Final report

1.1 Project details

Project title	EVergreen Quick Charger
Project identification (pro-gram abbrev. and file)	64012-0229
Name of the programme which has funded the project	EUDP
Project managing compa-ny/institution (name and ad-dress)	Vikingegaarden A/S Tinnetvej 70 DK-7173 Vonge
Project partners	Vikingegaarden EcoMove Banke MM Media Mannov
CVR (central business register)	30089375
Date for submission	24/11-2015

1.2 Short description of project objective and results

Formålet med projektet har været at udvikle en Quick Charge ladestander til elbiler for der-med at få komplet EVergreen (EVG) produktprogram. Ladestanderen er baseret på Combo protokollen, som supporterer alle de nyeste europæiske elbiler, og som forventes at blive godkendt som EU-standard. EVG quick charger er baseret på åben adgang for 3 parts inte-gration. Alle ladestandere i Evergreen serien kan styres ud fra CO_2-prognoser og reguleres trinløst – med store CO_2-besparelser til følge.

Quick chargeren er udviklet i samarbejde med EcoMove og Banke. EcoMove har integreret Combo stikket og protokol i deres elbil, Q-Beak, Banke har lavet en løsning med onboard opladning, som EVergreen systemet supporterer. Der er dermed udviklet en løsning, der muliggør flere typer opladning til industrien.

The objective of the project was to develop a Quick Charge charging station for electric cars in order to get complete the EVergreen (EVG) product range. The charging station is based on the Combo protocol, which supports all the newest European electric cars, and is ex-pected to be approved as EU standard. The EVG quick charger is based on open access for partner integration. All charging stations in the EVergreen series can be controlled according to CO_2 forecasts and adjusted steplessly – resulting in large CO_2 savings.

The quick charger is developed in collaboration with ECOmove and Banke. ECOmove has integrated the Combo socket and protocol in their electric car, Q-Beak. Banke has created a

solution with onboard charging supported by the Evergreen system. Thus the system is applicable for various charging needs.

1.3 Executive summary

The EVergreen Quick Charger project has resulted in a complete quick charger including backend system, load balancing, integration into vehicle and on-board charging of battery-hydraulic drives for garbage trucks.

The quick charger
A complete quick charger has been built using the design from the AC chargers in the EVergreen product range. Modifications have been made to accommodate the combo outlet as well as power transformers. The combo protocol was chosen due to the fact that this is expected to be approved as EU standard.

Backend system

The Evergreen backend system has been further developed to handle and manage the quick chargers. Form the backend system owners of the chargers have complete overview of the chargers. The Evergreen system is intelligent in terms of using electricity when the CO_2 emissions are lowest. The system downloads the forecasts form Energinet.dk on a daily basis.

Vikingegaarden has further developed a web service which allows owners to adjust the power thus providing load balance in order to avoid grid overload. I other words the Evergreen chargers are a smart grid solution.

EcoMove's Q-Beak e-car
EcoMove has developed an e-car called Q-Beak. During this project they have implemented the combo protocol and build in the combo connector in the car. This will reduce the charging time significantly which was of great importance to EcoMove's customers. EcoMove resigned in the middle of the project and has stalled the further development of the e-car.

Banke garbage trucks
Banke develops garbage trucks with battery-hydraulic drives. Banke and Vikingegaarden have developed a solution with on-board charging. The garbage trucks are usually charged during night time, and with the intelligent system Banke's customers will accomplish great savings on CO_2 – this is crucial to Banke's customers.

1.4   Project objectives
The project has devolved as foreseen but with delays – delays were due to the supply market not being as mature as expected. Purchasing components for the charger was more time consuming than expected and delivery time was very long. EcoMove resigned in the middle of the project as an important partner.

The e-car market has not developed as expected, thus the market for the quick charger is still uncertain.

The outcome of the project has met the expectations, and the solution proves strong. The risk is if the market is ready for a quick charger and smartgrid. However, the backend system, the webservice and Banke's solutions are requested by customers, so in total the project has great value. Especial for further integration in the Sønderborg H2020 SmartCity project and other partners.
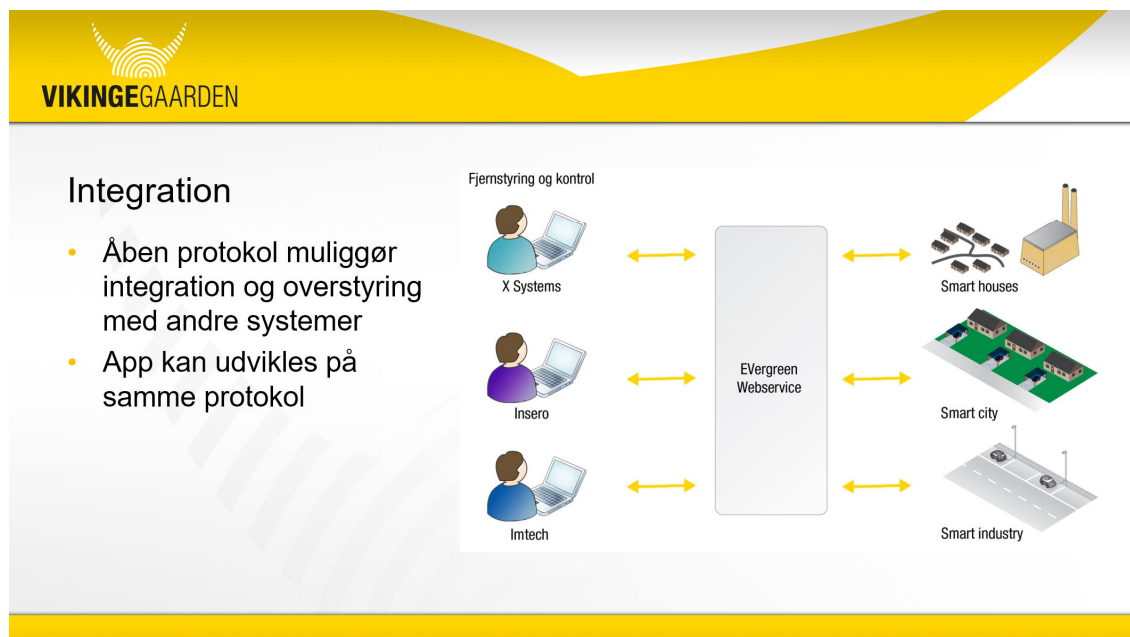
1.5 Project results and dissemination of results

The project has succeeded in realising the objective – a complete quick charger system has been developed and tested.

The technical solution based on an open protocol has proven to have great commercial potential. The solution has enabled Vikingegaarden to collaborate with the following companies:

- *Atea*: Atea has developed an app where users can start and stop a charge, and they can pay for the electricity using the app. The app is integrated with the Evergreen charger using the web service solution.
- *Insero*: For Insero's live lab Vikingegaarden delivered 19 chargers as well as a web service, which enabled Insero to regulate on the charges. The load balancing resulted in savings of 17 % C02. The conclusion was that the system has great potential and that it is possible to reduce the peak load on the power grid by controlling the charging of EVs without reducing the users comfort.
- Imtech: Imtech produces street equipment and has decided to build the Evergreen core parts into a street light post. This is expected to have great potential worldwide.
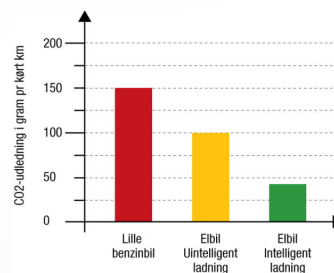
1.6   Utilization of project results

The project participants have the flowing expectations regarding utilization of results:

Vikingegaarden: has a full product range ready to be sold. The system consists of chargers, backend system and webservice. The system is flexible and based on an open protocol enabling integration with other systems. Vikingegaarden has already done projects with other companies (see 1.5), and expect more projects to come of this sort. Vikingegaarden business plan is newly updated and Evergreen is an important part of our future cloud strategy along with our other telemetry products. Sales will only be done through integrators.

Vikingegaarden also expects the outcome of the project to grov fast as Evergreen is now part of the Sønderborg H2020 SmartCity project.

EcoMove: has stalled their development of the e-car.

Banke: Enabling intelligent charging and load balancing has the potential to save significantly on CO_2 for Banke's customers. Banke expects this to be a selling point as we can do savings for their customers as well as on CO_2.

The project has great potential to realize energy policy objectives. The system downloads the CO_2 forecasts from Energinet.dk, and performs intelligent charging based on this. Also the system allows a stepless voltage regulation via the webservice, which again results in savings on CO_2, plus helps avoid grid overload.

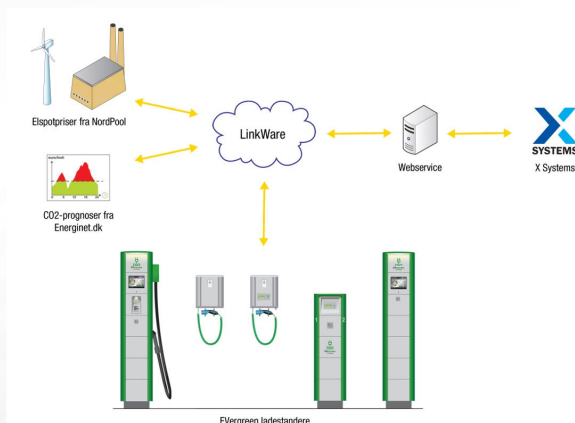## 1.7   Project conclusion and perspective

The project has resulted in an intelligent quick charger that completes the series of EVergreen chargers. The backend system is unique and forms the basis for a wide range of applications. The open architecture enables integration and partnerships like the above mentioned (Atea, Insero, Imtech) – potential partnerships are in the pipeline.

The system's intelligence ensures that charging will take place at the time with lowest CO_2 emission thus contributing to the governments visions of smart grid solutions.

Evergreen development and progress will proceed and as well prepare to join the SmartCity project H2020 project in Sønderborg. Evergreen will be implemented as an important part of the smargrid and to balance between windmill production and consumption. The plan is to mount 30 Evergreen chargers. The backend system will be used in another application to control the chargers remotely.

X Systems' Evergreen

- X Systems' muligheder
  - Trinløs regulering af opladningseffekt
  - Start/stop opladning
  - Status på stik/stander
  - Central fejlovervågning
  - Status på energiforbrug
  - Overholde forsyningssikkerheden
    - Decentralt (overstyret)
    - Centralt (ladestander styrer)

Elspotpriser fra NordPool

LinkWare

Webservice

X Systems

CO_2-prognoser fra Energinet.dk
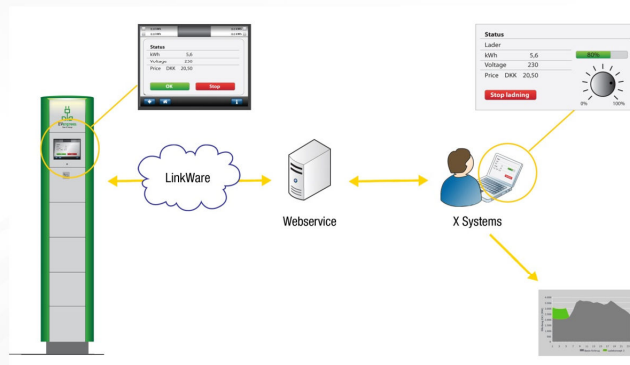
EVergreen ladestandere

IMTECH will be an important partner for us and Evergreen. Over the next year there 3 integration steps are specified and this is about how to integrate chargers into IMTECH backend and how to use chargers along with IMTECH products. The first order is already placed.

Annex
Project website: www.evergreen.dk
Chargers website: www.tipcharge.com

Nyhedsbreve:
http://www.evergreen.dk/show/1470

Insero case:
http://www.vikingegaarden.com/content/reference/showreferencearticle/id/450061

Atea case:
http://www.vikingegaarden.com/content/reference/showreferencearticle/id/450065

Vikingegaarden bliver en del af Smart City-projekt i Sønderborg:
http://www.vikingegaarden.com/content/news/shownewsarticle/id/450071