Small scale renewable energy case studies: impact of Feed in Tariffs

Tom Bailey

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Case Studies

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Case Study 6: Community wind scheme, 1,500MW wind turbine

Scenario Description

A community in central England invest in a turbine rated at 1.5MWe capacity, and 80m tall. The turbine is sited on the periphery of a small town. The local topology is relatively flat in all direction for at least several miles, and so the wind regime is good for a low land area and the site typical for deployment of a large scale wind turbine.

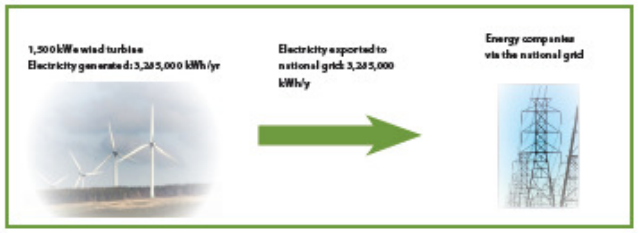
The turbine is sited 1.5km from the nearest electrical connection, this is because it is a windy site and it is a site well serviced by access roads, with many rural roads in the area too narrow and with too tight turnings to allow access for long vehicles carrying turbine blades. Assumed the turbine will connect to the public utility at 11,000 volts via a new metering circuit breaker and allowing for 1.5 km of HV cable.

Discussion with manufacturers and installers indicates that this scale of wind turbine has very high installation and erection costs per kW of capacity. This is because the turbine is a large utility scale unit, requiring specialist cranes and installation procedures. It involves a similar level of complexity for transportation and construction as larger utility scale units (such as 2, 2.5 and 3 MW systems), but offers a much lower output. It has not been possible to get a direct quote to capture the impact of this on capital cost but discussion with industry implies it may result in £/kW installed costs for 1.5MW systems being 10-20% higher than for larger units. Therefore a 20% premium has been added to the cost of this turbine. This value is very dependent on dynamic variables such as available cranes and supply chain issues and so is included purely for indicative purposes, and will likely change over the coming years, particularly if there is a change in demand for turbines at this scale.

Wind power technology

Large scale wind is a very well established technology, with thousands of units operating around the world, many of which for over a decade. Therefore the technology risk around wind is relatively low.

Energy Flow Model



Operation

For a turbine of this size, given the range of customers who are potentially connected at different points on the local distribution network, it is assumed that all the electricity generated by the turbine is exported directly to the grid. Therefore all generation is awarded the FIT and export tariff, amounting to a total of 7.5 p/kWh awarded. In the specified location the turbine would be expected to achieve a capacity factor of around 25%, and therefore generate 3,504 MWh per year.

Assumptions	
Location type	Periphery of small town, favourable topography
Project life [yr]	20
Average annual wind speed at 50m height [m/s]	7-8
Capacity factor [%]	25
Year commissioned	2012
CO2 factor grid electricity [kg/CO2/kWh]	0.517

Capital Costs	
Turbine capital cost [£]	1,250,000
Planning costs [£]	32,000
Grid connection costs [£]	191,000
Foundations/civils [£]	147,156
Road construction [£]	14,881
Consultancy [£]	19,841
Control systems [£]	4,960
Increased margin[1] [£]	324,000
Total [£]	1,944,187

Operational Costs		
Cost	Year 1-5	Year 5+
O&M contract [£/yr]	16,425	32,850
Land rent [£/yr]	6,876	13,751
Insurance [£/yr]	2,483	4,966
Administration [£/yr]	8,022	16,043
Grid power [£/yr]	1,910	3,820
Total [£/yr]	35,715	71,430

Financial Analysis	
No. of years FIT Tariff Level will apply	20
FIT generation tariff [£/yr]	308,790
FIT export tariff [£/yr]	98,550
Electricity bill savings [£/yr]	0

Investment Potential	
Required IRR	8 - 10
Achieved IRR	15.9
Simple Payback [yr]	7

Environmental Benefits	
Annual CO2 savings [tCO2 /year]	1,698

Case Studies

Choice of case studies

Case studies chosen to reflect:

1.The range of variables that effect economic performance

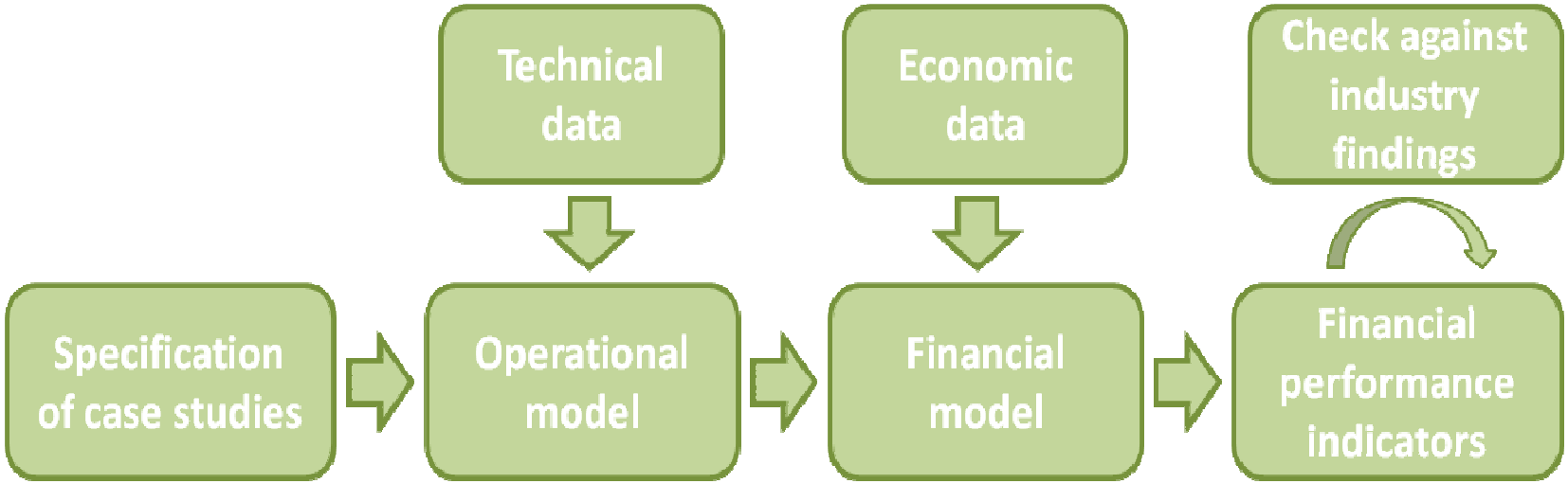
2.Situation grounded in reality

3.Application favourable to economic performance:

I. assuming appropriate deployment of technology
II. assuming no unexpected overwhelming costs.

Case Studies

Methodology



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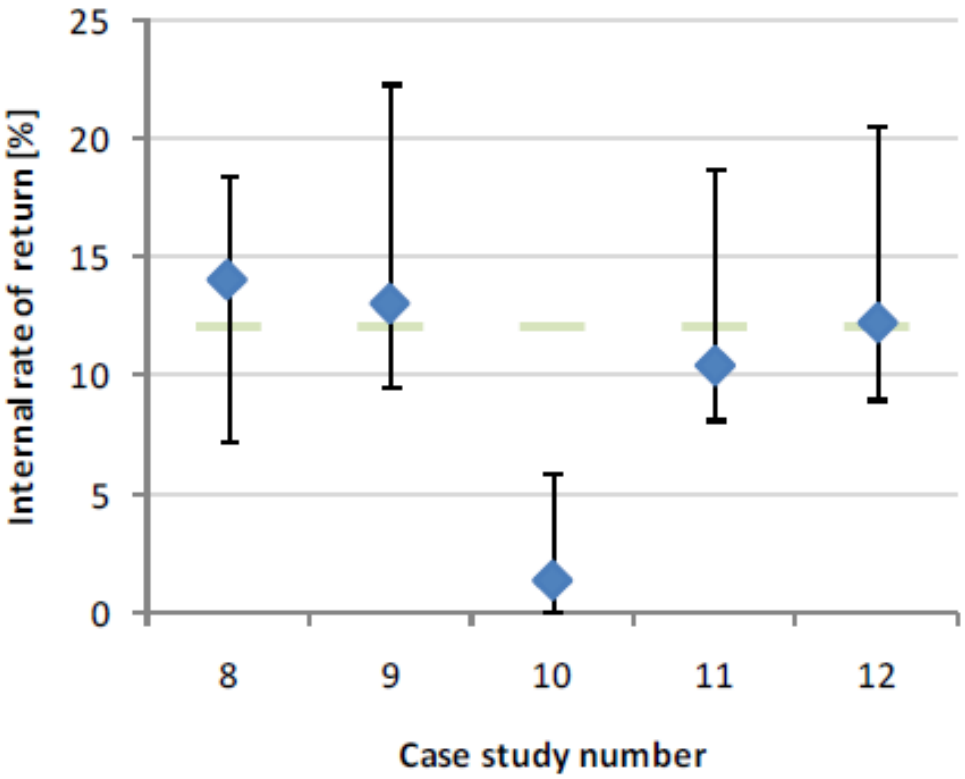
Photovoltaics results



8 Domestic PV retrofit, 2 kWe
9 Domestic PV new build, 2 kWe
10 Community roof tile PV, 2.2 kWe
11 Social housing PV scheme, 20 kWe
12 Commerical PV scheme, 200 kWe

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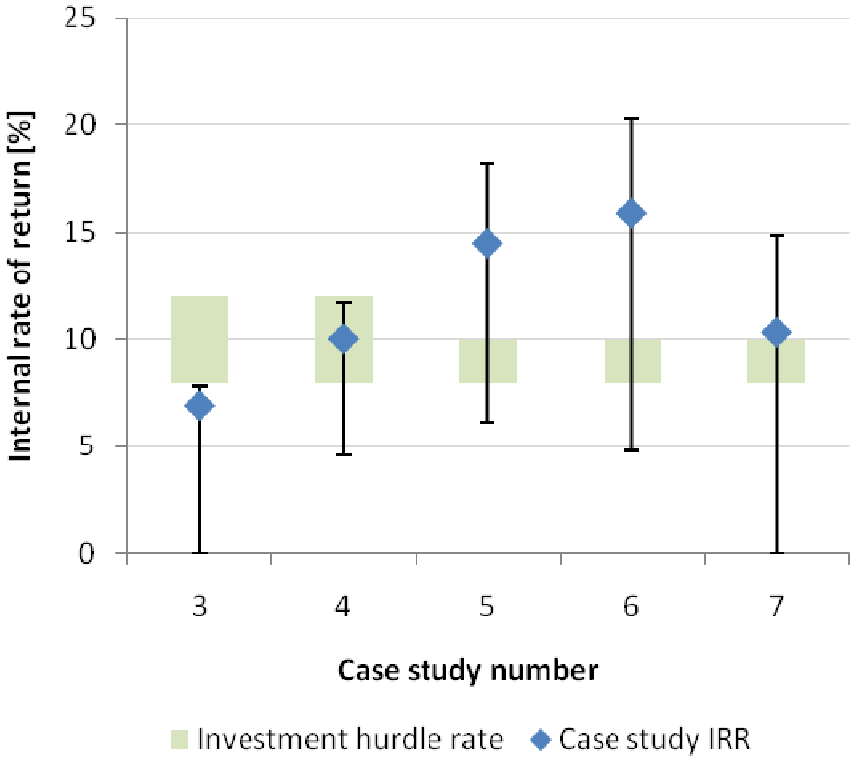
Wind results



3 Micro domestic wind, 1.5kWe
4 School wind scheme, 15kWe
5 Public sector wind scheme, 330kWe
6 Community wind scheme, 1,500kWe
7 Private sector wind scheme, 2,000kWe

- At 2,000 kW return drops to 3.6% if owned by a local authority and not permitted to sell electricity.

- For 2,000 kW return would be 9 - 12% if remained under Renewable Obligation based on today's value.

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Case Study: Farm with Onsite 100kWe Anaerobic Digestion CHP System

Anaerobic digestion (AD) – Farm waste, mainly manure, used to generate methane fuel for electricity.

Scenario

- New bracket was introduced into FIT as a result of consultation to target farm scale AD in particular

- A farm uses 5,250 t/yr of own on-site organic waste, (agricultural manure from cows, pigs and chickens) to fuel an AD plant.

System operation

The 100kWe CHP plant generates 670,140 kWh/y. All of this electricity is consumed on the farm and its premises. No electricity is exported.

All heat generated is reused within the digestion process

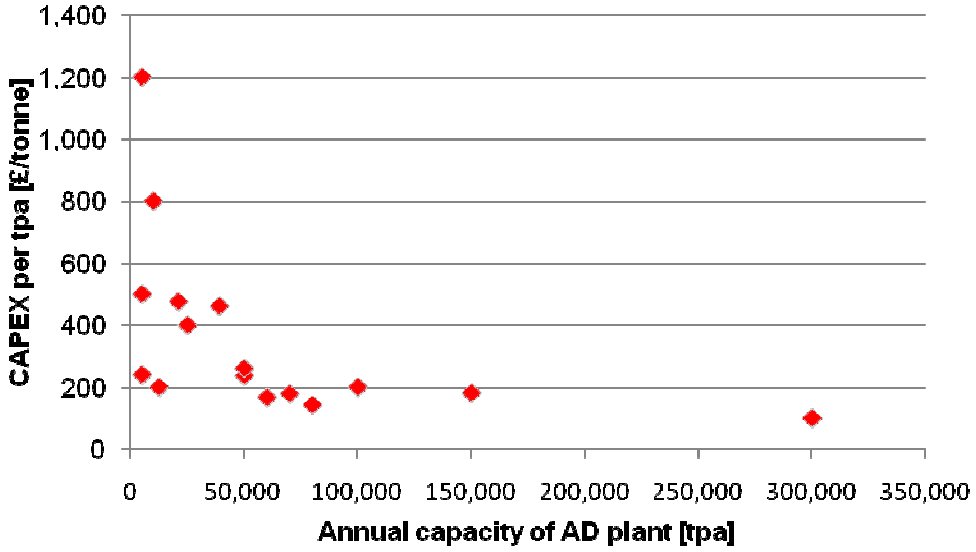
Case Study: Farm with Onsite 100kWe Anaerobic Digestion CHP System

Financial performance

- The scheme produces only as much income over a 20 year period as is expended in capital and operational costs. It therefore does not pay back over that 20 year period.
- Consultation with manufactures and the industry would seem to support these findings
- To achieve suitable returns higher tariff required

This performance is due to:

- High variability in capital cost, particularly at smaller scales
- Low calorific value of some feed stocks



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Case Study: University Campus, 1,000 kW biomass gasification CHP

Biomass in the feed in tariff

Biomass is not in FIT, as has been removed since the summer 2009 consultation.
However included this scenario to explore impact this has had.

Scenario

- A university campus in a suburban setting is to install a 1MWe biomass gasification CHP system.

- Heat distribution system already installed.

- Site modelled includes faculty buildings, student accommodation, a library and a campus shop.

System operation

- The system is expected to supply 90% of site heat demand (high percentage allowed by the large thermal store) and 60% of electricity demand.

- 3.7GWh of electricity generated is exported to the national grid

- The CHP in this scenario would operate for 4,400 full load equivalent hours per year

Case Study: University Campus, 1,000 kW biomass gasification CHP

Financial performance

- Hurdle rate: 14%
- Renewable Heat Incentive is currently being consulted on, proposed rates have been included in the analysis
- The scenario modelling delivers a return of 4.4%, and so under the discount rate specified would never achieve pay back.
- The technology is therefore still considered economically unviable.
- Are examples of projects going ahead but normally with support

Environmental Benefits	
Annual CO_2 savings	3,506 tCO_2 /year
Cost carbon saved	£35 tCO2

Capital and Operational Costs	
Turnkey capital cost	£3,700,000
Simple payback	~17 years

Summary

Key findings

- FIT has introduced a positive investment environment for most small scale technologies, as long as deployed in the appropriate context after undertaking suitable analysis
- Farm scale anaerobic digestion and biomass CHP remain financially unattractive
- No improvement in performance for medium scale wind schemes

Final report

- Include full results, data and assumptions from analysis.
- 20 case studies covering all technologies in the FIT across range of applications
- Launched in near future at ministerial event in parliament

Delivering renewable and low carbon energy

- How are renewables to be rolled out and integrated across a local authority? Strategies for doing so increasingly recognised as important due to key role local authorities can take in delivering and enabling low carbon energy.

- Climate change strategies are a likely requirement of the proposed Local Carbon Budgets expected in the new Local Government Bill

I pledge to support a local carbon budget for every local authority: that caps CO_2 in the local area in line with the scientific demands for emissions cuts and local circumstances.

Chris Huhne,
Secretary of State for Energy and Climate Change, 27 April 2010

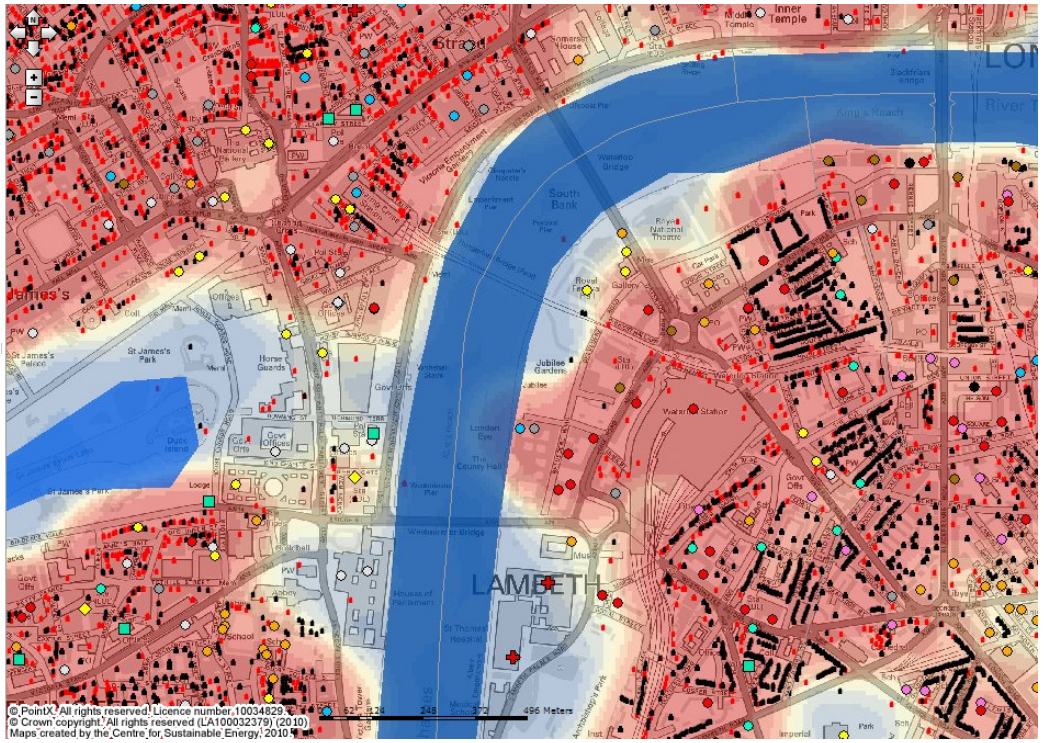
On behalf of Greg Clark, Caroline Spelman and myself, I can confirm that we recognise the need for local carbon budgets as part of the implementation of the Climate Change Act.

Oliver Letwin
Minister of State at the Cabinet Office, 28 April 2010

Delivering renewable and low carbon energy

Uniquely complex aspect of delivering local low and zero carbon energy is the provision of heat:

- No market for heat
- No regulation
- No national grid



Local authorities have particularly important role to play:

- Developing evidence base – heat mapping
- Offering anchor heat loads
- Developing special purpose vehicles to allow delivery of high cost schemes

Confirmed in government's Green Deal

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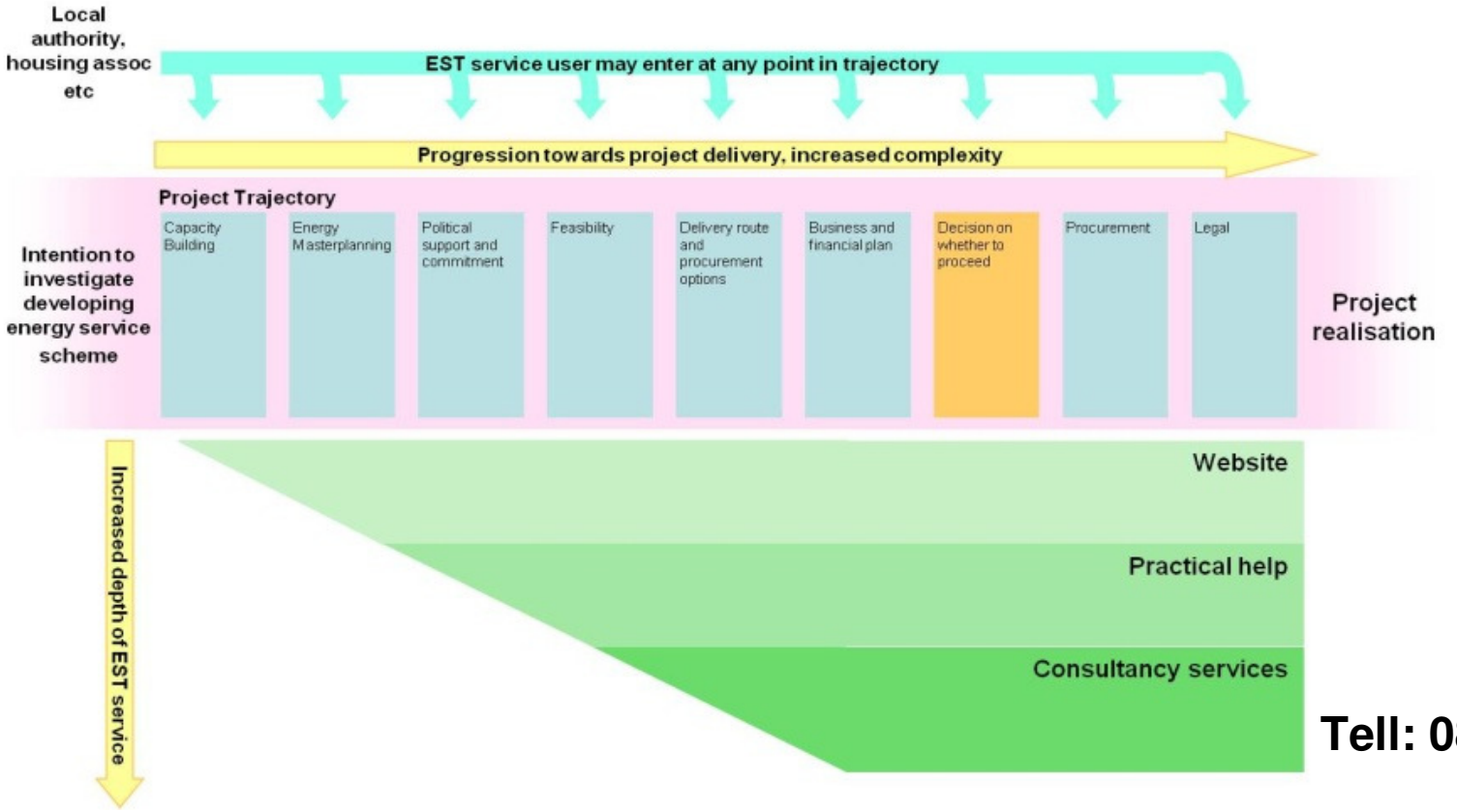
Delivering renewable and low carbon energy

EST provide consultancy support and advice to local authorities and housing associations on energy service provision in England, Wales and Northern Ireland.

The support being offered builds on the following key stages of energy services delivery:



Tell: 0844 84 888 30

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Thank you

tom.bailey@arup.com