Aalto University
School of Engineering

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How to achieve a carbon neutral, sustainable energy future? What are the challenges and solutions?

Title of the dissertation ***Delivering sustainable energy in the European context: challenges and solutions***

Contents of the dissertation

The public examination of the doctoral dissertation of Samuel Cross M.Sc. (Tech.) will be held on 15 January 2020 at 12 o'clock noon at Aalto University, Otaniemi Espoo, and remotely by Zoom. The title of the dissertation is *Delivering sustainable energy in the European context: challenges and solutions*. The field of the dissertation is Renewable Energy, Islanded Power systems and complementary technologies.

This thesis explores the challenges of reaching sustainability in energy systems as follows:

- Overall progress of EU countries to reaching the 2020 Renewable energy (RES) targets
- Developing bioenergy
- Island power systems
- The role of electrical energy storage

The results indicate that effective, stable planning and policy support are required to advance renewable energy, and that a broad portfolio of RES technologies is most appropriate, instead of a dominant reliance on a single technology. The analysis indicates that a number of EU Member States will struggle to meet the 2020 objectives, e.g. France, Holland and Poland. Another key result is specific to the bioenergy sector; the objectives of the member states go beyond the resource available in the EU and significant questions of sustainability are raised. Indeed, as it becomes more recognized that not all biomass is carbon neutral, the contribution of this resource to a low carbon energy future is further constrained.

An extensive benchmarking analysis of 28 islands reveals the challenges and best practices. The measures identified to have been successful in these islands have wider applications. The development of renewables is an obvious solution whilst measures such as peak shaving, development of interconnectors and electric energy storage are critical not only in island systems but also in managing the intermittent renewables required to provide carbon neutral energy systems in all geographical contexts. A detailed analysis is made of electrical energy storage (EES) on the island of Jersey.

The thesis leads to two key conclusions for delivering sustainable, low carbon energy scenarios. Firstly, a wide range of technical and systemic measures are required, which existing modelling approaches do not always identify in order of cost efficiency. And secondly strong, credible

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energy policies that address all challenges and incentivize the appropriate mix of solutions are needed to achieve sustainable energy systems.

Field of the dissertation	Renewable Energy, Bioenergy, EU Energy Policy, Islanded Power Systems, Electrical Energy Storage
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The dissertation is publicly displayed online 10 days before the defence at
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