Ener-Vate Consultancy Limited

Power ESCo Review for Somer Valley

A Techno-Economic Review of a Power ESCo option for Bath & North East Somerset Council

SMARTKLUB
Empowering Communities

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Contents

	Glossary
ASHP	Air Source Heat Pump
ESCo	Energy Services Company
LA	Local Authority
B&NES	Bath & North East Somerset Council
D&B	Design & Build
O&M	Operations and Maintenance
M&B	Metering & Billing
CWC	Crookes Walker Consulting
EVCP	Electric Vehicle Charge Point
kWh	Kilowatt Hours
MWh	Megawatt Hours
GWh	Gigawatt Hours
NIA	Nett Internal Area
BESS	Battery Energy Storage System
HV	High Voltage
OPEX	Operating Expenditure
CAPEX	Capital Expenditure
REPEX	Replacement Expenditure
COP	Co-efficient Of Performance
IRR	Internal Rate of Return
NPV	Net Present Value
CM	Capacity Market
FFR	Firm Frequency Response
DNO	District Network Operator
DUoS	Distribution Use of Service
iDNO	Independent District Network Operator
PPA	Power Purchase Agreement

1 Introduction

1.1 The Project

1.1.1 Ener-Vate Consultancy Ltd and SmartKlub Ltd have undertaken a research project to examine the options for establishing an Energy Services Company (ESCo) at new developments in each of four Local Authority (LA) areas.

1.1.2 The LAs involved in the project are:

- Eastleigh Borough Council,
- Isle of Wight Council,
- Bath and North East Somerset Council, and
- Cornwall Council.

1.1.3 This report looks in more detail at the possibility of developing a Power ESCo for the forthcoming Somer Valley Development for B&NES, minimising the use of fossil fuels as an energy source.

1.2 ESCo Commercial Structure

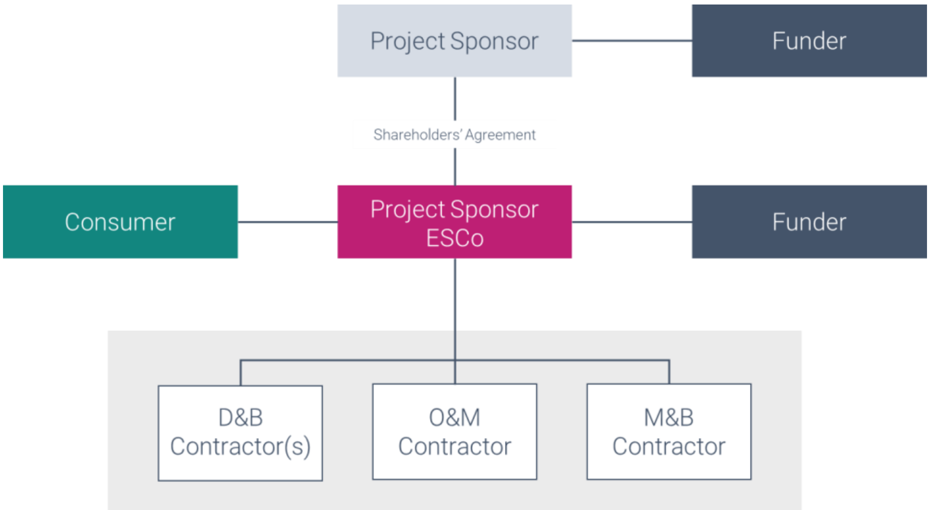
1.2.1 A business that sells an energy service adds value to the provision of energy as a commodity by meeting some additional aspect of the customer's needs.

1.2.2 In its most developed form, an ESCo provides a commitment to deliver the benefits of energy to a specified level of performance and reliability whilst providing the ESCo entity itself with long-term revenue streams.

1.2.3 This business model is of particular interest to LAs because an ESCo with a performance contract has a strong incentive to increase the energy efficiency with which it meets its contract, and thereby drive down carbon emissions.

1.2.4 Following the recent "Common Scope ESCO Report", published by Ener-Vate, the "Project Sponsor ESCo" has been selected as the structure that underpins this report as this provides the greatest control and maximum financial return for the council.

2 Project Sponsor ESCo



2.1 Roles and Responsibilities

2.1.1 The Project Sponsor establishes a wholly owned ESCo to deliver the low carbon energy scheme without a 3rd party.

2.1.2 The Project Sponsor will be the low carbon energy scheme asset owner and operator.

2.1.3 The Project Sponsor will be responsible for funding the low carbon energy scheme as well as the procurement of D&B, O&M and M&B contractors.

2.2 Control, Risk and Reward

2.2.1 The Project Sponsor will have control of the ESCo's contractors, future expansion and tariffs for the low carbon energy scheme therefore giving a lot of flexibility.

2.2.2 The Shareholders' Agreement will regulate the decision making in the ESCo, for example which decisions can be made by the ESCo itself, and which decisions can be made by the Project Sponsor as shareholder.

2.2.3 In return, the Project Sponsor will take on all funding, construction and operation risk. It will also benefit from all of the financial rewards from the success of the project.

2.3 Exit Strategies

2.3.1 The Project Sponsor has the ability to sell its shares in the ESCo or refinance any debt extended to the ESCo.

2.3.2 Should the Project Sponsor wish to sell its shares, the low carbon energy scheme should be fully built and operational over a period of a few years to be attractive to a secondary market.

2.4 Advantages and Disadvantages of a Project Sponsor ESCo

We recommend the Project Sponsor ESCO model as appropriate, due to its ability to deliver the needs of the development and achieve climate change targets. Once the ESCO is established and proven for a period, it could be sold or part sold in order to reduce responsibilities and generate revenue. This could be part of a council strategy to "pump prime" ESCOs in the local authority, with a finite amount of capital that is refreshed each time a proven ESCO is sold on. This will make Somer Valley more renewable, while limiting risk to the LA and showing leadership to the private sector.

Advantages	• Project Sponsor retains all strategic control over the project such as future expansion and setting power tariffs. • Opportunities to exit the project through the sale of shares and/or refinancing of project debt. • Maximises opportunities to use the clean solar energy from new solar farm to supply businesses and common infrastructure.
Disadvantages	• Project Sponsor is exposed to all project risks (if not passed down to contractors). • Responsibility for funding/securing funding lies with the Project Sponsor. • The Project Sponsor will need to procure external expertise and skills.

3 Assumptions

3.1 Masterplan

3.1.1 Somer Valley consultation exhibition board

Projected to deliver:

1,700
direct jobs for the Somer Valley

54,000
square metres employment floorspace

£122m
annual economic value uplift to the area

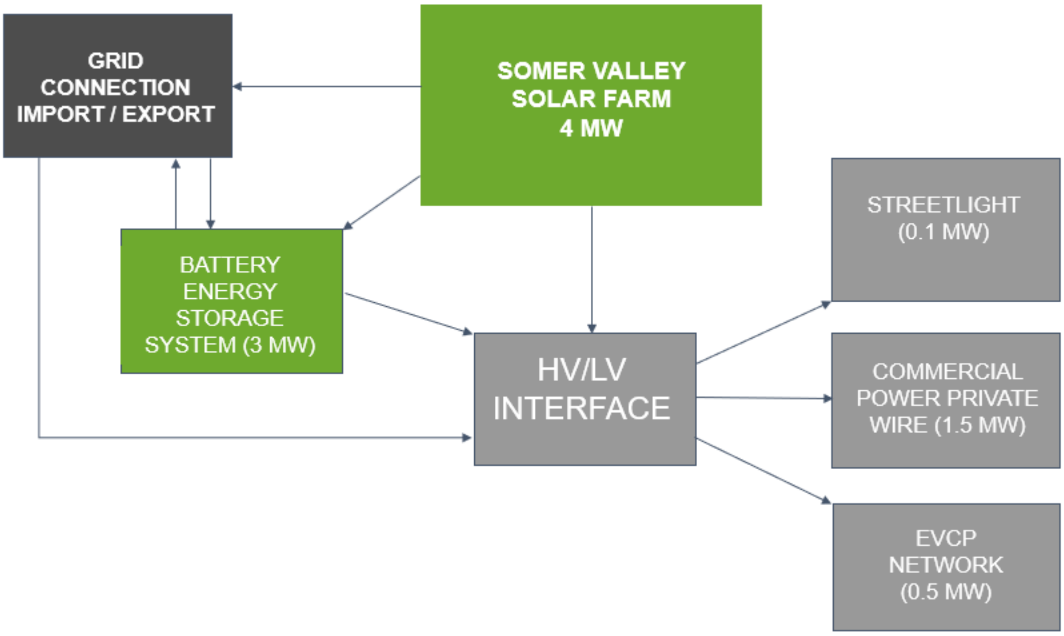
The site will attract investors as it will offer access to superfast broadband, business rates discounts and a sustainable, attractive working environment.

The Enterprise Zone site, with Midsomer Norton beyond

3.1.2 This report is a stand-alone power model.

3.1.3 This report only considers electricity supply to common infrastructure and non-domestic consumers.

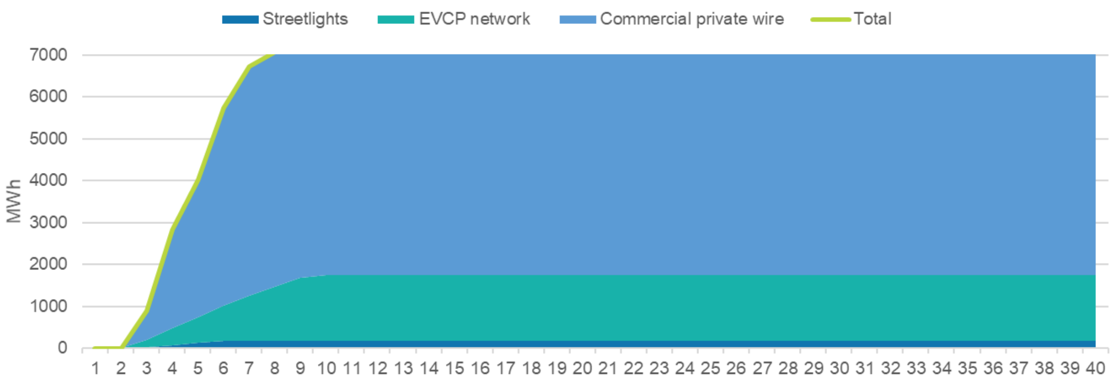
3.1.4 Power Schematic



3.2 Power demand assumptions

3.2.1 Without a detailed schedule the following assumptions have been made in order to calculate overall electricity demand:

Power consumption at build out	Qty	Annual demand (kWh)	Total annual demand (kWh)
Street & Traffic Lighting	1	180,000	180,000
EVCP (7.2kW twin)	112	14,000	1,568,000
Commercial (m2 NIA)	22,500	2,317,500	2,317,500
Light Industrial (m2 NIA)	22,050	2,271,150	2,271,150
Hotel (m2 NIA)	4,050	1,012,500	1,012,500
Losses (5%			367,458
TOTAL			7,716,608



3.2.2 Non-domestic building demand is calculated by taking the peak demand assumptions (by property type) and assuming 30% peak load for 4,100 hours per annum.

3.2.3 Commercial ESCo models are sensitive to the speed of construction whereby the earlier the demand comes on the better the financial performance of the scheme. However, from experience it is prudent to be conservative when forecasting in order to provide a more realistic picture and minimise the financial risks of possible delays, clearly as Project Sponsor B&NES can exert some influence over this to minimise risk. Demand profile yr1 =2023:

3.2.4 EVCP are 7kW twin operating for 2,000 hrs per annum. Assumption based on EVCP,s being in operation for two thirds of daylight hours minus weekends per annum.

3.2.5 A 4MW solar array was chosen as the optimal size to supply the development with the current demand assumptions. At this size it provides 39% of the development power demand requirements as modelled.

3.2.6 Other assumptions

- A discount factor of 3.5% has been applied to calculate return on investment for ESCo option presented.

- The ESCo concession term is 40 years, typically ESCo concession terms range from 25 to 50 years and up to 80 in some examples.

4 Power ESCo

4.1 ESCo structure

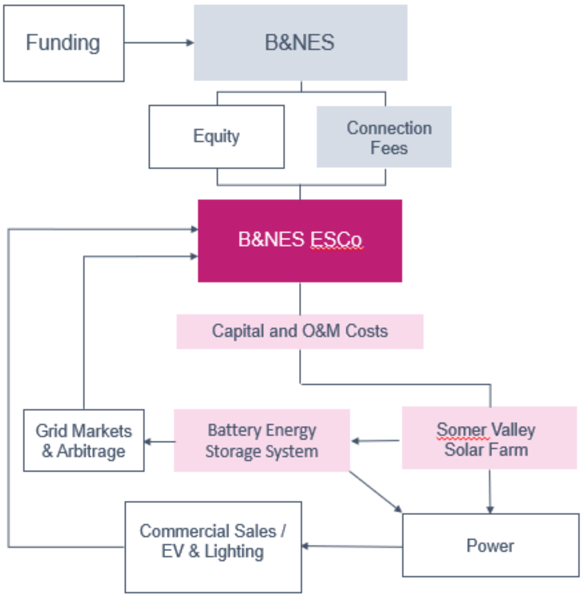


Image illustrates ESCo asset ownership and the flow of the various power revenues back to the ESCo.

4.1.1 ESCo is responsible for the funding, design, construction and operation of the energy system:

- Battery Energy Storage System (BESS)
- Private Wire network and connections to commercial properties
- 4MW solar PV array

4.1.2 ESCo will receive all revenues associated with the energy system, including but not limited to:

- Private Wire Electricity sales
- Arbitrage and ancillary market services
- Grid Export sales

4.2 Energy Concept

4.2.1 The design concept for this option is power only, heating assumed by Heat Pumps as a development cost for each property on the development.

4.2.2 B&NES ESCo will receive fixed standing and variable electricity charges.

4.2.3 A compound will be required for HV infrastructure and BESS, this would be c. 1,000m2

4.2.4 Approx 12 acres of land will be required for 4MW ground solar PV array.

4.2.5 Modelling assumes first power on Jan-23.

4.3 Financial model

4.3.1 Capital Expenditure (CAPEX) breakdown and assumptions made:

ITEM	£	Notes
Solar Farm	3,600,000	4MW 12 Acres £900 per kW
EVCP	280,000	112 x 7.2kW
BESS	856,000	3MWh energy / 3MW inverter
Private Wire Network	445,000	Inc LV Connections to Commercial Buildings
Prelims	380,000[1]	Design & Project Management
TOTAL	**5,561,000**	

- Battery sized and specified to maximise revenue generating opportunities. NB. Income from grid services are volatile.

Battery sizes need to be optimised in order to get satisfactory returns. This depends on their energy capacity (MWh) required to serve the private wire network load and their power capacity (MW) to provide grid services.

The grid connection costs need to be understood here. The larger the connection the more valuable the battery is to the grid, but also the more likely connection costs will be high. This can only be decided when connections are being discussed with the DNO when investment ready business plans are being written.

- Capex phased in line with construction & electricity demand.
- No allowance made for any additional import capacity required.

[1] £100k of legal and set up costs included here.

4.3.2 Operations expenditure (OPEX) breakdown for project life and assumptions made:

ITEM	£ lifetime (uninflated)	Notes
Solar Farm	1,520,000	£10 / MWh / annum
BESS	420,500	£12k/yr
EVCP	100,100	1% capex/yr
Insurance & Legals	375,000	£10k per annum
Metering & Billing	88,715	£20 per connection / annum
System monitoring & CCTV	1,912,500	£60k per annum
Land lease	382,500	£10k per annum
Business rates	503,813	Solar & BESS asset 2% capex
TOTAL	5,303,128	

4.3.3 Annual operations expenditure (OPEX) breakdown at build out and assumptions made:

ITEM	£ annual 2035 (uninflated)	Notes
Solar Farm	40,000	£10 / MWh / annum
BESS	12,000	£12k/yr
EVCP	2,800	1% capex/yr
Insurance & Legals	10,000	£10k per annum
Metering & Billing	2,540	£20 per connection / annum
System monitoring & CCTV	50,000	£50k per annum
Land lease	10,000	£10k per annum
Business rates	13,395	Solar & BESS asset 2% capex
TOTAL	140,735	

4.3.4 Replacement expenditure (REPEX) breakdown and assumptions made:

ITEM	£m lifetime (uninflated)
BESS	827,156
TOTAL	827,156

4.3.5 Pricing assumptions

ITEM	Commercial	Assumptions
Connection fee (one off)	£12/m2	Avoided cost of DNO connection
Fixed Electricity Tariff	£1/m2	Power availability charge
All Electricity sales (kWh)	14p	
Solar power price (kWh)	0p	
Grid Export price (kWh)	4.75p	
Grid Import price (kWh)	12.75p	

4.3.6 Electricity Cost & Revenue assumptions

Full build out Electricity supply to ESCo	Volume (kWh)	% supply	Price (2020) £	Annual Cost
Grid import electricity	4,716,608	61.1%	0.1275	£601,367
Import from Solar Farm	3,000,000	38.9%	0.0000	£0
TOTAL	7,716,608			£601,367

- The Solar Farm will be connected to the HV infrastructure and BESS via a Private Wire Network.

4.3.7 Financials & Sensitivity

- For the base case scenario the power supplied to the ESCo from the solar farm is set at 3GWh per annum, this is 75% of expected annual output.
- This is considered a balanced assumption however it may be possible to capture more of the solar generation to sell via private wire at higher prices, detailed HH modelling will provide these answers and this sensitivity is shown in the table below.

BASE MODEL ASSUMPTIONS (INFLATED - LIFETIME)	
Discount Factor	3.50%
Concession Term	40 years
Connection Fee Income	£608,558
Variable Electricity charge income	£69,096,784
Fixed Electricity charge income	£3,333,880
Grid Services income	£12,743,076
Grid Export income	£3,782,795
CAPEX	£6,252,474
OPEX (inc commodities)	£54,646,522
REPEX	£1,604,289
IRR	11.26%
NPV	£8,008,715

SENSITIVITY	IRR	NPV
Base Case	11.26%	£8,008,715
50% Solar Output to ESCo	9.22%	£5,622,279
Grid Service revenue +50%	13.67%	£10,567,662
Grid Service revenue -50%	8.88%	£5,431,934
No Grid Service Revenue	6.44%	£2,843,559
Power Demand +20%	16.71%	£13,624,945
Power Demand -20%	5.93%	£2,324,812

4.4 Grid Services

4.4.1 Grid Services

Where a battery and suitable grid connection are available the incremental cost of selling grid services via an aggregator allows additional revenues to be earned. The prices for these are highly volatile depending on market liquidity and needs of the National Grid. This in turn depends on climatic conditions and customer power demands. However, the expected trend is for values to increase as society transitions from gas and oil for heating and transport respectively.

- Grid services are calculated on a per MW availability basis and include:
- Capacity Market est £2k/MW/yr

  CM supports standby energy capacity to ensure demand can be met by supply. Rules on this are being transitioned currently and prices are very low, but participation does not carry risk or obligations.

- TRIAD est £15k/MW/yr

  This service helps large energy users to offset their peak demands during December, January and February and so avoid large charges from National Grid. An aggregator uses demand and weather forecasts to try and calculate when the winter peaks or Triads will occur and run a battery portfolio at this time to offset this. The actual Triads are declared by National Grid retrospectively so there is no guarantee of earnings if the battery was not run at that time.

- Firm Frequency Response est £42k/MW/yr

  This service supports grid frequency and can import or export energy at a stated power. This is usually bid for on a monthly basis and can be for 24 hours to a few hours. There is no guarantee of winning a contract every month and much depends on an aggregator's bidding strategy.

The detailed operation of the energy scheme, its half hourly solar generation and behind the meter demand will determine the availability of energy and power available for grid services and this cannot be determined in a pre-business case study of this type. For that reason, we provide some sensitivity analysis that assumes 50% and 150% availability to illustrate impact and risk.

4.5 Advantages and Disadvantages of a Power ESCo

Advantages	• Ability to provide a Return on Investment and secure long-term revenue stream for B&NES Council. • Low risk in terms of energy technology • Increased likelihood of compelling developers to connect: • No other choice of power supply

	• Land agreements with council • Planning conditions • Control over pricing regime. • Ability to optimise the investment in new Solar Farm. • Positioned well to exploit current and future revenue streams associated with decentralised & flexible power generation and storage.
Disadvantages	• Power ESCo's carry more complexity than heat ESCo's and there will be a lot of change in the embedded generation market with a transition into smart optimisation services over the first 10 years. This could be considered an opportunity also. • Grid capacity constraints for the supply of power to the electric heating systems on the development.

5 Summary

5.1 Financial model

5.1.1 A case can be made for the development of a power ESCo for Somer Valley, however the model assumptions are linear in nature i.e. total annual supply and demand assumptions.

5.1.2 In order to proceed towards an investable business case further detailed design and modelling will need to be performed with a range of profile data:

- Half Hourly (HH) solar farm generation from Somer Valley area
- Full understanding of the available power connection capacities to the national grid for import and export.
- Location, quantum and operating regime for EVCP's.
- HH demand assumptions for Commercial unit types.

5.1.3 With this data calculations can be performed to maximise revenue streams from the BESS:

- Arbitrage / time-shifting
- Frequency Response
- Reserve

Appendix A – Preliminary Risk Matrix

RISK IDENTIFICATION & MITIGATION							RISK ASSESSMENT - RESIDUAL RISK		
Ref	Category	Risk	Potential Impact	Risk Owner	Mitigation Action (preliminary)	Prob.	Impact	Risk Score (out of 25)
1	Technical / Commercial	Grid connection import capacity upgrade possible expensive grid re-inforcements	ESCo Commercial Viability	ESCo	Urgent DNO engagement to understand grid capacity and costs for upgrade	2	5	10
2	Technical / Commercial	EVCP energy demand	ESCo Commercial Viability	ESCo	EV strategy to be agreed and reflected in commercial model	2	4	8
3	Technical / Commercial	Balance of energy demand, generation and storage	ESCo Commercial Viability	ESCo	Detailed Half Hourly modelling to underpin business case	3	4	12
4	Management	ESCo is an unregulated electricity supplier with no ability for consumer to switch	Delivery	ESCo	Balancing good consumer value with adequate supply margin is critical, Supply agreements to be carefully constructed with clear price review mechanisms. Regulatory advice to be taken from legal specialist.	1	4	4
5	Commercial	The model assumes an overall loss between generation of power and customer consumption of 5%	ESCo Commercial Viability	ESCo	Specialist M&E design of HV/LV infrastructure to provide higher certainty	3	2	6
6	Commercial	Not securing the forecast electricity contracts but as most of the base load is provided by ESCo controlled infrastructure.	ESCo Commercial Viability	ESCo	The majority of loads within the base case model are EVCP and site infrastructure.	1	5	5
7	Operation and Maintenance	Poor installation and/or operational performance by selected partner	ESCo Commercial Viability	ESCo	The Services element of the DBOM Contract should contain key Performance Indicators and should have reportable details on which the contractor is judged with penalties and termination events and consequences. The performance of the Contractor should be monitored monthly and reported at least bi-annually	2	4	8
8	Commercial	Indexation of Electricity Cost v Revenue	ESCo Commercial Viability	ESCo	Power should be supplied with an agreed mechanism of indexation such as projected BEIS Electricity predictions plus RPI. This should maintain the balance correctly. This ensures that any global effect on electricity cost effects both the buying and selling equally to maintain equalibrium. Standing Charges are also inxed to RPI.	1	3	3
9	Commercial	Bad debt.	ESCo Commercial Viability	ESCo	ESCo models typically allow a small percentage (1%-3% depending on customer profile), 1% has been allowed but can be flexed.	1	2	2
10	Technical / Commercial	Replacement Plant over the term	ESCo Commercial Viability	ESCo	The commercial model accrues capital cost for all major plant and equipment based on assumed replacement periods. This should be fully clarified through a specialist M&E design process.	2	3	6