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Riding Sunbeams: Powering our trains with solar PV

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About the research

In August 2019, Riding Sunbeams demonstrated that it is possible to connect solar photovoltaic panels directly into the electrified rail network to power trains. Direct supply of solar power to railway traction systems has never been done before, anywhere in the world. Its market and decarbonisation potential for railways and mobility in general is huge. The technical, commercial and legal arrangements being developed between Network Rail and Riding Sunbeams provide a route to market for both zero-carbon mobility and distributed electricity generation from renewable sources.

Where renewable energy generation assets are under community and commuter ownership, this also creates great potential for social-impact oriented energy procurement. Network Rail's energy procurement can thus act as a catalyst to leverage social and environmental value inherent in community renewable energy supply and support both technical and governance innovation through early adoption. By supplying low-carbon and high social impact community energy through a Power Purchase Agreement (PPA), Riding Sunbeams can help Network Rail fulfil their business, social and environmental objectives through capital investment sourced from outside the company.

Riding Sunbeams is developing contractual agreements with community energy groups for direct-wire electricity supply which are a means of both future-proofing Network Rail's business model and consolidating a bottom-up self-regulatory approach pre-empting more stringent regulation. This does not only apply to Network Rail as many other public sector organizations and regulated utilities have the potential to fulfil business, social and environmental objectives through energy procurement.

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Policy implications

- The Public Services (Social Value) Act 2012 needs to be recognised as an opportunity to shift from regulatory compliance towards proactive, innovative environmental and social value procurement, thus maximising flexibility under current UK and EU public procurement rules.
- Recognition of value-added procurement, or procurement for value, as an innovation opportunity is needed to provide organizations such as Network Rail with the means to procure social and environmental value in line with their strategic objectives and broader public interests.
- Network Rail should use the evidence developed by Riding Sunbeams as a blueprint to scale up the embedding of social and environmental value requirements in open-market tendering procedures once their Innovation Partnership has been terminated.
- Social and environmental value requirements should be included in open-market tendering procedures by regulators such as Office of Rail Regulation (ORR), Water Services Regulation Authority (OFWAT) and Office of Gas and Electricity Markets (OFGEM) to allow intermediaries to create multiple routes to market for value-added community energy.
- Through their Regional Hubs, the Department for Business, Energy and Industrial Strategy (BEIS) should continue to provide seed funding via the Rural Community Energy Fund (RCEF) and reintroduce the Urban Community Energy Fund (UCEF) to de-risk community solar traction developments in rural and urban environments.
- Innovate UK needs to ensure that Small Business Research Initiative (SBRI) funding is more widely available and accessible to social enterprises such as community energy organizations to support grid edge innovations.

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Key findings

Riding Sunbeams can help Network Rail fulfil its 4Cs business objectives (cost reduction, carbon reduction, capacity increase and customer satisfaction), its environmental objectives and its social objectives by connecting communities and commuters through share ownership of low-carbon generation assets developed by local social enterprises (which together form the 5Cs):

- *Cost reduction* – For the same or a lower price as Network Rail currently procures grid electricity, Riding sunbeams can deliver renewable, low-carbon electricity which entails social and environmental value, thereby reducing overall costs

- *Carbon reduction* – Riding Sunbeams' direct-wire renewable electricity supply is the lowest carbon option available to Network Rail. Purchasing Renewable Energy Guarantees of Origin (REGOs) is the first step towards decarbonising and diversifying Network Rail's electricity supply, but procuring renewable energy through PPAs and direct-wire is necessary for full decarbonisation.

- *Capacity increase* – Riding Sunbeams can provide additional direct-wire electricity supply in areas of network squeeze. Such areas are characterised by technical constraints to the amount of electricity that can be supplied through transmission and distribution networks. By supplying electricity directly into substations, capacity can be increased without costly transmission and distribution network upgrades.

- *Customer satisfaction* – Riding Sunbeams intends to open share ownership of the individual community solar traction projects to the public, and especially to rail commuters, so that they will have a share in the services that will be partially powered by community and commuter co-owned generation capacity.

- *Connecting communities* – By enabling local people and commuters to own and benefit from the clean energy powering trains, Riding Sunbeams can help Network Rail create social value through "connecting communities through better use of railway assets". Community benefit funds also allow community groups to help address fuel and mobility poverty.

The combined business, social and environmental benefits that Riding Sunbeams can provide to Network Rail are as follows:

- Riding Sunbeams provides the first route-to-market for direct-wire PPAs and the technical, commercial and legal feasibility of the pilot sites will help guide Network Rail's low-carbon trajectory.

- Riding Sunbeams can deliver and report social and environmental value creation along its community energy supply chain to help Network Rail fulfil their social and environmental obligations.

- Through Network Rail's IMPACT Tool, such social impact data can be consistently collected, reported and monetised. Qualitative impacts can be measured using a Social Value Maturity Matrix.

- Engaging in an Innovation Partnership with Riding Sunbeams ensures that this unique and fully developed product, as demonstrated by Riding Sunbeams at Aldershot, is captured by Network Rail to help inform its principles of procurement.

In addition to the zero-carbon electricity that Network Rail can procure from Riding Sunbeams' community energy organizations, the social and environmental impact inherent in their community approach does not require capital investment on behalf of Network Rail. Such value creation is therefore both outsourced and additional from Network Rail's perspective, and directly linked to their key social and environmental performance indicators.

Further information

Riding Sunbeams is a consortium involving Possible, Community Energy South, Ricardo Energy, University of Bristol and University of Birmingham. It was funded by the Department for Transport through InnovateUK – SBRI (Small Business Research Initiative) 'First Of A Kind' Round 2: Demonstrating Tomorrow's Stations and a Greener Railway.

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