lowest cost and therefore least commercially risky. The main benefit is a recognised, trusted or local brand as a form of advertising and engagement with the local community. We have heard anecdotal evidence that the costs of negotiating an agreement with partnering supplier could be as much as £100,000.

This option may be of use to long-standing CALE groups with an established membership (it is effectively being used by Hebridean Energy as a white label of Our Power), who may also be able to use the supplier as a route to market to arrange PPAs with a fully licensed supplier.

2.11.7 Relevance to CALE groups

To date white labels have focussed almost exclusively on supply deals revealing a modest commission to the local entity. If a more inclusive model were developed, it is likely this would cede much of the value of local production to the supplier unless sleeving elements were explicitly included. If this can be achieved, the model would probably have much greater relevance to the CALE group.

2.12 Energy supply company – Licence exempt supply



2.12.1 Description

A licence-exempt supplier, operating over the public networks to supply energy to its customers. Licence exempt suppliers operate within the *Electricity (Class Exemptions from the Requirement for a Licence) Order 2001*.

2.12.2 Conditions/ scenario

The exemptions for suppliers create several classes of exemption:

- **Class A**: Small suppliers that supply no more than 5MW from their own generation assets to customers, of which no more than 2.5MW can be sold to domestic consumers
- **Class B (resale)**: Suppliers selling on electricity sold to them by licensed supplier or persons that fall under a Class C exemption (below). A Class B resale must not in any one-year supply more than 250MWh of Class C electricity to domestic customers (this is approximately equal to around 60 to 80 households[6])
- **Class C (on-site supply)**: Suppliers sell electricity generated on-site to consumers who occupy the same site, or is supplied to them by a licensed supplier and other supplies to groups of consumers (see below)
- **Class D (offshore supply)** is not relevant for this paper

This model would use a Class A exemption to supply small quantities of energy over the pubic network, from its own generation assets, topped up as necessary by energy re-sold under a Class B exemption.

Meters energised on the public system and serviced by an exempt supplier would still need to be registered by an entity in industry settlement, in effect necessitating some form of commercial agreement with a

[6] Based on Ofgem's Typical Domestic Consumption Values for medium consuming households with gas for heating (3.1MWh/year) and households with electric storage heating (4.3MWh/year). https://www.ofgem.gov.uk/sites/default/files/docs/2015/05/tdcvs_2015_decision_1.pdf

supplier. This would no doubt include provision for the pass through of network and policy costs to the exempt party.

2.12.3 Revenue stack and benefits

Revenues would arise from the sale of energy to customers. As the supplier is licence exempt, it would be able to escape payment of final consumption levies (such as RO, FiT, CfD), providing commercial advantage but only where sales occur behind the meter (top-up energy would attract the cost of these levies). It could also buy larger amounts of energy than any of its individual customers, potentially securing better rates from a licensed supplier but probably not if the volumes only relate to top-ups.

However, the supplier would not be able to access embedded benefits, which arise through central industry settlement processes.

2.12.4 Variations

The supplier could target domestic or non-domestic customers, though it should be noted that the class exemptions favour non-domestic customers, allowing twice the volume of supply (5MW rather than 2.5MW) and unlimited supply in cases where the generation and demand are on the same site or energy is being resold.

This is also the model under which heat would be supplied to customers, as the supply of heat is not currently regulated in the GB market.

2.12.5 Future developments

Ofgem launched a call for evidence on the continuing suitability of the supplier hub principle in November 2017. The supplier hub principle sees the supplier sitting in the middle of the market, responsible for all customer interface with the wider markets. This includes passing through network charges, final consumption levies and taxes, arranging and funding metering. The result is that a supplier must accede to all industry codes, which is a complex and expensive process. If the supplier hub principle was abandoned, this may allow innovative business models for suppliers. It could also reduce cost and complexity of market entry. We do not, however, see Ofgem reaching a landing on this quickly, and it has talked in terms of enabling reforms to open up the market in 5-10 years' time.

Smart meters have to be offered to all domestic and small business customers by end 2020. To date, however, less than 20% roll-out has been achieved.

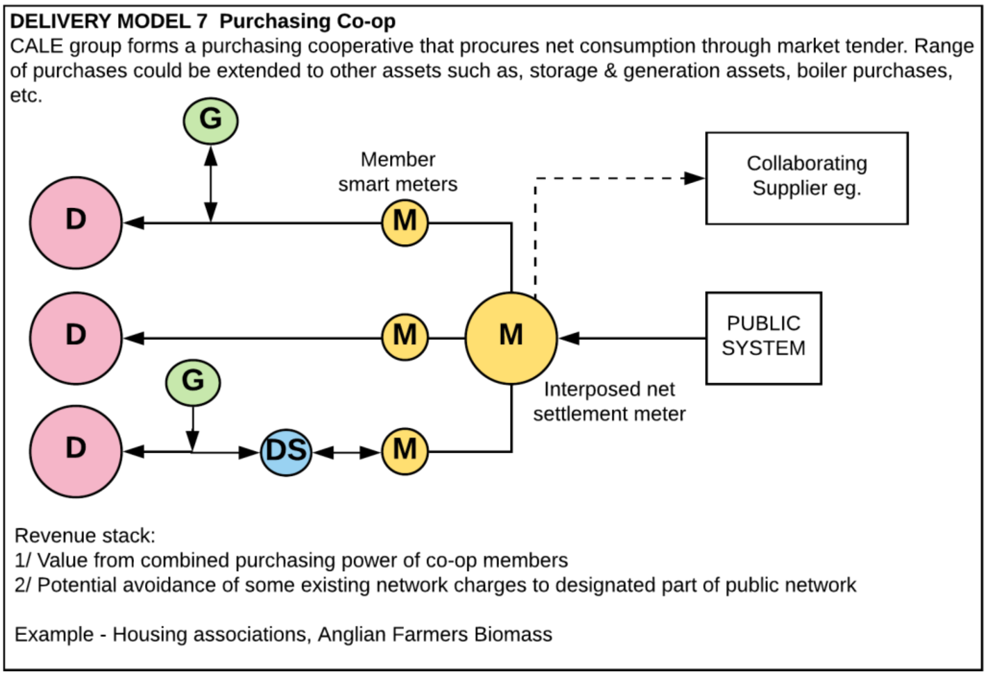
2.12.6 Critical assessment

Using a Class A exemption would allow only a relatively small amount of generation to be sold on to customers. However, a better price for this could be obtained. This model is perhaps best suited to help achieve a better price for excess generation exported under a self-consumption or private wire arrangement (models 1B and 2B respectively).

2.12.7 Relevance to CALE groups

We think this is largely limited opportunity that might be utilised by schemes split across private and public networks. It is not a means of bypassing industry costs and still necessitates negotiation of complex agreements with a supplier.

2.13 Cooperative purchasing – Collective purchasing via CALE group



2.13.1 Description

The Purchasing Co-op is formed by the CALE group to procure energy and other assets on behalf of a group of sub-metered customer-members. In doing so, for settlement purposes, the connection MPAN is assumed by the Co-op, which measures netted demand potentially via an 'interposed settlement meter' (Model 3D).

Alternatively, the Co-op would bulk-purchase fuel or other physical energy resources, such as heaters, boilers, hot water tanks, smart thermostats to give a few examples, achieving better prices for members.

Should a member wish to leave the scheme, then the householder’s incoming supplier would need to register the customer though most collective switches we are aware of are fixed duration and have an exit fee.

2.13.2 Conditions/ scenario

Contexts where groups of customers live in high-density accommodation - such as social housing complexes or associations, blocks of residences or similar high-density developments. Demand would be netted-off by the settlement meter or alternatively individual settlement meters or sub-meters used to attribute individual residence billing. The bigger the participating group, the more likely a range of suppliers would be interested.

The scenario could include other asset opportunities such as domestic generation and storage assets within the site.

2.13.3 Revenue stack and benefits

The primary objective would be to accrue savings for members by competitive tender for energy supply to the CALE membership, and there are some recent examples of suppliers offering bundles under some municipal switches.[7] It would also allow the community to benefit from the lower cost of generation from local assets (solar PV, batteries, micro-CHP), which would evolve the arrangement towards a sleeving arrangement

[7] https://thepeoplespower.co.uk/2018/02/25/best-domestic-energy-offers-available-now/

(DM 3A) . However, this could be extended to the group purchase of additional energy assets such as domestic generation, efficiency measures and storage.

2.13.4 Variations

The CALE group can operate a simple power tendering model akin to a collective switch on behalf of its members or implement extensions covering other services, potentially including insurance policies, broadband and phone for example.

2.13.5 Future developments

Could be impacted by future Ofgem pilots on opt-out collective switching, which at this stage may potentially obviate the need for the intervention by the CALE group on power purchase tendering. However, the model is likely to be strengthened if the trend for the cost of distributed generation and domestic storage continue to decline. It could evolve into a peer-to-peer model (see DM8).

2.13.6 Critical assessment

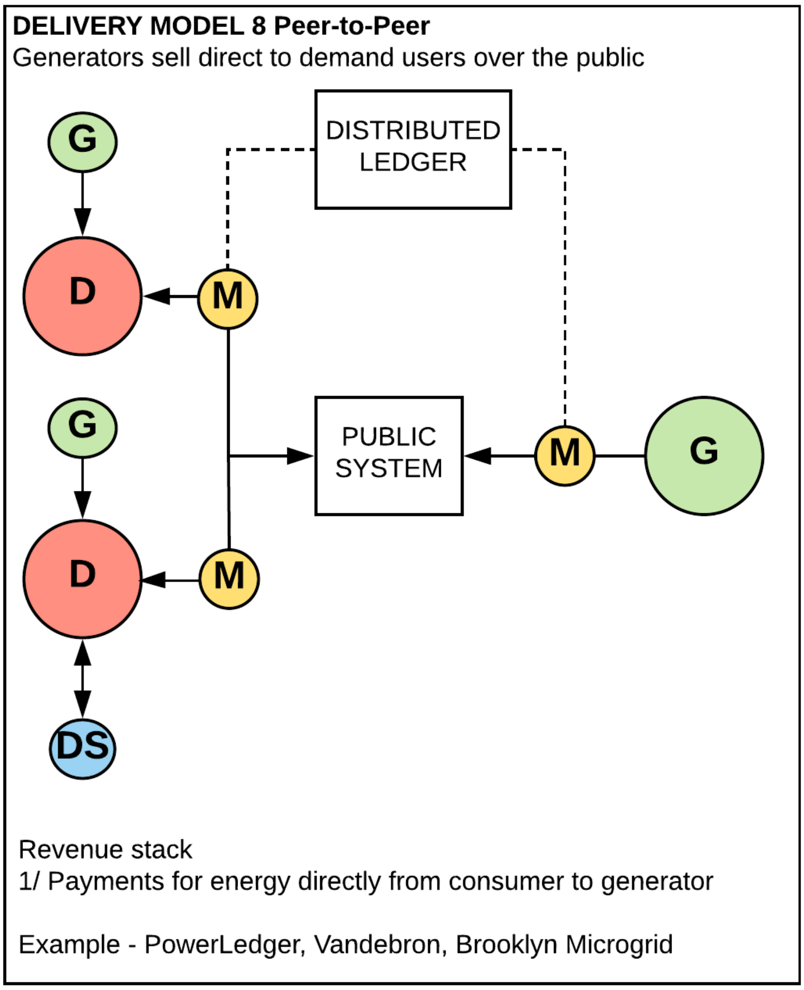
This model will work now but requires commitment by householders to join the scheme by joining the Purchasing Co-operative. It offers a solid basis for community resilience and engagement in a collective level of organisation. Most collective switch schemes that have delivered market beating prices have involved a few thousands of customers over large municipal areas.

Club structures have been slow to develop but hybrid sleeving/ collective switch arrangements superficially appear to make sense, though we would expect suppliers to seek longer term deals than a year.

2.13.7 Relevance to CALE groups

We think this is a fertile area especially fir urban based housing associations. This is subject to the proviso that high levels of engagement can be achieved in large self-contained tenement blocks and low rise housing estates.

2.14 Peer-to-peer – Direct contractual arrangement via public network



2.14.1 Description

Consumers contract directly with generators, over the public networks, and outside of the consumer-supplier relationship. Pricing and contracting is handled through a separate system, such as a blockchain-based trading platform.

2.14.2 Conditions/ scenario

This model cannot currently function in the GB market due to various market rules, in particular the current legislation requires a supplier entity to operate in the generator to load supply chain. However, the peer-to-peer (P2P) model is under consideration by Ofgem who have sanctioned a number of sand-boxed trials including those involving EdF Research in Bristol[8] and Repowering in London[9]. Blockchain-based P2P trading

[8] https://www.edfenergy.com/about/energy-innovation/innovation-blog/research-development-peer-to-peer-trading
[9] https://verv.energy/news/bringing-to-life-peer-to-peer-energy-trading-in-the-uk/

systems are also currently being demonstrated in other markets, notably under the Reforming the Energy Vision (REV) protocols in New York, the Brooklyn Microgrid[10] and PowerLedger in Perth, Australia[11].

2.14.3 Revenue stack and benefits

Generators could obtain a better value for their surplus power than selling into the wholesale markets, and consumers could pay less for their power, due to cutting-out the supplier and avoiding some elements of network charges (eg. transmission system charges).

Small-scale and domestic generators in particular may benefit from these arrangements, as it would make possible direct selling of energy to users in the same neighbourhood, without requiring private wires. As such P2P trading has also been cited as offering a defence to grid-defection by generators following the self-supply model as P2P trades require the use of the local distribution networks. Latency in trading energy could also be reduced, enabling settlement at a higher resolution than half-hourly periods. In Australia, PowerLedger are settling at 5 minute intervals for example.

2.14.4 Variations

While peer-to-peer energy sales are presented as an example of an ideal system to manage with a blockchain, or distributed ledgering, the current paradigm is for local trading, However as more participants join the trading platform and the volume of trades increase, systems will be required to align more closely with existing centralised industry systems to enable system balancing and fair apportionment of charges. The Energy Local Club model is in some ways similar to this in terms of the basic relationships, though managed through an energy supplier.

2.14.5 Future developments

Ofgem launched a call for evidence on the continuing suitability of the supplier hub principle in November 2017. The supplier hub principle sees the supplier sitting in the middle of the market, responsible for all customer interface with the wider markets. This includes passing through network charges, final consumption levies and taxes, arranging and funding metering. The result is that a supplier must accede to all industry codes, which can be a complex and expensive process. If the supplier hub principle was abandoned, this may allow innovative business models for suppliers such as peer-to-peer supply.

The outcomes of trials such as the ones mentioned above will inform the legislation supporting future developments.

2.14.6 Critical assessment

The technology is currently being piloted in a number of overseas jurisdictions, but remains far from proven at scale. Regulatory and market arrangements in these places are profoundly different to GB.

This model is not currently permitted in the GB market by licences and codes.

2.14.7 Relevance to CALE groups

This delivery model does not immediately fit with the usual understanding of a CALE group project, principally because it is predicated upon small-scale peer trading. With the additional uncertainty of the future regulatory position towards the P2P model, at this point perhaps the most obvious UK application is following the

[10] https://lo3energy.com/
[11] https://powerledger.io/

Repowering London model. Here, residents in high density housing, equipped with solar generators and battery storage have developed a local energy trading system in which technology-equipped residents organised by the CALE group participate.