



EAUC Green Gown Awards
Keele University: Smart Energy Network Demonstrator (SEND) –
9th July 2024

Julian Read, Matt Dean and India Ford

Our *green* timeline



2008

University Council agrees to follow a 'Deep Green' path

2010

HEA 'Green Academy' Keele in pilot

2010

Keele's first carbon management plan launched

2011

Sustainability Hub created

2012

Dedicated 'Dir of EfS' role and Sustainability Project Officer(s)

2015

New University strategy 'to promote sustainability in all that we do' one of 6 strategic aims

2017

Smart Energy Network Demonstrator and HyDeploy projects commences

2017

Root & Branch sustainability 'brand' launched

2018

Outstanding Leadership Team of the Year Award

2018

Institute for Sustainable Futures launched

2019

Climate Emergency declared

2020

Sustainability Institution of the Year Award

2021

8MW low carbon energy generator build commenced

2022

SEND & low carbon energy operational

HyDex

2023

Digital Science and Innovation. IC7 Launch. Integrating Data Sci and Smart Energy

Smart Energy Network Demonstrator

A European-first that is transforming the Keele campus into a living laboratory, enabling the creation and development of low carbon energy technologies.

Enabling at-scale research



SIEMENS

The SEND project (ref. 32R16P00706) is part-funded through the European Regional Development Fund (ERDF) as part of the England 2014 to 2020 European Structural and Investment Funds (ESIF) Growth Programme, and is available to ERDF eligible companies. The project is also receiving funds from the Department for Business, Energy and Industrial Strategy (BEIS)

Keele University Facts & Figures

Approximately 600 acre campus

Wide range of mixed use buildings and facilities – Academic, Residential & Commercial

>12,000 staff and students per day

The size and scale of a small town

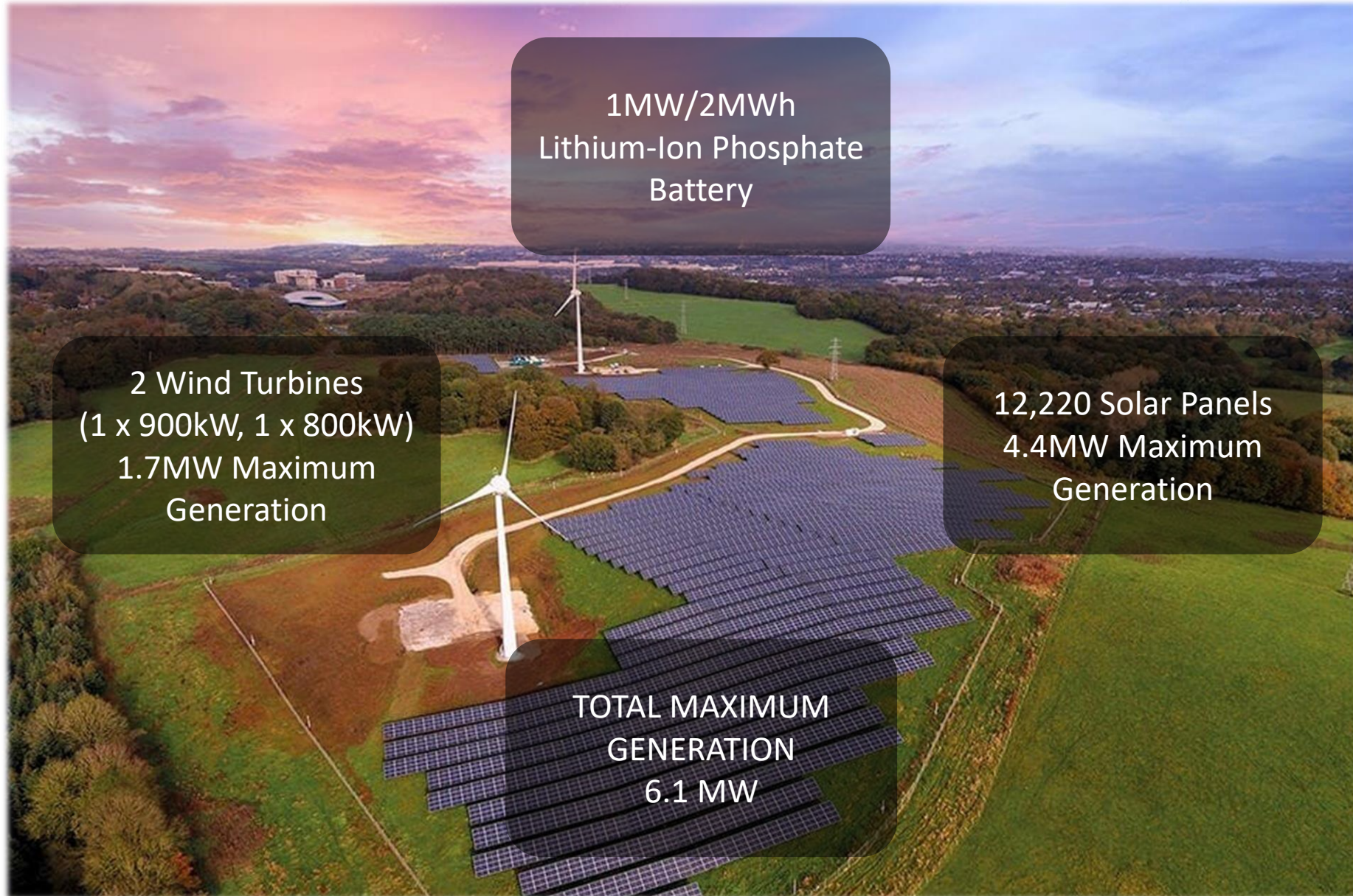
Onsite renewable generation producing up to 50% of our electricity

Campus Gas Demand: 39.2GWh pa

Campus Electricity Demand: 13.8GWh pa



Low Carbon Energy Generation Park



1MW/2MWh
Lithium-Ion Phosphate
Battery

2 Wind Turbines
(1 x 900kW, 1 x 800kW)
1.7MW Maximum
Generation

12,220 Solar Panels
4.4MW Maximum
Generation

TOTAL MAXIMUM
GENERATION
6.1 MW

Smart Energy Network Demonstrator Control Room



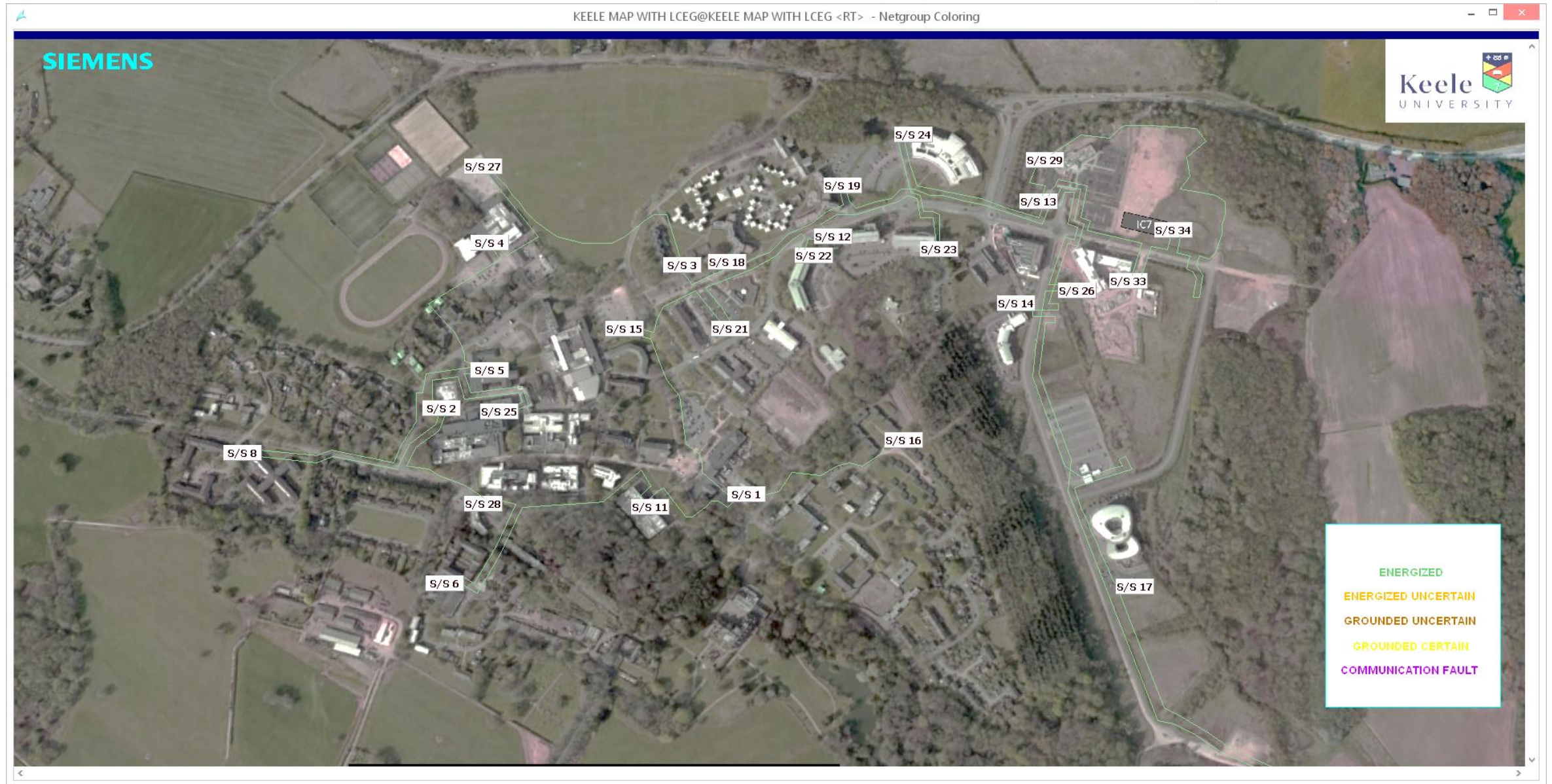
SEND Software



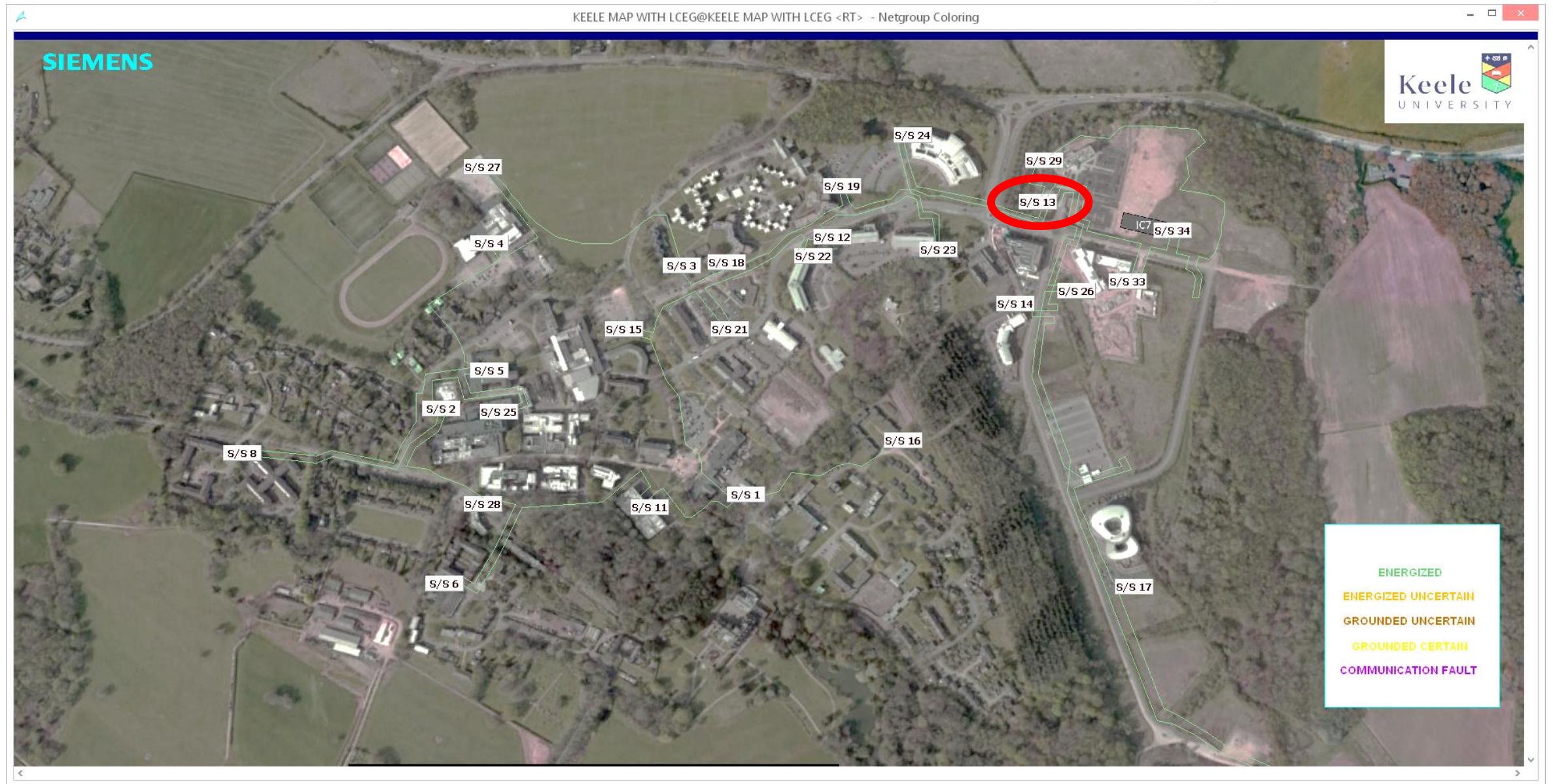
SP5 Spectrum Power 5

DEOP Decentralised Energy Optimisation

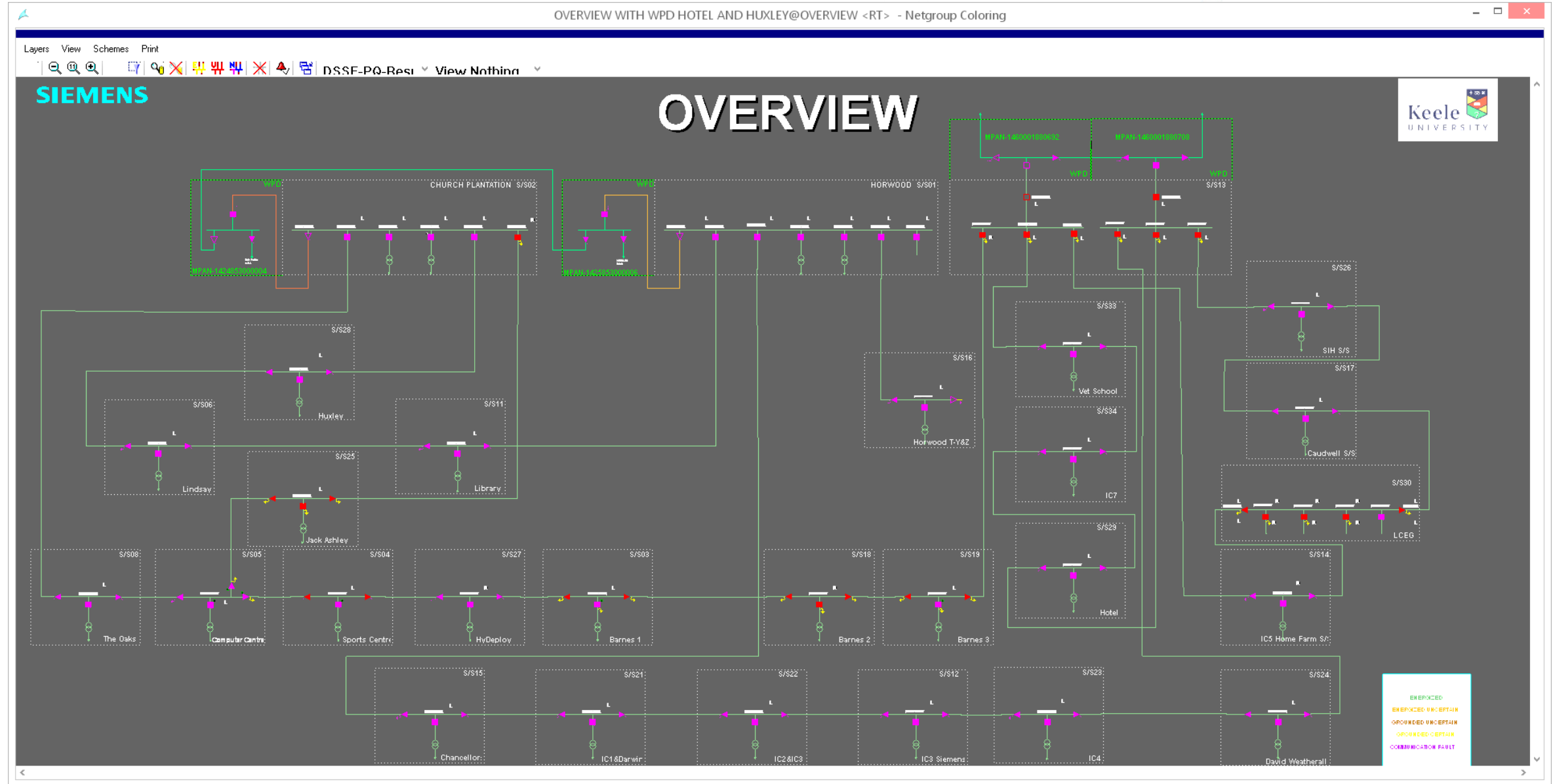
SP5 Geographical Substation View



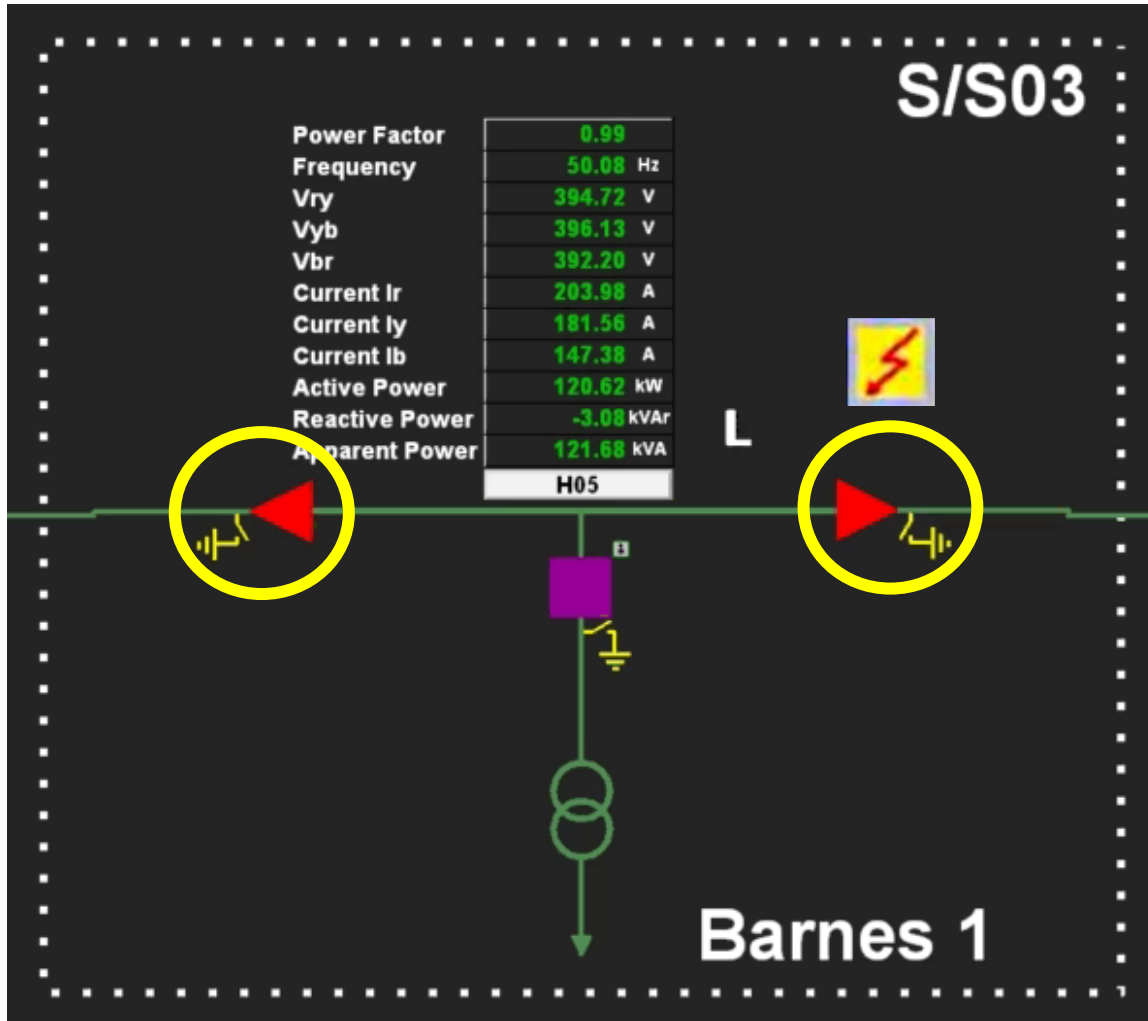
SP5 Geographical Substation View - Substation 13 PPC



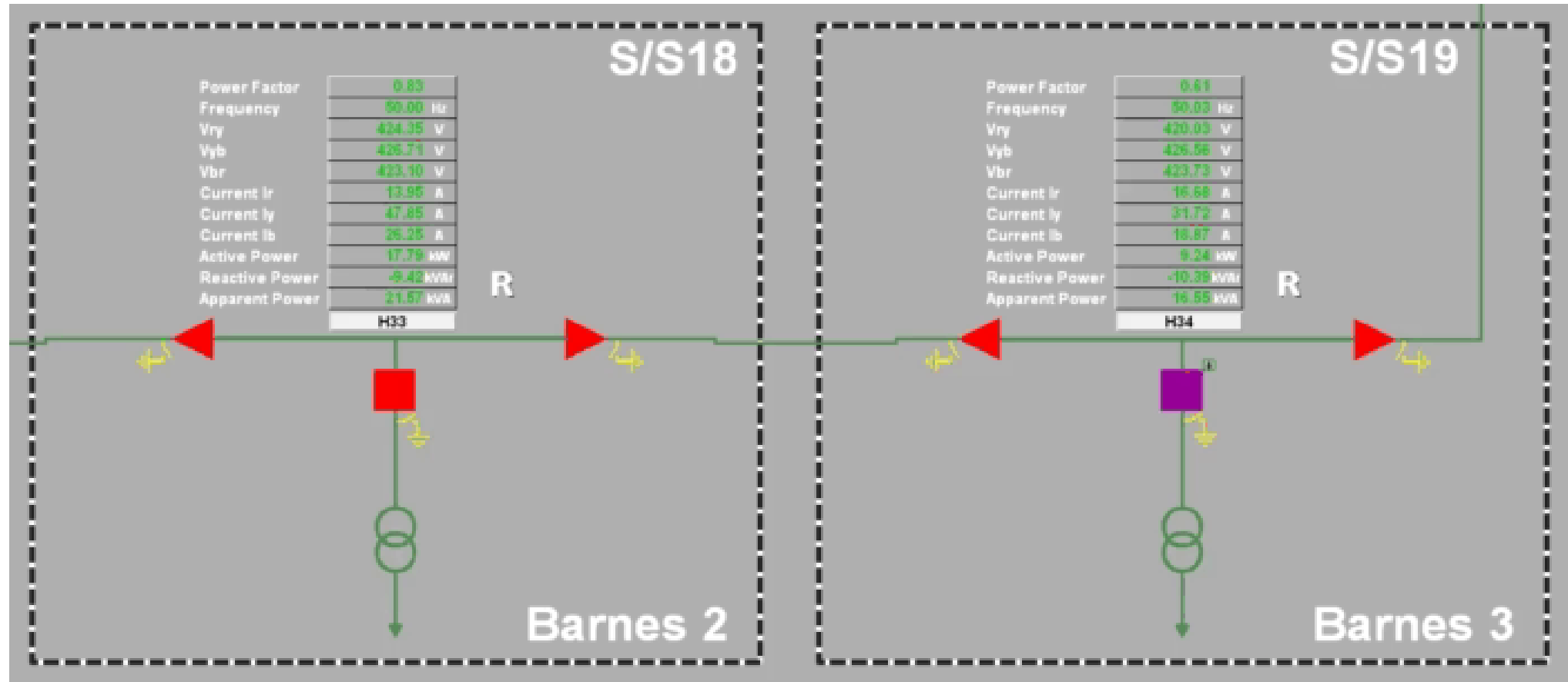
SP5 SLD (Single Line Diagram)



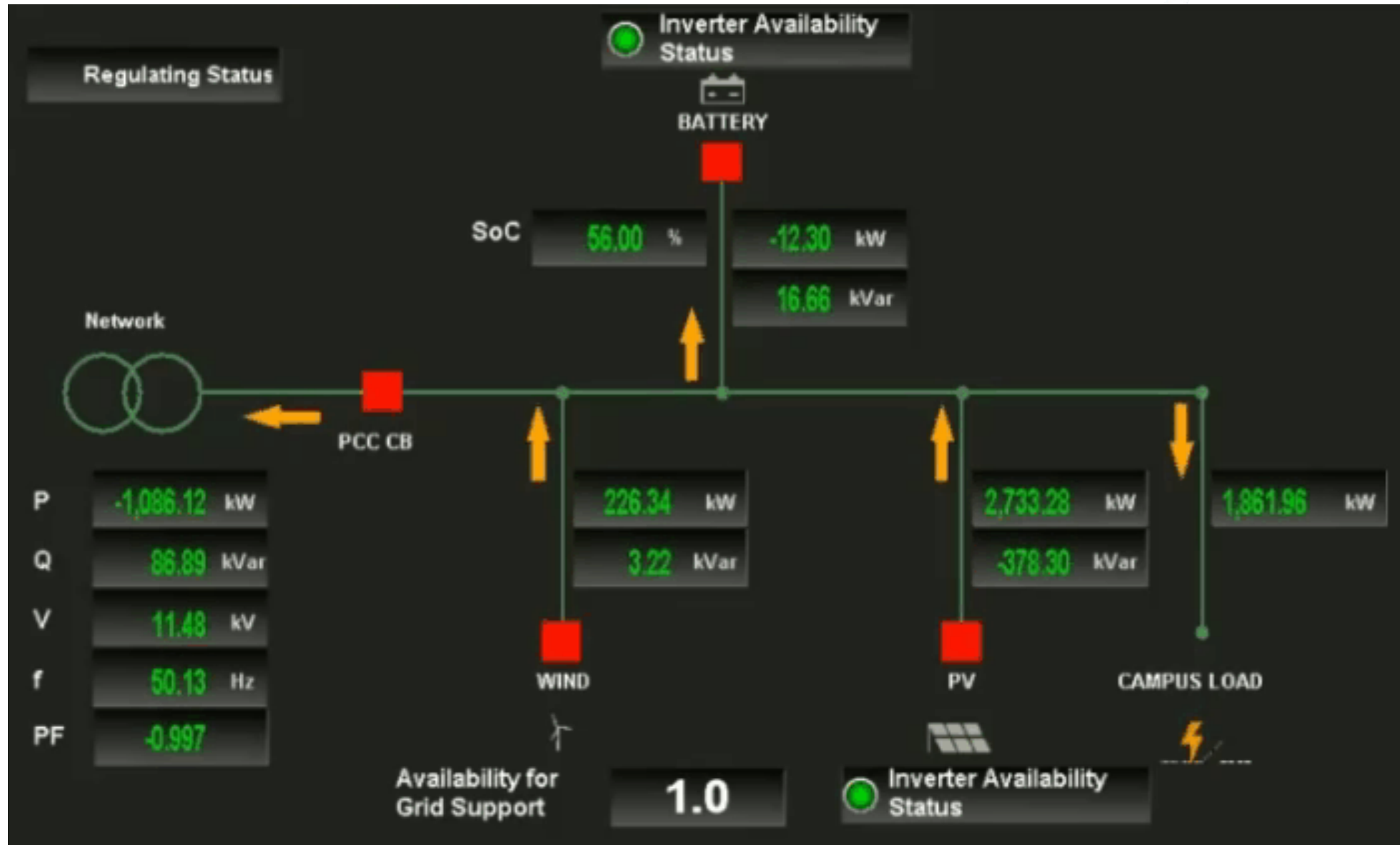
SP5 High Voltage Switchgear



SP5 Study Mode



SP5 Power Flow Monitoring



SP5 Demand Response Assets

If we breach the export limit for 5 seconds, the renewables site is remotely turned off by the National Grid.
It takes around 25 minutes to start generating again.

To avoid this, we try to utilise as much of the excess electricity as we can by using it in different ways such as:

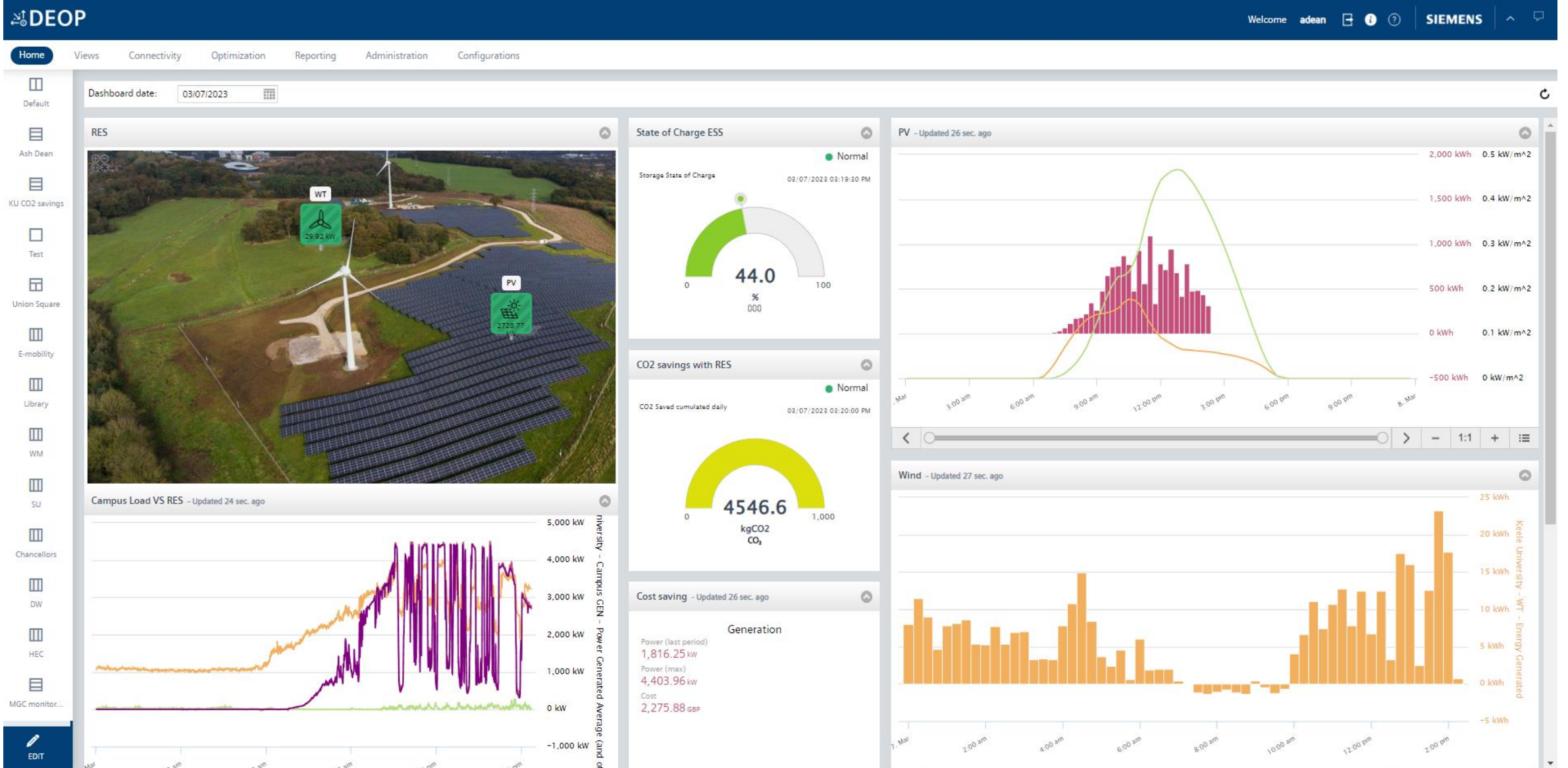
Turning off gas boilers and
instead, heating the water with
electric boilers



Turning up things like air
conditioning and air handling
units in buildings



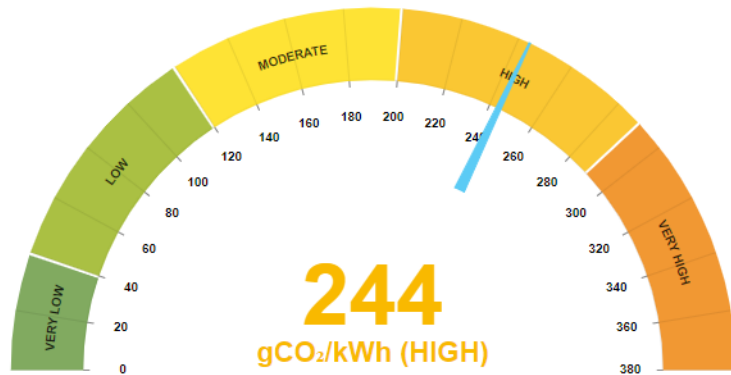
DEOP Generation Details



THIS IS KEELE

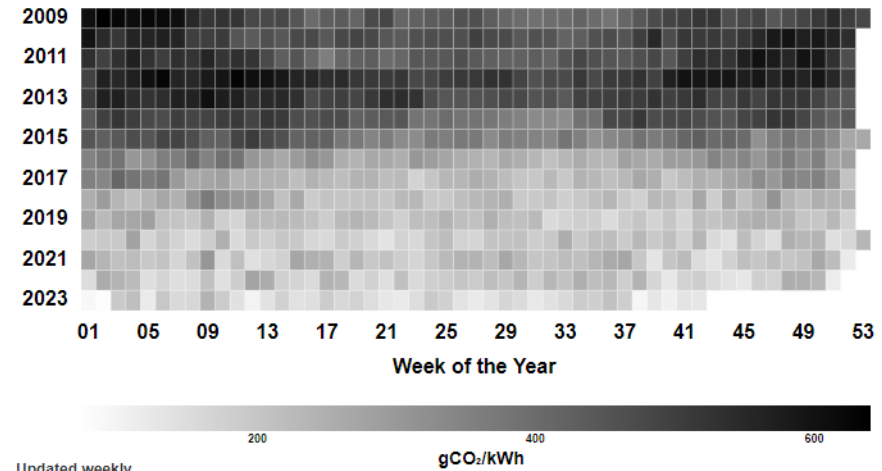
National Grid Carbon Intensity Monitoring

Current Carbon Intensity



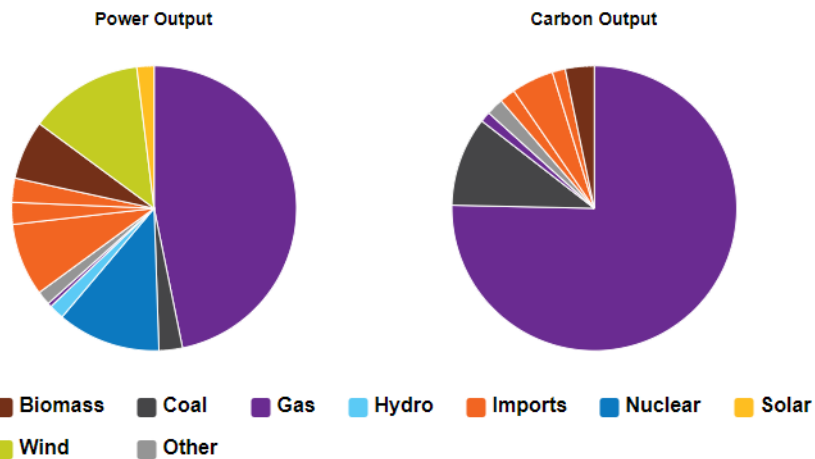
Updated every 30 minutes

History of Carbon Intensity of Generation



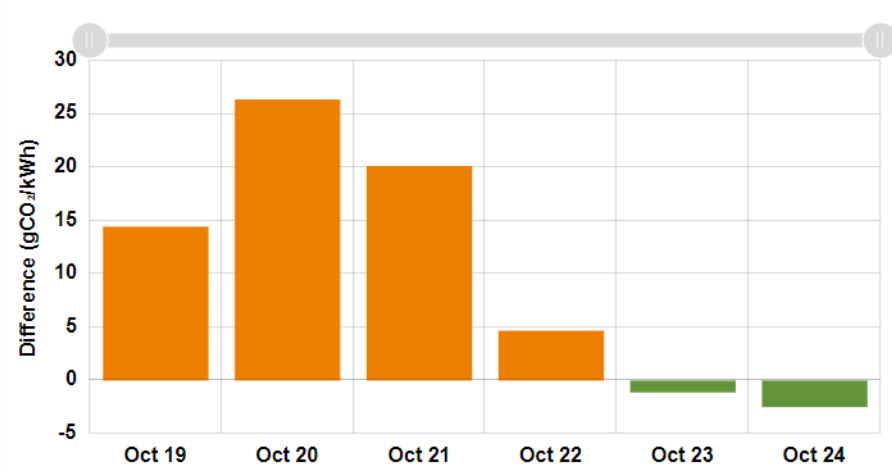
Updated weekly

Current Generation Mix and Carbon Emissions



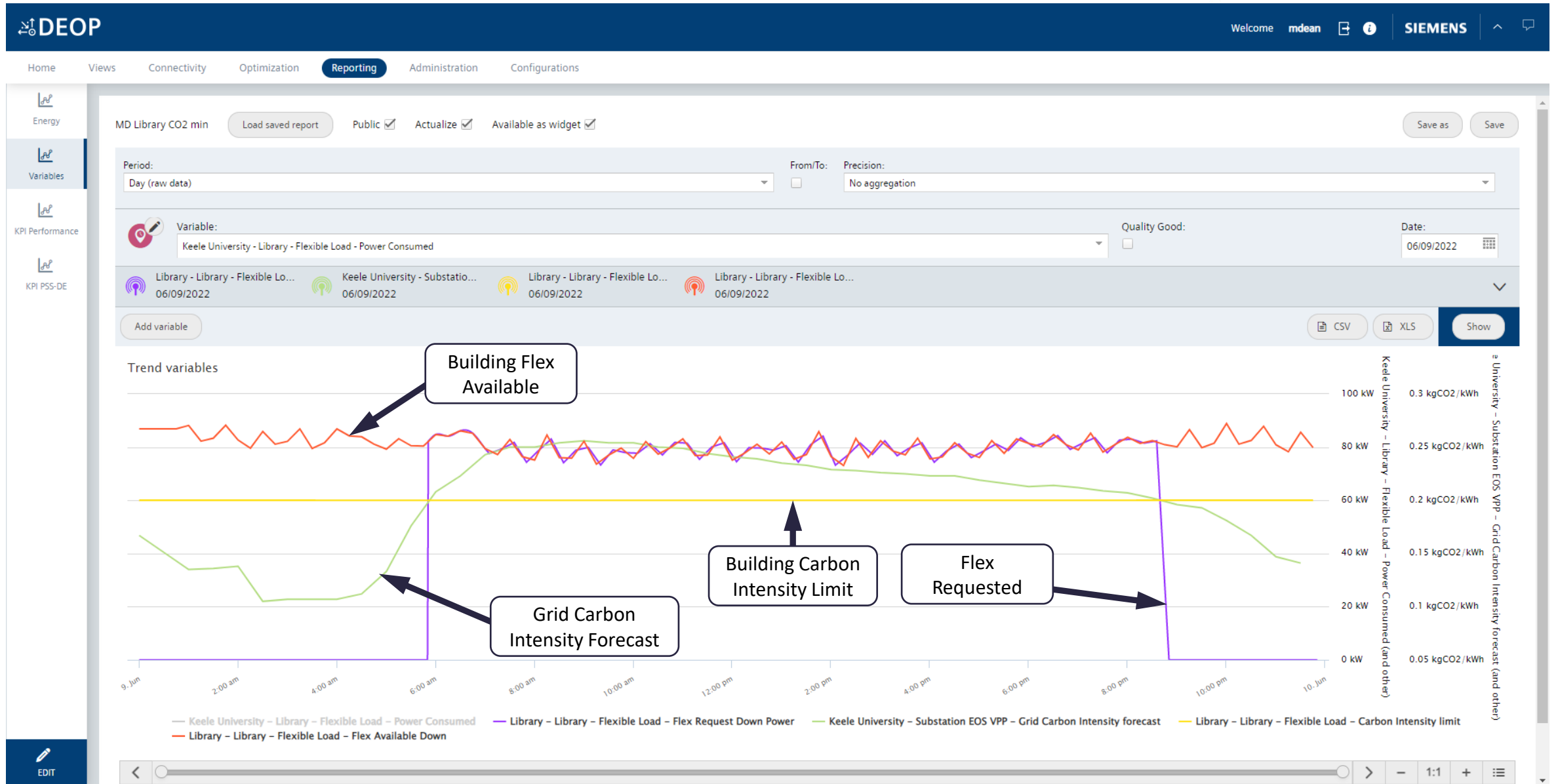
Updated every 30 minutes

Carbon Intensity of Balancing Actions



Updated every 60 minutes

DEOP Virtual Power Plant (VPP)



DEOP EV Charging Data



THIS IS KEELE

DEOP Smart Charging



11:55 4G

← Start recharge

Vehicle Information

Car model *

Car plate

Battery capacity * **13 kWh**

1 kWh ●————— 200 kWh

Current battery * **20 %**

0 % —●————— 100 %

Desired battery * **80 %**

20 % —————●————— 100 %

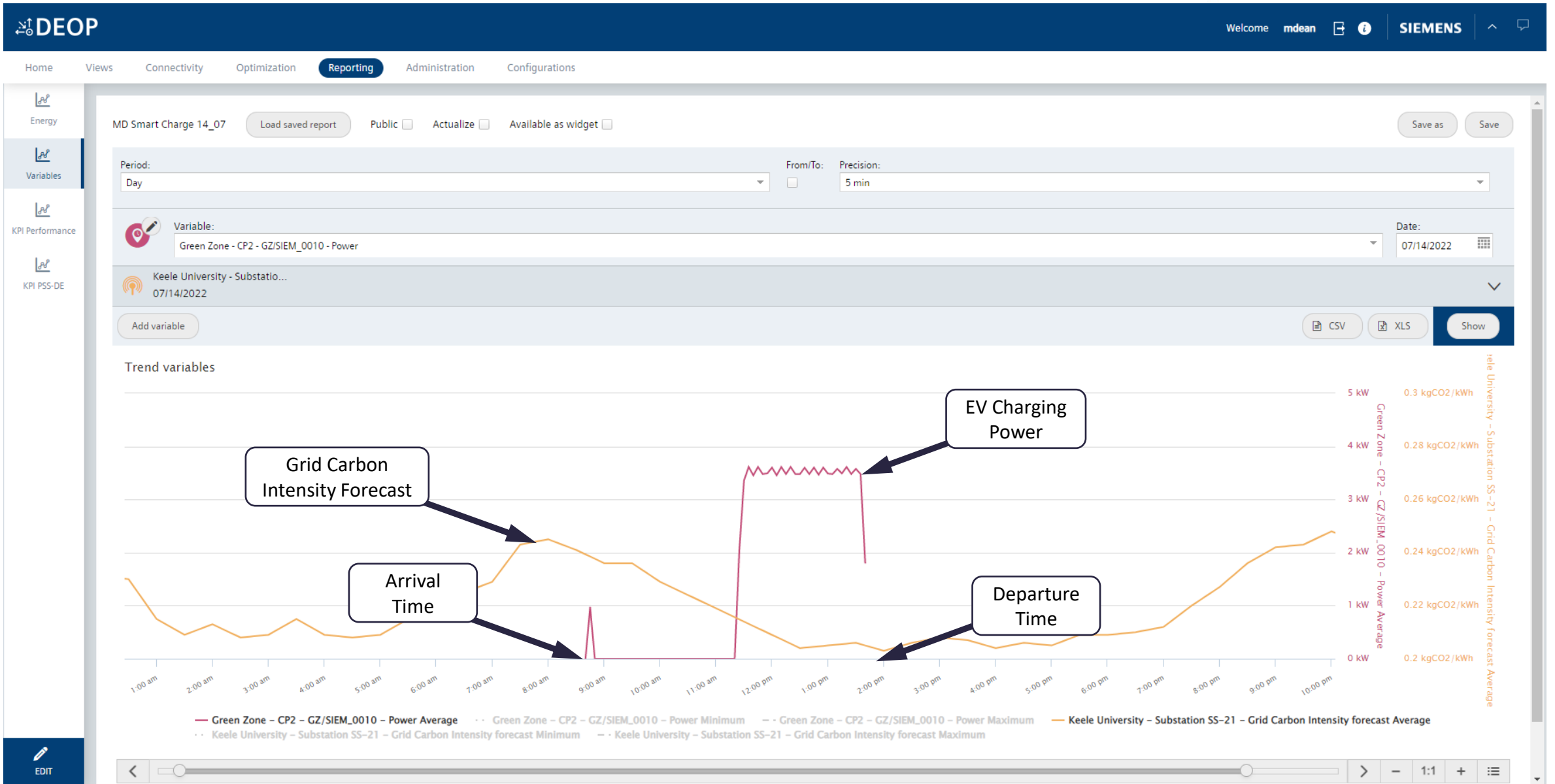
Desired end recharge *

On day 11 Aug 2022

At 16:00

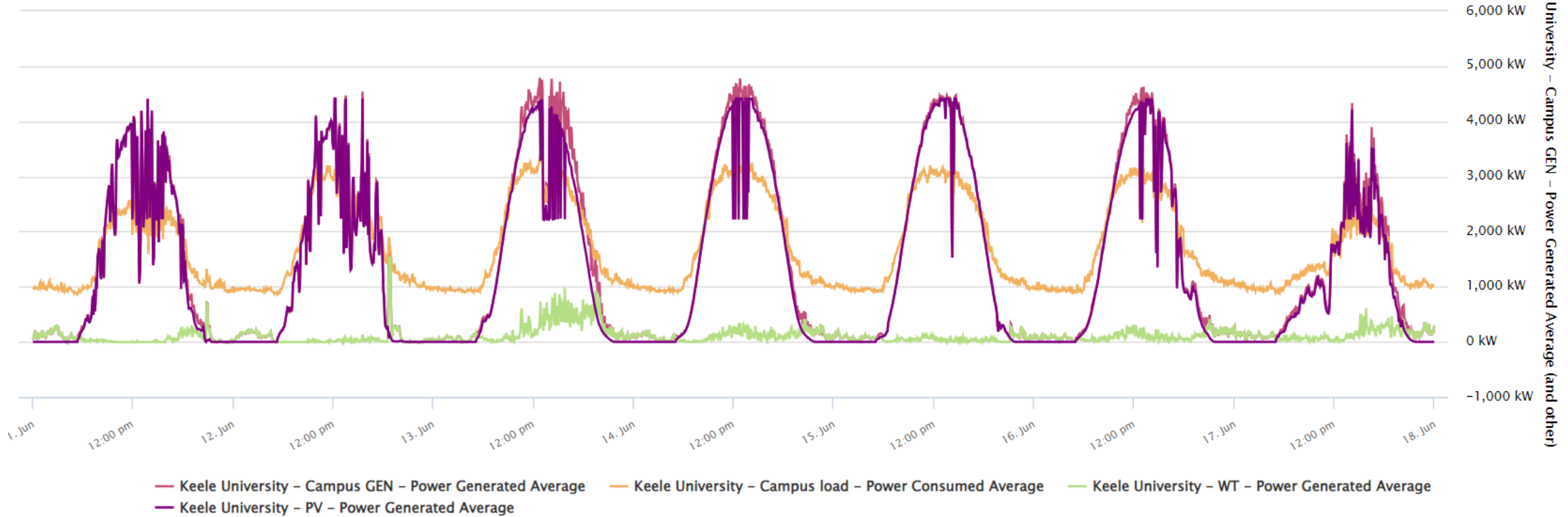
▶ START RECHARGE

DEOP Smart Charging



Typical Summer Generation

Trend variables



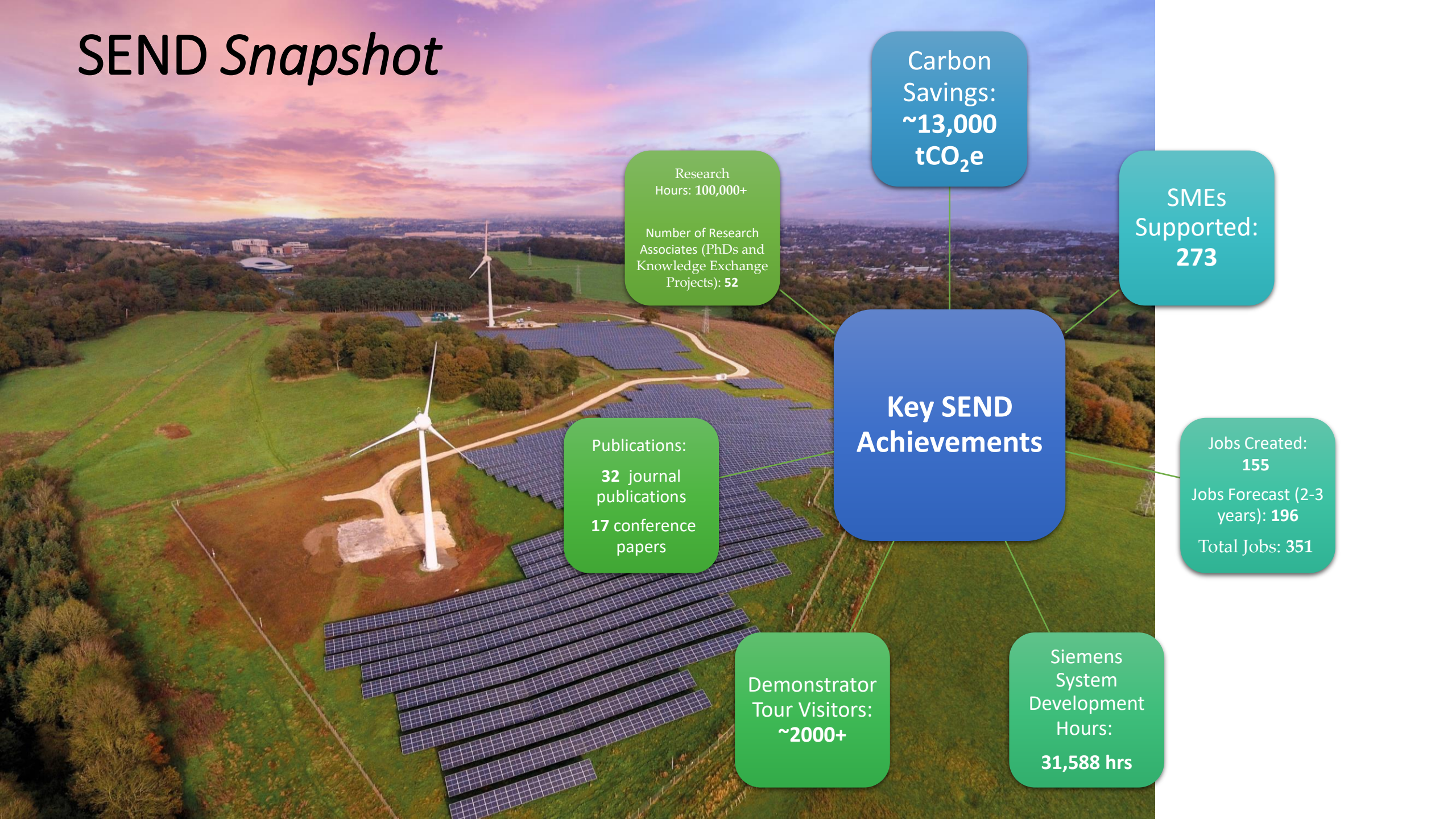
Keele University – Campus GEN – Power Generated Average (and other)

Our *commitment* to the region

Committed to working with our local and *regional community* to tackle the climate and ecological *emergencies* and ensure a just transition.



SEND Snapshot



Key SEND Achievements

Carbon Savings:
~13,000 tCO₂e

SMEs Supported:
273

Research Hours: **100,000+**

Number of Research Associates (PhDs and Knowledge Exchange Projects): **52**

Jobs Created: **155**
Jobs Forecast (2-3 years): **196**
Total Jobs: **351**

Publications:
32 journal publications
17 conference papers

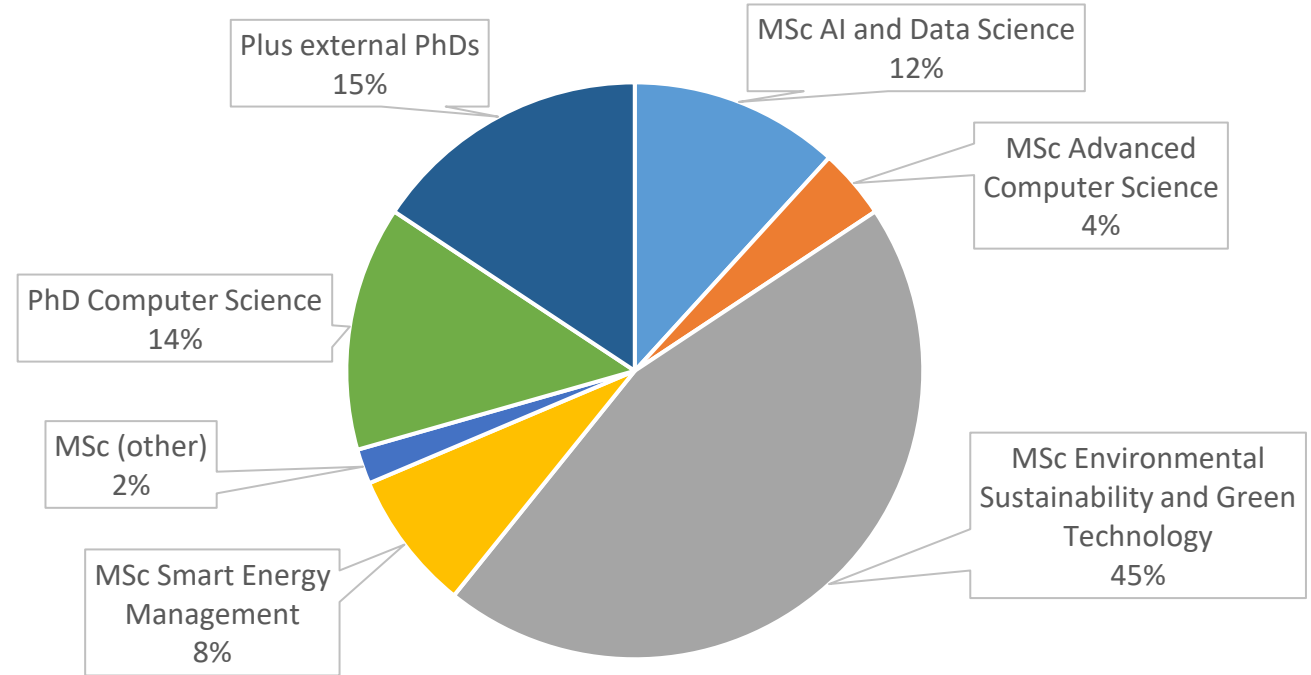
Demonstrator Tour Visitors:
~2000+

Siemens System Development Hours:
31,588 hrs

SEND Programme & Student Futures

Provided paid placement opportunities for students/graduates across disciplines; some students completed multiple projects:

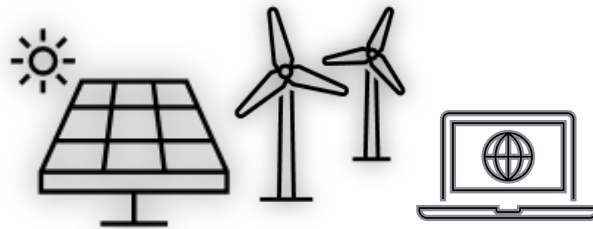
Recruitment process: competitive, included applications and interviews with employers.



Project manage and work collaboratively



Apply knowledge from degree



Explore topics in greater detail



Opportunities to present research



Produce a bespoke report for an SME



Increased confidence

awa

Researcher Progression

SEND Researchers have progressed into a variety of roles within organisations, including:

- JCB
- Adelan
- Lucideon
- BAE Systems Digital Intelligence
- Koura
- WSP UK
- Peel NRE
- Wardell Armstrong
- The Defence Science and Technology Laboratory (DSTL)
- Mantis Energy
- Local authorities
- Universities
- Hospitals

Roles include:

- Sustainability Officer
- Data scientists
- Research scientists
- Environmental and Sustainability Consultants
- Energy Consultants
- Software Engineer
- Power Systems Engineers
- Product Development
- Quality Assurance
- Business Development Manager
- PhD student

“SEND Project gave me the opportunity to apply my skills to gain experience in renewable energy. This was one of my first projects in England and it gave me the **project management exposure** as an International Student. It was very **well-managed** and the right resources were available throughout the project. It allowed me an excellent study-work balance and I was able to finish the project on my own pace and come up with a useful onboarding and prediction product.”

“**Valuable experience** gained engaging with multiple small businesses. The projects were **worthwhile.**”

“My experience of working on a SEND Project was hugely valuable both in helping me get a job & actually doing the job. My current role is putting projects and funding packages together to deliver decarbonisation programmes for local authorities. The SEND project I worked on at Keele gave me the experience of **developing a research project, presenting the draft project to both academics & business, delivering the project & updating key stakeholders** throughout the delivery of the project. All this was done in the safe environment of Keele with the support, advice and learning environment of University & Businesses staff.”

Student Feedback

“Each of these unique projects offered **invaluable experience** for me as a graduate by engaging with SMEs, which has helped **to facilitate a desire for me to seek out similar job roles in the sector as an environmental sustainability consultant or advisor.** There have been positive contributions from everyone involved on the programme which have resulted in **real-life benefits for our SME partners** that we worked with. A win-win scenario all round!”

“It was a **wonderful experience** to be able to work with the industry directly after finishing my studies. It provided me with an **understanding of how to work with the industry** from a sustainability perspective and provided me with an opportunity to apply the knowledge I gained during my studies. I also got a chance to **enhance my research, project management, and teamwork skills** along with supporting the company's sustainability performance, which was **very fulfilling.**”

Keele *Offers*

CLIMATE AMBASSADORS

In association with EAUC, STEM Learning and the University of Reading

Research

Student Placements and Projects

Skills Bootcamps: Net Zero and Smart Energy Transition and Place-based Decarbonisation

Climate Ambassador Programme





Global *Sustainability* Institution of the Year

INTERNATIONAL GREEN GOWN AWARDS 2021



Thank you

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