Delivery no.: D4.3a
Installation and SAT test report on Glen Dimplex storage space heating technology installed

Photo: By & Havn / Ole Malling

Glen Dimplex Nordic
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Public deliverable ☒
Confidential deliverable ☐

Preface

EnergyLab Nordhavn – New Urban Energy Infrastructures is an exciting project, which will continue until the year of 2019. The project will use Copenhagen's Nordhavn as a full-scale smart city energy lab, which main purpose is to do research and to develop and demonstrate future energy solutions of renewable energy.

The goal is to identify the most cost-effective smart energy system, which can contribute to the major climate challenges the world are facing.

Budget: The project has a total budget of DKK 143 m (€ 19 m), of this DKK84 m (€ 11 m) funded in two rounds by the Danish Energy Technology Development and Demonstration Programme (EUDP).

Forord

EnergyLab Nordhavn er et spændende projekt der løber til og med 2019. Projektet vil foregå i Københavns Nordhavn, og vil fungere som et fuldskala storbylaboratorium, der skal undersøge, udvikle og demonstrerer løsninger for fremtidens energisystem.

Målet er at finde fremtidens mest omkostningseffektive energisystem, der desuden kan bidrage til en løsning på de store klimaudfordringer verden står overfor nu og i fremtiden.

Budget: Projektets totale budget er DKK 143 mio. (EUR 19 mio.), hvoraf DKK 84 mio. (EUR 11 mio.) er blevet finansieret af Energiteknologisk Udviklings- og Demonstrationsprogram, EUDP.

Project Information

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WP title: Smart Network Services
Task Leader: Sören Christensen
WP Leader: Magnus Klintström
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Executive Summary

Glen Dimplex has, as a part of the Energylab Nordhavn project, installed Quantum Electrical Storage Heaters in Energylab Nordhavn facilities at Sundkaj 7.
The facilities include showroom for the entire Energylab Nordhavn project and three conference rooms adjacent to the showroom.

The Quantum Heaters installed are storage heaters who, whenever needed, are able to receive and store electrical energy, in order to

1) Help stabilize the frequency of the electric net.
2) Move load from peak during daytime to off-peak during nighttime in order to minimize the instantaneous load on the electric net.
3) Store electrical energy from renewable sources.

This report explains the hardware installed and the test so far.

It can be concluded that the installation and function of the hardware so far is successful. The Quantum heaters works well and warm up the areas and software communication is close to be finished.

Version Control

Version	Date	Author	Description of Changes
V1.1	2018-06-04	Magnus Klintström	Generic data added
V1.2	2018-06-08	Sören Christensen	First draft
V1.3	2018-08-28	Sören Christensen	Updated after review
V1.4	2018-09-25	Magnus Klintström	Final version

Quality Assurance

Author	Reviewer	Approver
Sören Christensen	Kristian Honoré	WPL group

Status of deliverable		
Action	**By**	**Date/Initials**
Sent for review	Sören Christensen, Glen Dimplex	2018-06-19
Reviewed	Kristian Honoré, HOFOR	2018-06-19/krih
Verified	Magnus Klintström, DTU, WP4 leader	2018-08-29
Approved	WPL group	2018-09-25/magklin

1. Introduction

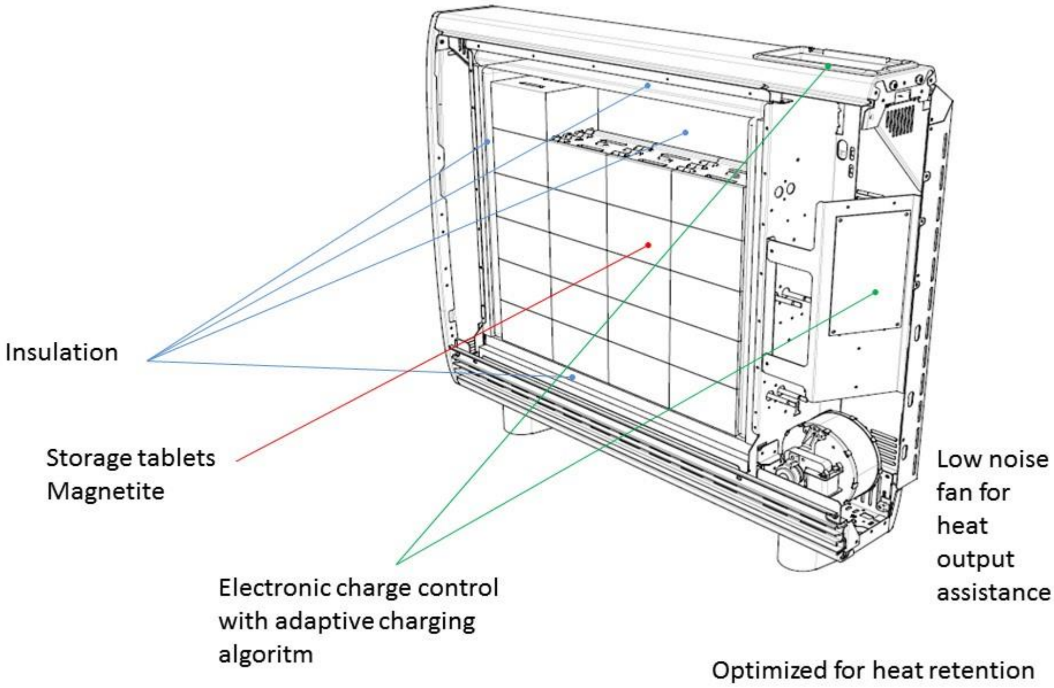
Glen Dimplex Quantum Electrical Storage Heaters have been installed at the EnergyLab E-hub in Nordhavn and at DTU Risø and DTU Lyngby campus. The test will give an understanding of how to store electrical energy in low-cost periods.

Quantum Electrical Storage Heater

Quantum Heater installation in Showroom

1.1 Quantum technology

The Quantum Heater stores electrical energy in a core of magnetite either controlled by the build-in electronically thermostat/timer or connected to the intelligent internet based control system, Quantum. The heater is insulated with several layers of insulation to make sure the energy stored, contains in the heater for as long as possible. When a demand for heat occurs, the Quantum will give out warm air by a build-in fan. If no energy is stored in the heater, a secondary direct heating boost element will help for as long as needed. The test installation uses a simulated internet connection to load the Quantum Heaters by low-cost electrical energy.

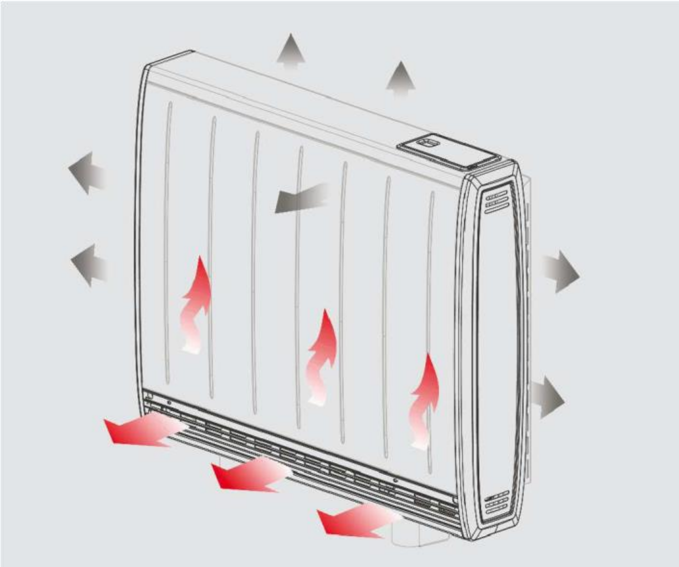


Exploded view of a Quantum Heater

1.2 Quantum Benefits

Quantum is designed to be a responsive heating system that meets comfort requirements while optimizing energy use.
The heater releases heat in two ways:

1. A small amount of heat is dispersed by 'natural' convection and radiation from the heater case.
2. The vast majority of heat is released using the built-in fan that pushes hot air out from the heat outlet grille at the bottom of the product.



Minimizing the release of stored heat from the outer casing means that more energy is available when warmth is required. This makes more efficient use of the stored energy as you can 'turn off' the heater when you are out or do not need it.

1.3 Quantum Heater Specifications

Quantum	QM100	QM150
Boost Output 230/240V~:	792/880W	1242/1380W
Storage Element Rating 230/240V~:	2042/2220W	3024/3300W
Rated Charge Period:	7.7 - 7 Hours	
Energy Cells:	24	36
Installed Weight:	115 kg	165 kg
kWh:	15.5kWh	23.1kWh

1.4 SW Development platform

The purpose is to develop a controller, by using the Glen Dimplex SW development platform. The controller will be used to interface multiple Quantum enabled appliances, for exchanging status, configuration and control data.

To facilitate the interface between one gateway based RF LAN transceiver and multiple appliance based RF LAN transceivers a network and application layers protocol shall be defined. This protocol shall focus on speed and reliability of data exchange rather than interoperability with standard protocols.

The Local Area Network (LAN) protocol is used to interface multiple Quantum enabled appliances to an external web server, for exchanging status, configuration and control data.

2. Installation sites

2.1 E-hub Showroom

The Quantum Heaters installed in the showroom are two QM100 and four QM150. The total area of the showroom is 500 m².

The storage capacity of the heaters are:

QM100 15,5 kW

QM150 23,1 KW

2.2 E-hub Conference room

The Quantum Heaters installed in the three conference rooms are one QM100 in each room. The total area of each room is 24 m².

The storage capacity of the heater is:
QM100 15,5 kW

2.3 DTU Lyngby and DTU Risø

There is one heater installed at each site and will be used for the controller design.
The storage capacity of the heaters are:

QM150 23,1 kW

2.4 SW communication platform test

The test of communication platform was divided into two parts:

1) Test whether laptop could retrieve the data from the heater.
2) Test whether a configuration frame from laptop could be received and accepted by the heater. It needs to be verified by checking the data sending back from the heater and to analyze if the configuration has been implemented. For example, room temperature set point etc.

So far, only part 1) was finished and verified. Part 2) is still ongoing. The script for communication needs further development from the developers in GlenD.
See chapter 3 for planned and scheduled activities.

3. Next step

First, the communication script needs to be fixed by the developers in GlenD. Secondly, communication from the laptop to the heater need to be verified as documented in section 2.4 second part.

After the communication successfully been verified, researcher from DTU could proceed with controller design. The goal of the design is to achieve load scheduling given day ahead market price signal.

Time schedule

Activities	Schedule/Planned
Solve issues with GlenD communication script.	1st August 2018
Verify communication between laptop/controller and Quantum Heater.	1st August 2018
Install sensors and power meters	1st October 2018
Collect sensor and meter measurements for controller design	1st November 2018
Controller design and verification in simulated environment	1st December 2018
Controller implementation in field	15th Jan 2019
Controller test and verification in field	1st April 2019