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The cost of Active Network Management Schemes at Distribution Level

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Abstract

The growth of wind generation in distribution networks is leading to the development of Active Network Management (ANM) strategies. ANM systems aim to increase the capacity of renewable and distributed generation (DG) that can connect to the network.
In addition to DG, ANM schemes can also include storage devices and Demand Side Management (DSM) strategies.
Currently ANM schemes are mainly part of network research and development programmes, funded through network innovation schemes. In future, ANM schemes will need to cover the costs of establishing such a scheme through payments from the network company and the users of the network.
This research will cover the options for running ANM schemes as a 'business as usual' case, and the impact that this could have on domestic demand customers' energy bills.

Objectives

This research aims to

- Discuss possible Access Arrangements for wind generators as part of ANM schemes
- Discuss the costs associated with ANM and the alternative solutions to network constraints
- Discuss the operation of ANM schemes as a 'Business as Usual' case
- Discuss the cost of ANM to domestic energy supply customers.

Background

To determine a business as usual case for ANM schemes, we must first consider the current costs, and processes. The following diagrams indicate possible contractual arrangements for non firm connected wind generators (i.e. generators subject to curtailment due to voltage, frequency or thermal constraints on the network), the 'building blocks' which form the ANM scheme and make up the bulk installation costs and finally an example of ANM costs from the Orkney ANM scheme [1].

NON-MARKET

LAST IN FIRST OFF (LIFO)
LIFO is an easy method to administer, but it does not provide the optimal use of resources and in some cases can lead to generators being needlessly curtailed. In the LIFO scenario the newest farm will be curtailed first.

SHARED PERCENTAGE
The Shared Percentage method curtails each farm by a fraction of the curtailment required based on the maximum capacity of each farm. All farms are curtailed simultaneously.

TECHNICAL BEST
This method determines which farm should be curtailed based on power flow analysis of the network. The wind farm which can minimise the network losses by being curtailed will be selected.

MARKET

MARKET BASED
A market approach requires the creation of a market mechanism to allow generators to bid for access to the network during periods of congestion or trade with conventional generation

Figure 1: Possible Access Arrangements for Wind Generators in ANM schemes

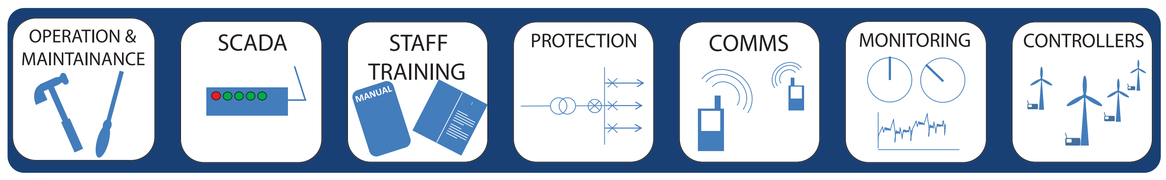


Figure 2: ANM scheme building blocks

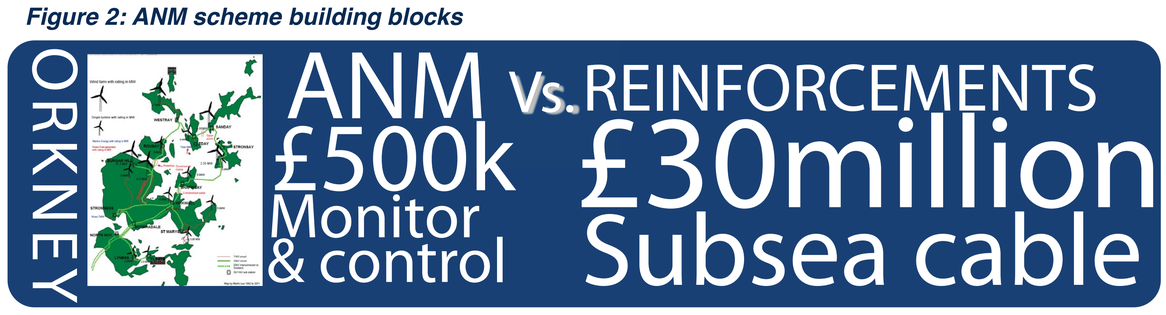
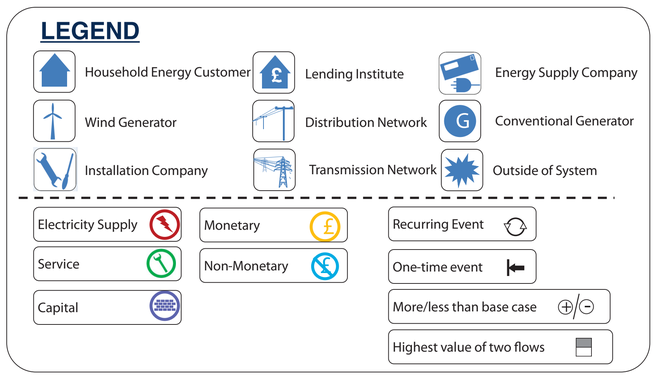


Figure 3: Case Study of Orkney ANM Scheme. The cost of the ANM scheme on the left is substantially less than the cost of network reinforcements shown on the right. [1]. Orkney network image courtesy of SSE [2]

Business Model

The costs of network reinforcements are recovered through a combination of connection and use of system charging depending on the voltage level of the connection. As ANM schemes become a 'business as usual' model, a mechanism through which the network can recover the costs of installing, operating and maintaining an ANM system must be established.



The base case against which all flows are compared in Figure 4 is a standard network configuration, without the inclusion of any network management or incentives to encourage renewable energy and most domestic electricity users sourcing power from vertically integrated suppliers and large centralised generators.
The installation of an ANM scheme on the network allows more wind to connect to the network. This reduces the volume of electricity provided by conventional generating methods and therefore reduces the emissions of the distribution network.
The cost of the ANM Kit is paid for by the Wind Farm, which will experience lower connection costs than that of typical connection agreements due to the non-firm connection.
There will be higher Use of System (UoS) charges passed on to customers due to an increase in network equipment and management, this however, is lower than the costs which would be incurred if network reinforcements were constructed.
In addition to the basic recovery of costs for ANM, there is the option to create ancillary services by incentivising domestic Demand Side Management (DDSM). The installation of storage devices in the homes is being trialled by Scottish & Southern Electric (SSE) for the Northern Isles New Energy Solutions (NINES) project 3].

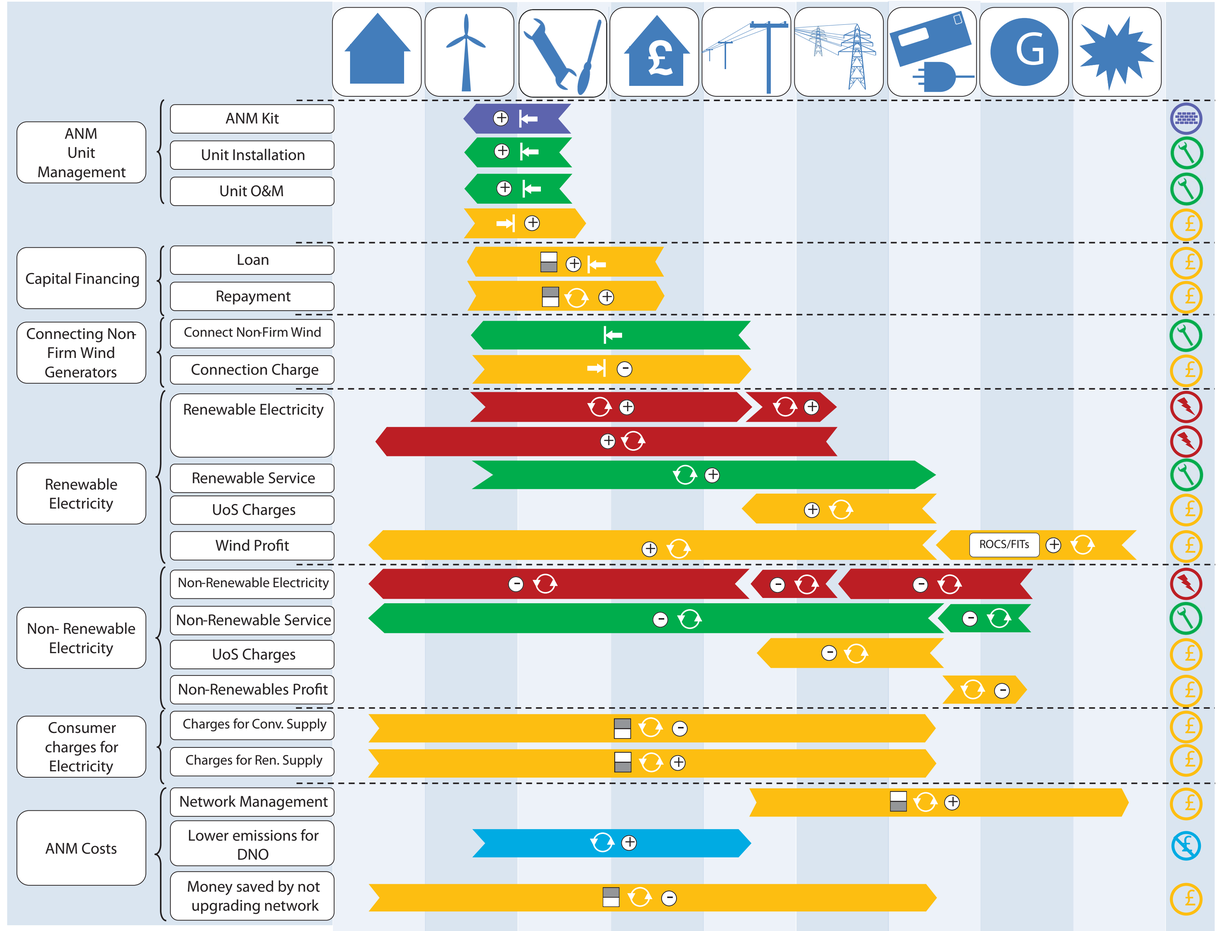


Figure 4: Business model for ANM schemes, based on Supergen HiDEF Distributed Energy Business Model [4]

Conclusions

All costs for creating and managing ANM schemes could be recouped through UoS charging by introduction of a market for ancillary services. This market would be simpler than market at transmission level. These charges filter down to consumer tariffs. Customers would be entitled to 'rewards' based on their le vel of participation in ANM schemes.
DG would participate in a curtailment market where generators bid on a day-ahead basis for access to the network during constraints. All costs are recovered during a settlement period which would see generators pay or be paid through UoS monthly payments.
Changes to connection arrangements for generators connecting to ANM schemes could increase customer bills by a minimal amount; however this increase will be a fraction of the cost which would be incurred as a result of network upgrades. However there will be options available for customers to participate more actively in ANM schemes through the use of demand-side management which can result in rewards for customers, and possible reductions in energy bills.

References

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