Decarbonization strategy for a New Distribution Centre facing grid capacity limitations

CASE STUDY FOR ULB/VUB STUDENTS

ENGIE Impact is a global advisory and services organization dedicated to accelerating the sustainability transformation of companies

Sustainability transformation scope

What

- Energy
- GHG emissions
- Water
- Waste

Where

- Sites
- Operations
- Transport
- Supply Chain

Services

- Advisory
- Implementation Support
- Managed Services
- Digital Solutions

Key figures

Number of clients	1,000
Sites under management	1,000,000
Global Revenue	200+M
Number of Employees	2000+
Number of Offices Worldwide	21

Example clients

ALCANTARA® · Henkel · Audi · Mercedes-Benz · GE · Unilever · Microsoft · HUAWEI · DHL

Part of ENGIE, the global reference in low-carbon energy and services

160,000
Employees globally

70
Countries

€61Bn
Revenues

€12Bn
Investments in energy transition over 2019-2021

24.8GW
Installed renewable capacity

€182M
R&D spend

+1,000
Researchers & Experts in 11 R&D centers

€166M
Investment in innovative start-ups

+100
University partners

1st
Independent power producer in the world

1st
Globally in microgrids

1st
Globally in cooling distribution networks

2nd
Globally in electric vehicle charging stations

2nd
Global supplier of technical installation services

4th
Globally in heating distribution network

We carry out simulation-based business case assessment to identify the optimal mix of decarbonization solutions

Monash University Green H2 strategy

Business case assessment of hydrogen end-use and production opportunities at its Clayton campus

National University of Singapore

Actionable decarbonization roadmap with prioritization and sequencing of decarbonization opportunities to meet 2030 ambition

NUS National University of Singapore

Local energy community in Mechelen (BE)

Design of an energy community with 5 C&I members to capture the full local renewable potential and reduce their energy bills

Smart local energy system in Nantes district

Optimal asset investment and operation for Energy sharing scheme in an eco-district in Nantes

Smart local energy system in Tours district

Optimal asset investment and operation focused on a large DHC scheme in the city of Tours

Local energy community, Alphen aan den Rijn (NL)

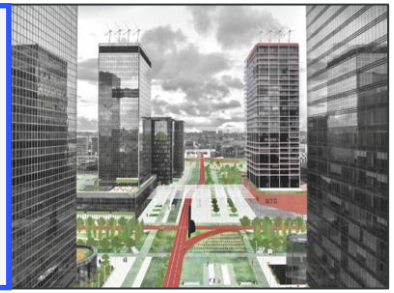
Energy sharing in an industrial parks to solve congestion at grid connection

Zero carbon Springfield Brisbane (Aus)

Urban planning, mobility and energy strategy for a zero carbon city by 2038

Zero carbon Brussels North district

Zero carbon roadmap with business case of energy asset investments for Northern district of Brussels



Eco-district in Rugeley (UK)

Mobility and energy roadmap, with business case and phasing of investments for new zero carbon district

OUTLINE

Situation

Technology Inspirations

Short- and Long-Term Approach

Key Assumptions Required (mind Excel File)

Connecting a new Distribution Centre (DC) to a Congested Distribution Grid

Quick facts

- Planned distribution center for Q3 – 2021
  - Estimated demand **until 2024**: 3.9 MW peak (including cooling, general power consumption, Heat Pumps, …)
  - Estimated demand **after 2024**: from 3.9 MW up to 4.5 MW (including cooling, general power consumption, Heat Pumps, EVs, ..)
  - Solar PV production planned to be installed in Q3 2021, maximum possible capacity is 4.5 MWp, wind generation only possible after 2024

  Constrained distribution grid: Only 2 MW grid connection possible until 2024

  The Management of the distribution centre is interested to reduce the carbon footprint of energy in a cost-efficient way

Illustration of a DC with solar PV

Key questions:

- Can **a Battery Energy Storage System (BESS) – in combination with the PV system and grid connection –** be considered to allow the DC to operate with a 2 MW grid connection until 2024?
  - If so, what battery size (kW & kWh) would be required?
  - What would be the costs for such a battery system?
- Are there **other (more economic) decentralized solutions** possible **until 2024,** while keeping the **CO2 footprint at a minimum***?
- *Bonus:* which **options for a smarter and cleaner energy approach exist beyond 2024**? Pay for grid capacity extension, extend decentralized solutions, ..?

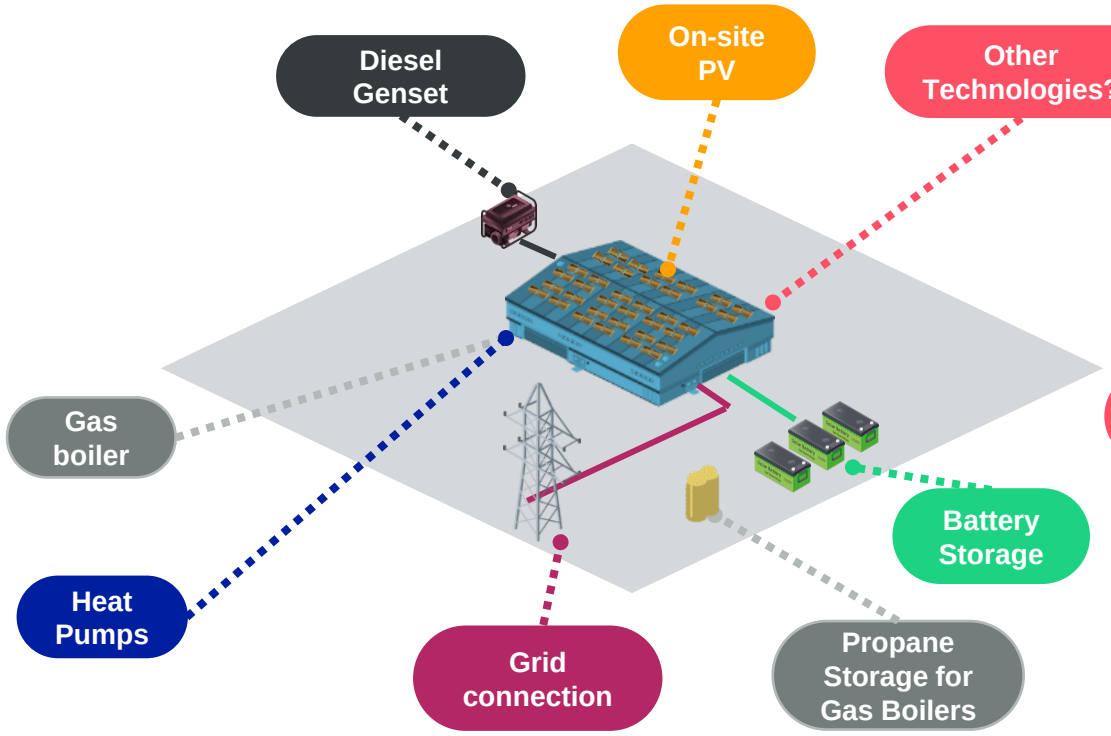
*Green Electricity Tariffs or PPAs are not possible, grid electricity is delivered at the average emission factor of the Netherlands

Two Timeframes to Optimize with Different Priorities

Short term solutions should fit with long term strategy

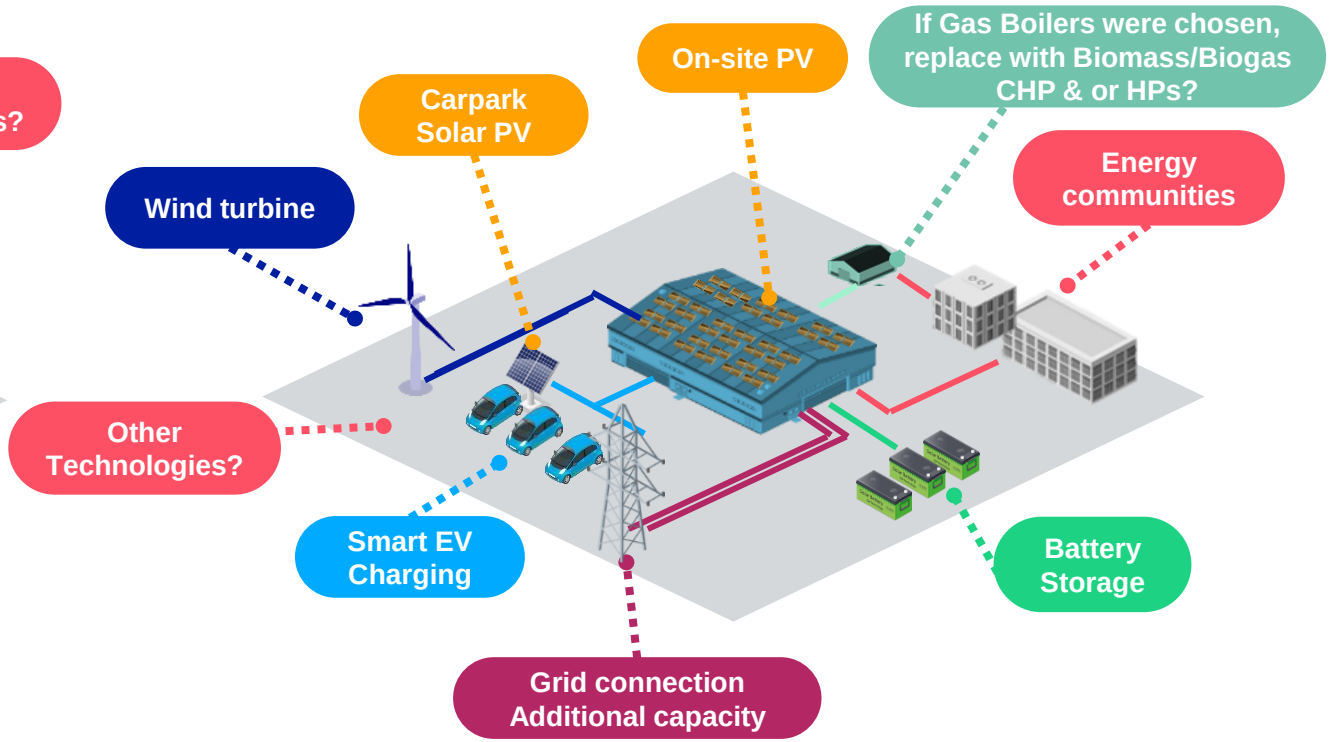
2021 – ensuring connection

Inspiration for possible technologies



2024 – smart energy system

Inspiration for possible technologies



CHP: Combined Heat & Power
HP: Heat Pumps

Solving the immediate need for 2021-2024

- Ensure that the Distribution Center can function with the grid connection constraint
- Consider solutions complementary to a battery and PV only approach (e.g. Wind Power, Diesel generators, initial gas heating, …), minimizing total cost of ownership and limiting environmental impact
- Embed resiliency that fully leverages the available energy system & minimizes costs

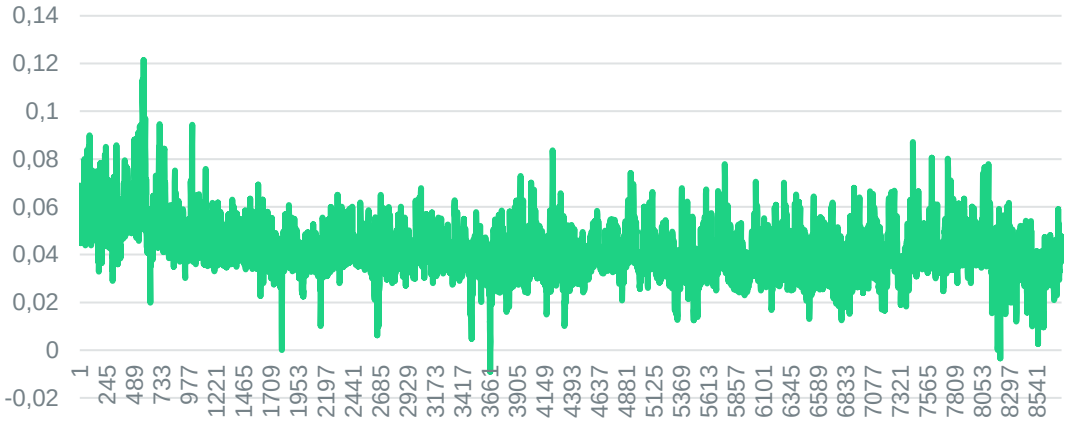
While considering long-term developments and strategies

- Additional battery system revenue streams (flexibility, load shifting, emergency power)
- Smart EV Charging & Car Park Solar PV
- Demand Response (Cold Storage, Electric Heat Pumps, …)
- Integrated generation approaches such as CHPs (e.g. including heating and cooling)
- Local Energy Community

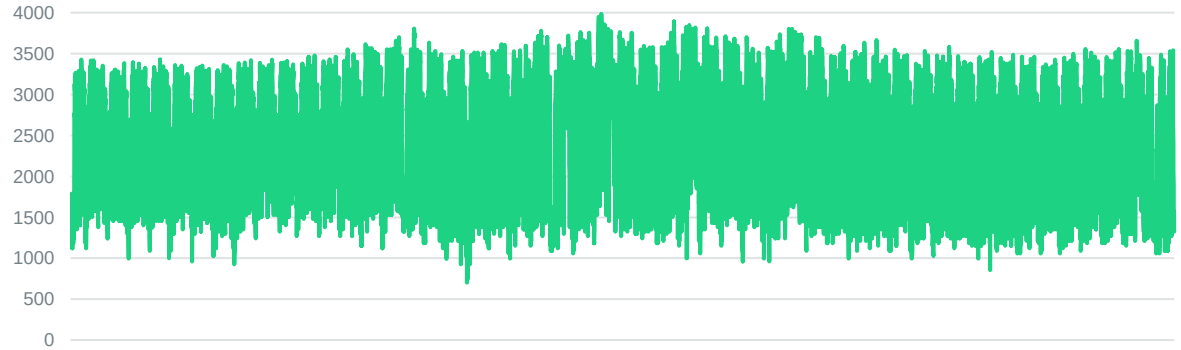
Techno-Economic Assumptions*

More Data Available in Excel-File

Electricity Price Profile (€/kWh) – based on prices typically applicable for retailers



Hourly Electricity Demand Profile (22 GWh/a)



Excel with the following information available

- Exact electricity demand per hour
- Exact electricity price per hour
- Diesel price
- Technology costs (PV, wind, CHP, Genset, battery)
- Maximum capacities (PV & wind)
- Renewable yields

In case of missing or conflicting data please take reasonable assumptions

*Based on generic but realistic data

Techno-Economic Assumptions

- One can assume that the Distribution Centre covers an area of 80.000 m2 with the following split:
  - 40.000 m2 require 18 degrees
  - 30.000 m2 require -5 degrees
  - 10.000 m2 require -18 degrees
- For the heat demand (18 degrees) you can consider the profile to be distributed.
- Cooling demand: it is best to consider it as part of the electrical load in a “base case”.
  - This is because the project is for the food & beverage industry, which is typically extremely conservative regarding the optimization of cooling loads.
- Nevertheless, if you would like to run scenarios (in addition to a base case), we would recommend to do an online search for typical data points for cooling loads in the food & beverage industry (ideally with regard to distribution centers) and, based on such data, create your own profiles.

Thank you