

# Electric Cars for Balancing Variable Power on Gotland

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*Due to a trend towards electrification of transport, opportunities are emerging to use electric vehicles for handling variability in renewable energy sources. When such opportunities are put in the context of the Swedish island Gotland, a considerable contribution can be made to balance renewable power on the island. Generally, there is an interest for contributing in this way amongst potential future electric car owners. It is important to consider their concerns and driving forces when implementing the technologies.*

The share of renewable power grows as part of the production mix. It yields promises of substituting traditional CO<sub>2</sub>-intensive power generation. By charging during periods of abundance in renewable power and supplying power to the grid during periods of power deficit, a better match can be met. Techniques used for accomplishing this are commonly referred to as smart charging, or vehicle-to-grid when the option of supplying power to the grid is enabled as well. The technologies have been proven in pilot project but have not been tried out at larger scale.

In this thesis, potential contributions from the technologies were examined in the context of the Swedish island Gotland. A model was built to reflect the transport and power systems on the island. In addition, a literature study was performed to find which economic incentives and modes of participation that are best in line with driving forces and concerns of potential participants. Limitations in transmitting power from Gotland to the mainland, large current contributions from wind power and great ambitions for increased renewable power generation on the island, makes the island of particular interest for implementing the technologies.

Three future scenarios have been considered, all with a 100 percent electrification of passenger cars but with different levels of power production on Gotland. It was found that by using smart charging or vehicle-to-grid technology on the island, more locally produced power could be used, avoiding export to the mainland.



The figure shows the Swedish island Gotland.

The potential contribution from the technologies grew with increased production. When power generation was increased to make up for the extra power needed by a fully electric car fleet, there were less import and export of power than under the circumstances of today. Findings also indicate that the reliability of electric cars for balancing variable power is high, with plugged-in cars being available to absorb excess power during most of the year.

According to literature, there is an interest for the smart charging and vehicle-to-grid technologies. Most of the economic incentives and modes of participation encountered in the study, could likely be tuned to align with the concerns and driving forces of potential participants. However, it should be considered that while economic earnings are important, they only provide one of many viable paths to reach electric vehicle owners. Allowing flexible modes of participation, communicating environmental benefits and carefully minding data privacy issues are examples of other important aspects.

The full report can be retrieved from the link below:

[www.iea.lth.se/publications/pubmsc.html](http://www.iea.lth.se/publications/pubmsc.html).