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## Executive Summary

The ORIGIN project demonstrated applied and modelled demand side management of energy use in three validation communities in Scotland (Findhorn), Portugal (Tamera) and Italy (Damanhur). The communities were selected based on their prior investment in renewable energy generation systems and commitment to a sustainable approach to energy resources.

The project deployed an end to end operation of a new breed of energy control architecture to facilitate demand response in a bespoke form in each of the validation communities. The starting point for the system is a new technology for accurate localised weather (and renewable generation) forecasting. It utilises new software technology for achieving demand-response from community-level energy actions.

In order to enable the residents of the communities to participate in active demand response the project developed a web-based graphical and numerical user interface using a participatory design approach to involve the communities in the design process. The user interface was customisable to the needs of the individual participants to ensure effective communication of demand response actions, historical and current energy usage and energy pricing signals.

During the project the consortium executed three different demand response models in the validation communities and modelled the potential of three others. The biggest potential positive impact upon increasing uptake of community generated electricity was shown to occur where community generation is curtailed by an inability to export to a national grid infrastructure. This was the situation in the validation community in Portugal where the research concludes that demand response and associated energy management could result in an increase of 33% in the uptake of photovoltaic generation.

In the wind generation dominated community in Scotland a maximum demand response of up to a 16% increase in uptake of renewable generation was estimated via a combination of an incentivised participatory demand response system, driven by price signals and energy information supplied via the user interface, and the modelled impact of automated actuation of thermal space and water heating.

In the Italian validation community the ORIGIN demand management system achieved a 3% increase in the community's use of their own roof-mounted photovoltaic electricity through active participatory involvement in demand response actions via the user interface.

ORIGIN highlighted that, even with the encouragement of financial incentives, there is a need for repeated engagement with the end users to relate the ongoing impact of consumers' their participation in the demand response management of their energy lifestyles.

The project results suggest that a viable business case can be made for a forecast informed actuated community scale demand response initiative if the community can trade with the local DNO. Although current revenue streams are small, new energy markets are emerging in response to the

transition to a low carbon economy and this is likely to create additional revenue opportunities in the coming years.

The project has produced, or is producing: 20+ academic publications; a joint venture agreement between seven of the consortium members; one spin out company to date; ten innovations; at least one patent application; a series of new product developments; and 11 applications for further funding from various potential sources, two of which have been funded at the time of writing.