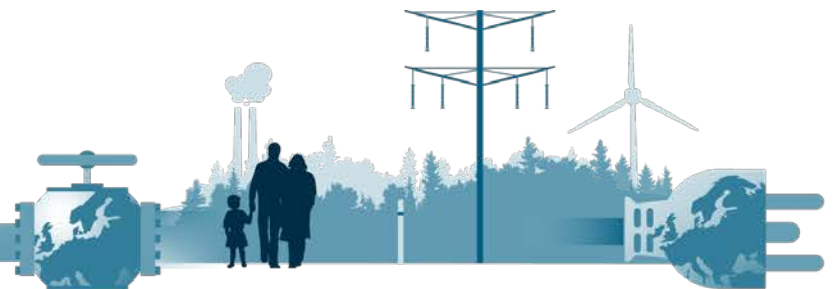


The role of gas

Gas storage in the integrated energy system

Hans-Åge Nielsen, Energinet.dk Gas Storage



Reflections on yesterday

Energy system models says it can be done

- and the results are solid and robust

This is a little like planning a sports game and saying:

- We are pretty sure some of the best will win

The player at the game says: Ok someone will win

- but will it be me?

Reflections on yesterday

This is what we talk about

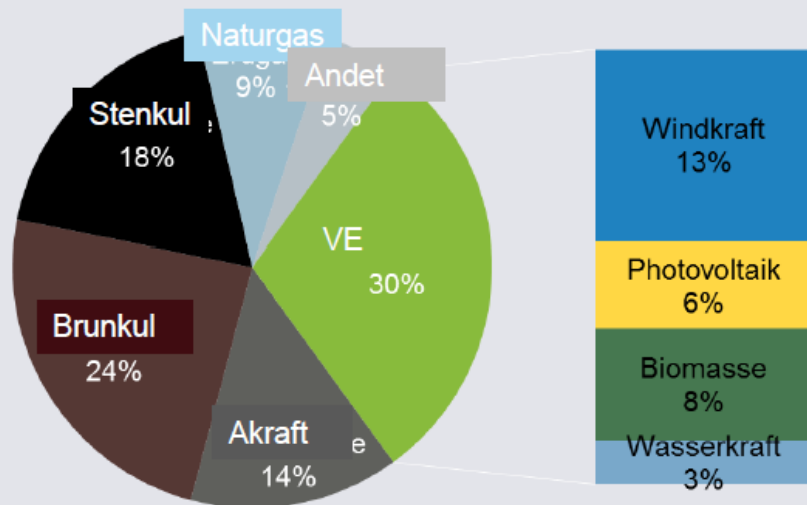


This is what keeps the light on
(and European industry running)



Elproduktion fra vedvarende energikilder spiller allerede en stor rolle - det er afgørende for det fremtidige elsystem...

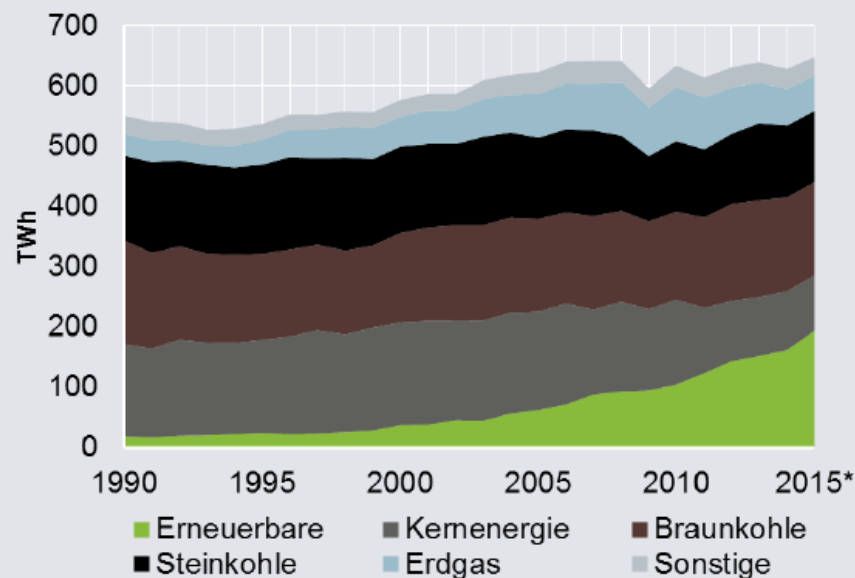
Elproduktion (brutto) i Tyskland 2015



AGEB (2016)

* foreløbig

Elproduktion 1990 – 2015

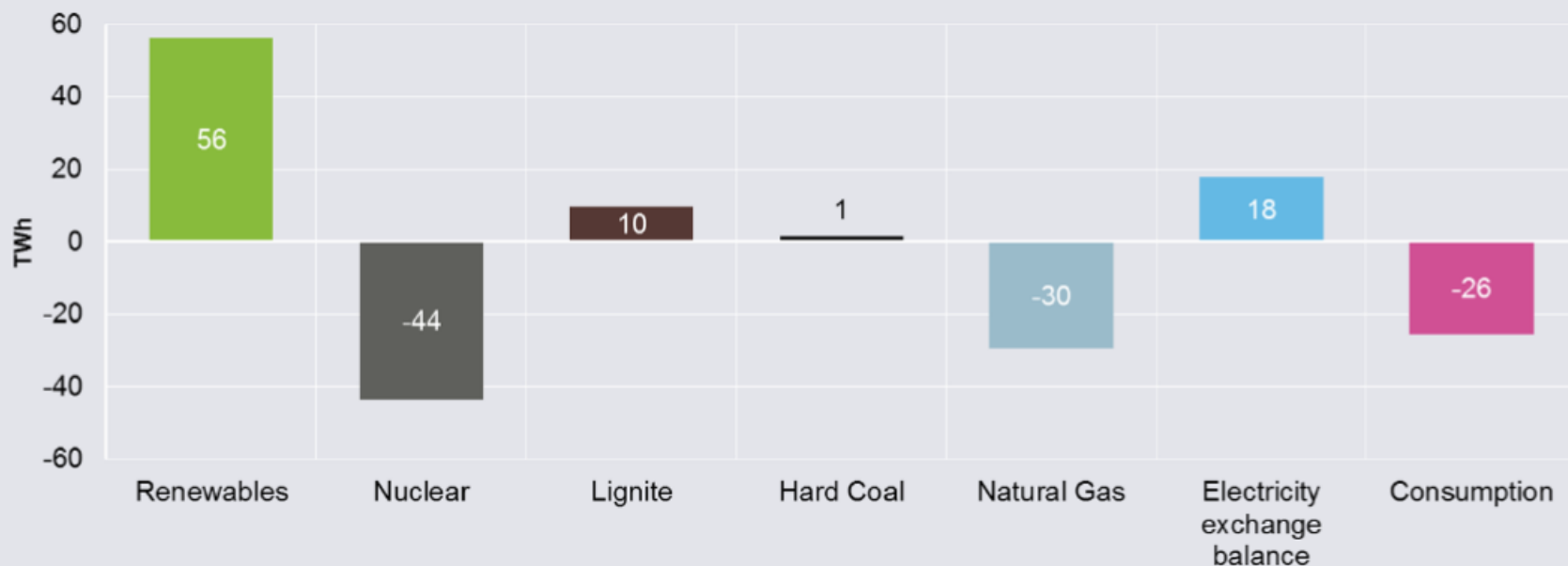


AGEB (2016)

* foreløbig

Renewable go hand in hand with Lignite

Changes in gross electricity generation, consumption and exchange balance, 2010 – 2014*



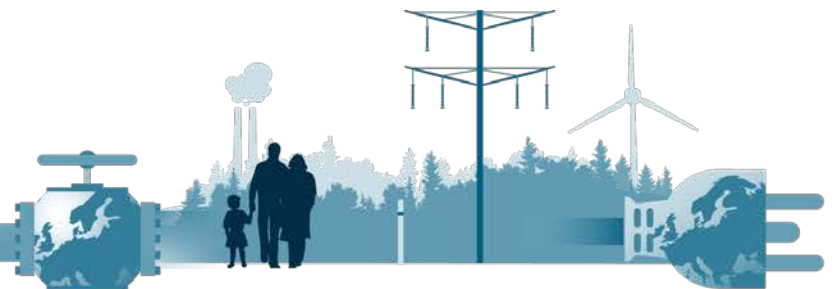
AGEB (2015)

* preliminary

I don't think that was the plan!

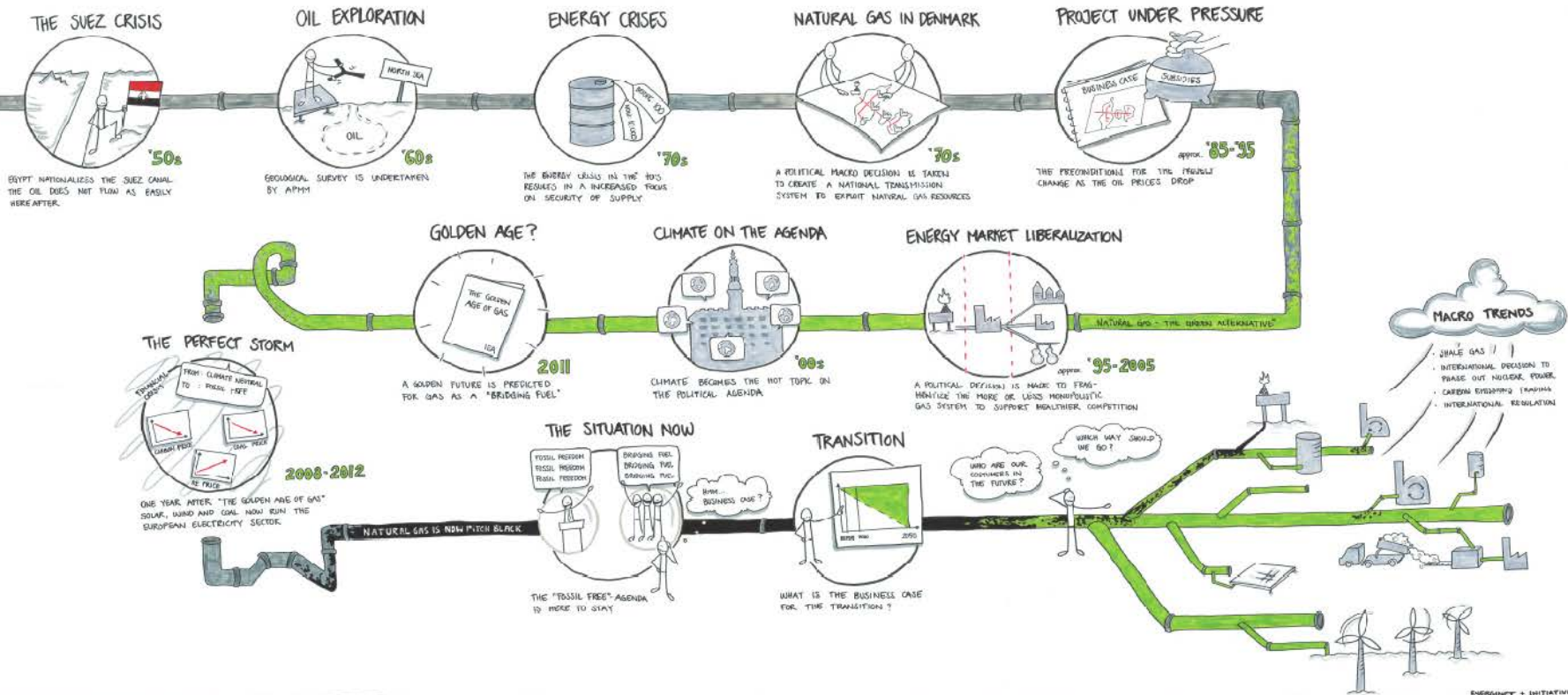
The Gas system

- Knowing the past can guide you to the future



The roots

The development of the Danish gas system

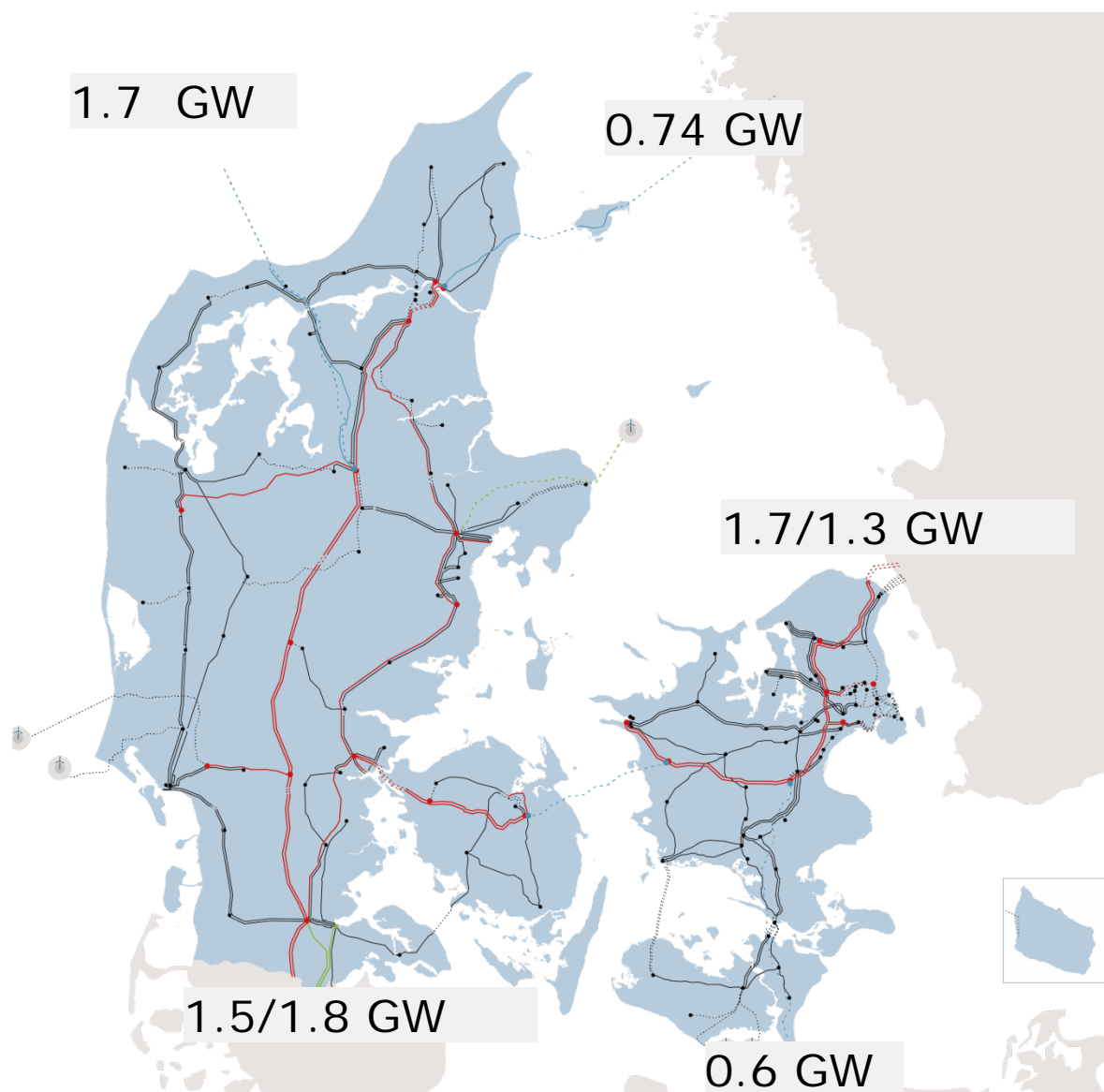
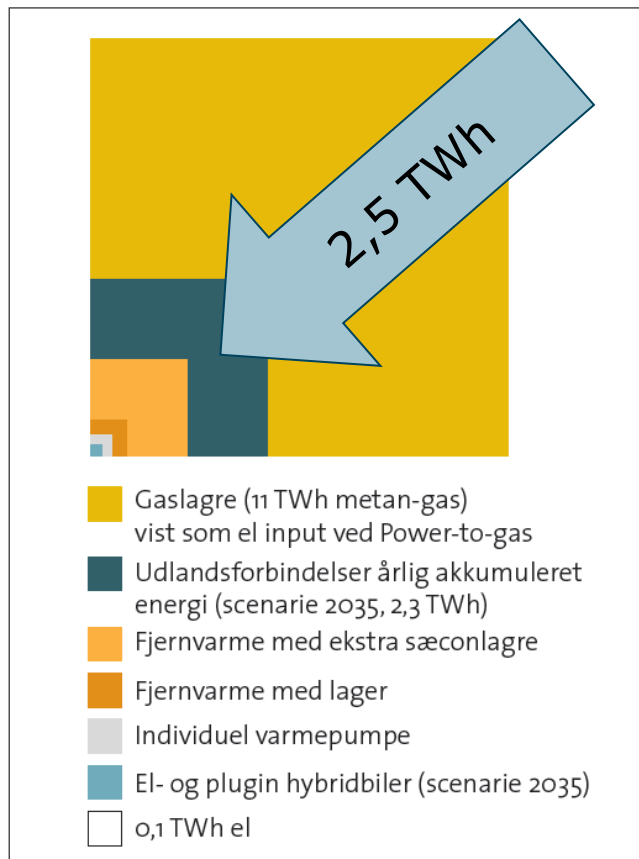


What system?

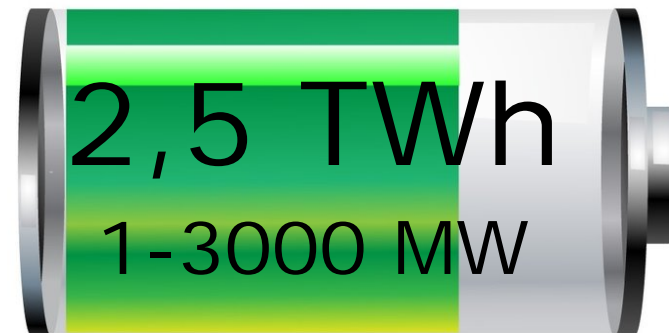
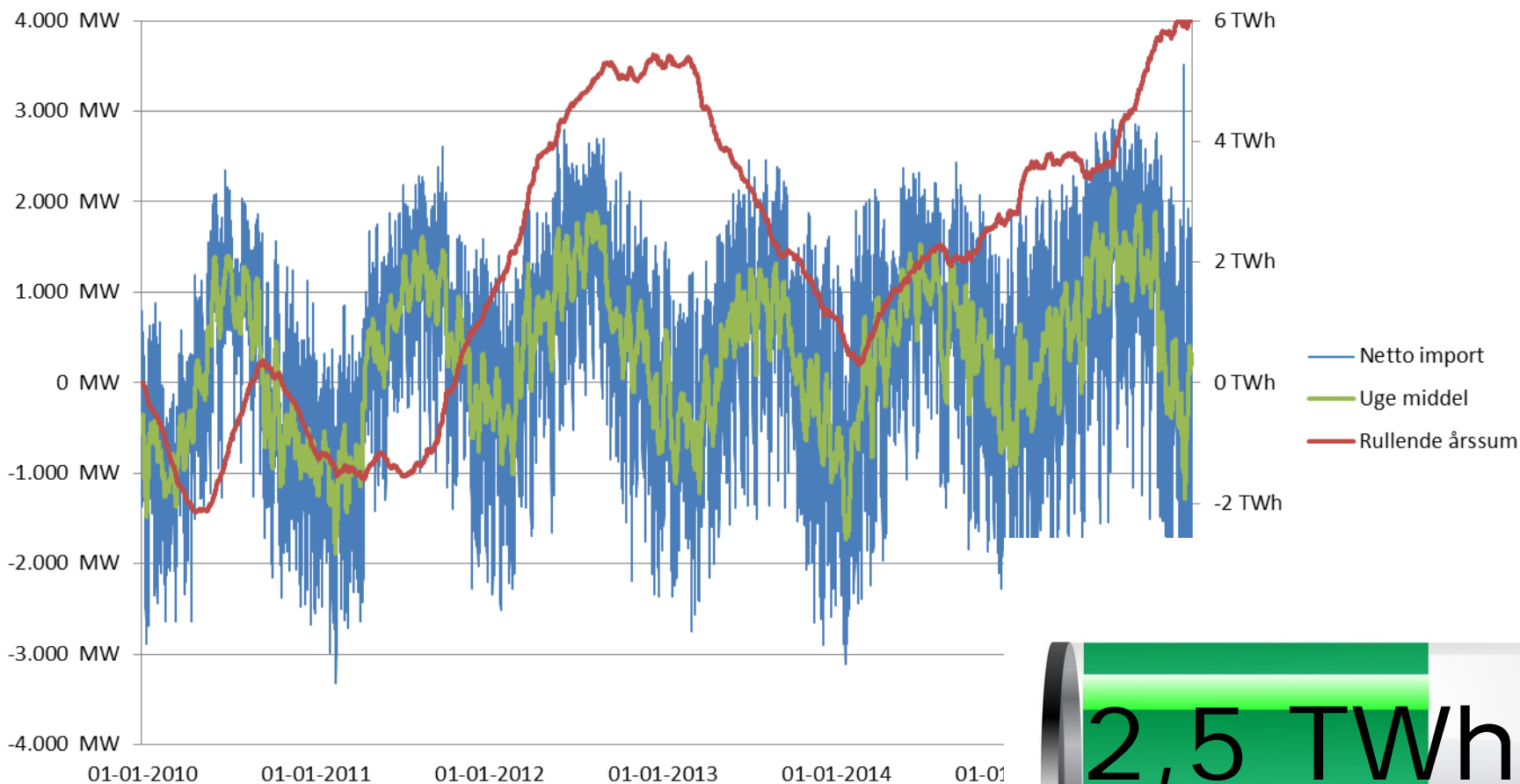
- The power system!



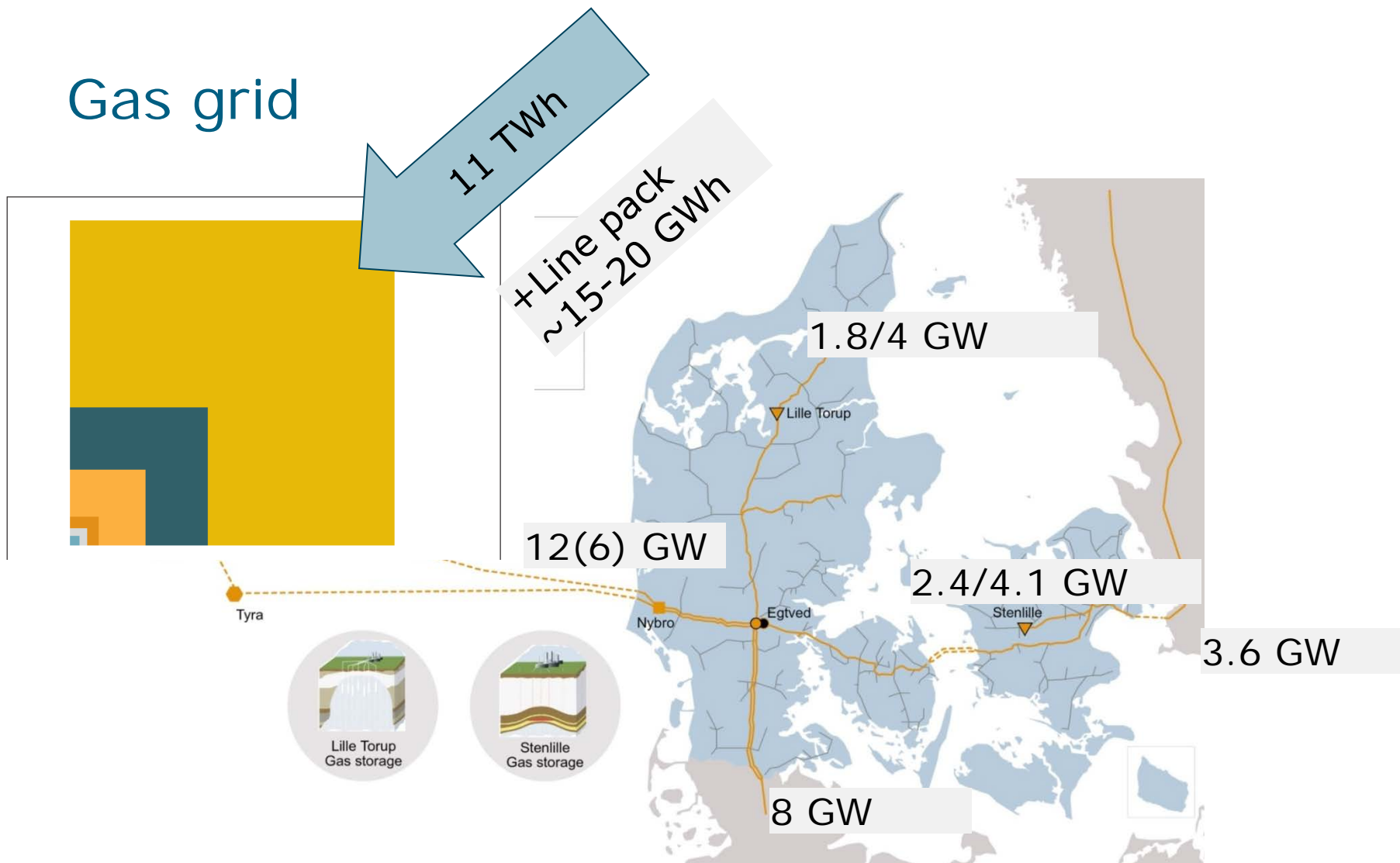
Electricity grid



This is where we are today



Gas grid



Biogas i naturgasnettet

Eksisterende og planlagte projekter – opgjort per april 2015

HMN

NATURGAS

DANMARKS STØRSTE
NATURGASSELSKAB

Bio Methane:
179 mio. Nm³ ~ 1,8 TWh

In gas system area

CO₂ ~ 100 mio. Nm³

HJØRRING: 6 MIO. M³/ÅR (JAN. 2014)
NETTILSLUTNING: HMN NATURGAS I/S

HJØRRING: CA. 2,2 MIO. M³/ÅR (AUG. 2014)
NETTILSLUTNING: HMN NATURGAS I/S

BRØNDERSLEV: CA. 6 MIO. M³/ÅR (DEC. 2014)
NETTILSLUTNING: HMN NATURGAS I/S

AALBORG: CA. 9,3 MIO. M³/ÅR (MEDIO 2015)
NETTILSLUTNING: HMN NATURGAS I/S

SKIVE: CA. 4 MIO. M³/ÅR (NOV. 2015)
NETTILSLUTNING: HMN NATURGAS I/S

SKIVE: CA. 4 MIO. M³/ÅR (OKT. 2014)
NETTILSLUTNING: HMN NATURGAS I/S

HORSSENS: CA. 7 MIO. M³/ÅR (JUL. 2014)
NETTILSLUTNING: DONG ENERGY

TARM: CA. 6,7 MIO. M³/ÅR (MEDIO 2015)
NETTILSLUTNING: HMN NATURGAS I/S

FREDERICIA: CA. 3 MIO. M³/ÅR (AUG. 2011)
NETTILSLUTNING: DONG ENERGY

HOLSTED: CA. 12 MIO. M³/ÅR (ULTIMO 2015)
NETTILSLUTNING: DONG ENERGY

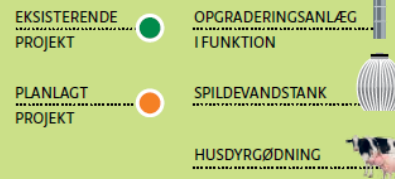
VEJEN: CA. 6 MIO. M³/ÅR (ULTIMO 2015)
NETTILSLUTNING: DONG ENERGY

TØNDER: CA. 35 MIO. M³/ÅR (PRIMO 2016)
NETTILSLUTNING: DONG ENERGY

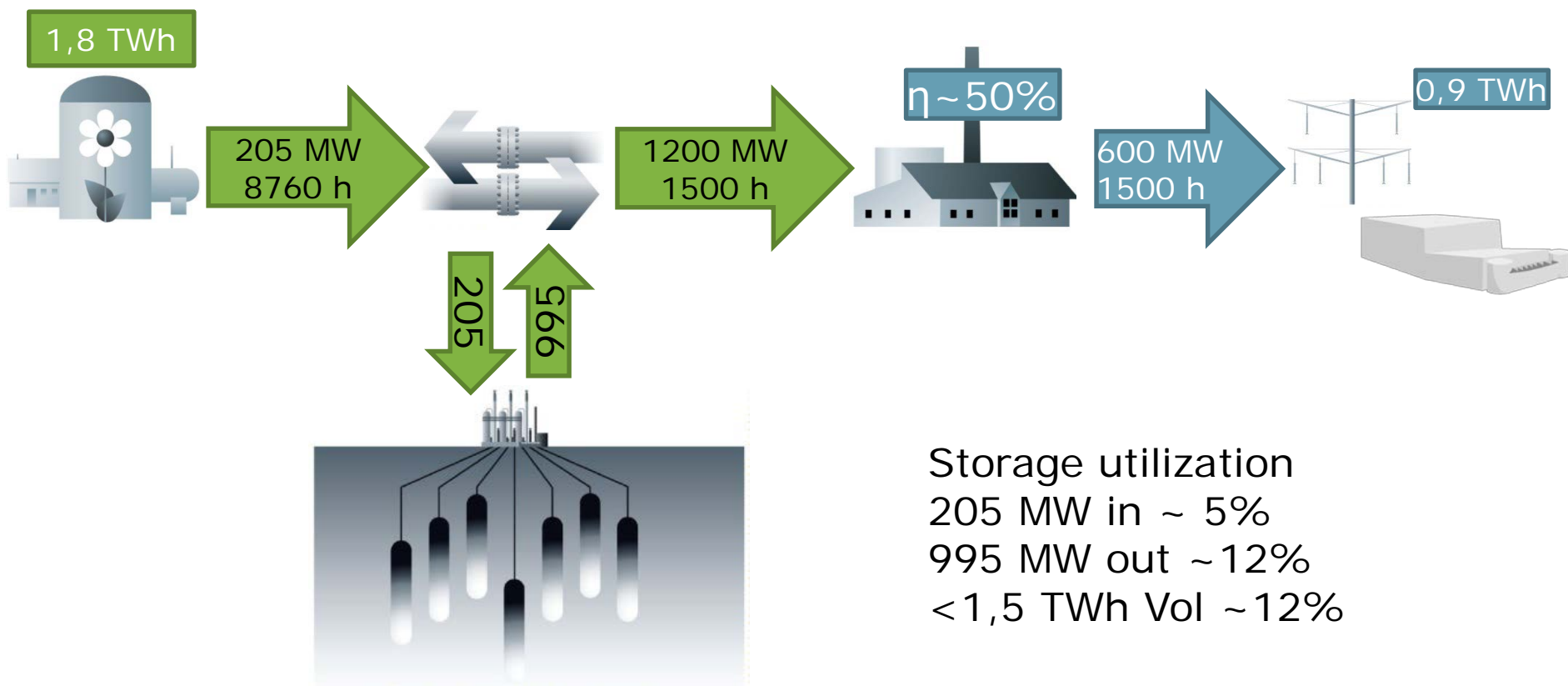
VOJENS: CA. 21 MIO. M³/ÅR (MEDIO 2016)
NETTILSLUTNING: ENERGINET.DK

AABENRAA: CA. 35 MIO. M³/ÅR (MEDIO 2016)
NETTILSLUTNING: DONG ENERGY

OPGRADERET BIOGAS I NATURGASNETTET
TILSPUNKT ANSLÆTS SAMLET MÆNGDE PER ÅR
ULTIMO 2015 CA. 76 MIO. KUBIKMETER
ULTIMO 2016 CA. 179 MIO. KUBIKMETER



Real Green Balance



Gas system vs. Battery

- 0,9 TWh = 900,000,000 kWh ~90,000,000 times:

Specs



Technology

Wall mounted, rechargeable lithium ion battery with liquid thermal control.

Models

10 kWh \$3,500

For backup applications

7 kWh \$3,000

For daily cycle applications

Warranty

Ten year warranty with an optional ten year extension.

Efficiency

92% round-trip DC efficiency

Power

2.0 kW continuous, 3.3 kW peak

Voltage

350 – 450 volts

Current

5 amp nominal, 8.5 amp peak output

Compatibility

Single phase and three phase utility grid compatible.

Operating Temperature

-4°F to 110°F / -20°C to 43°C

Enclosure

Rated for indoor and outdoor installation.

Installation

Requires installation by a trained electrician. AC-DC inverter not included.

Weight

220 lbs / 100 kg

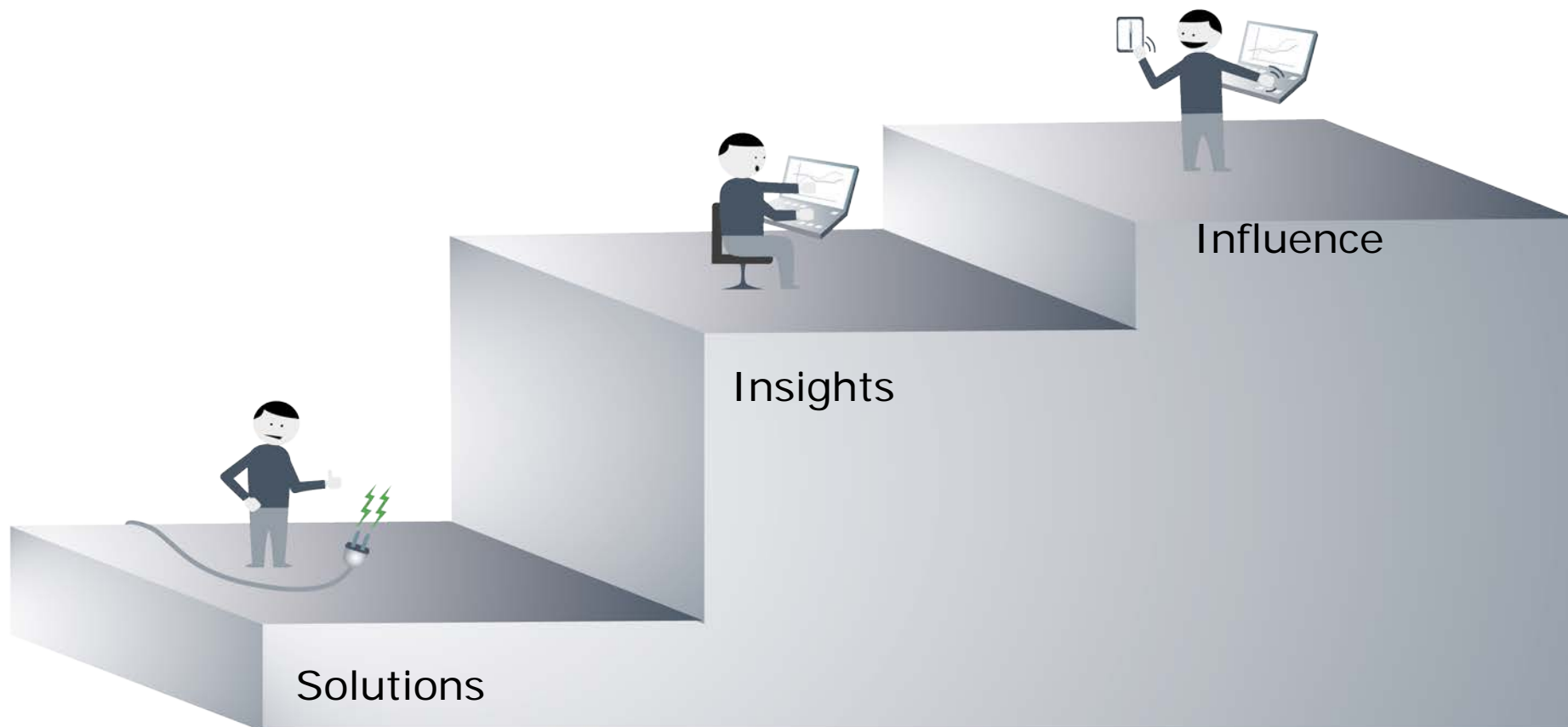
Dimensions

52.1" x 33.9" x 7.1"
130 cm x 86 cm x 18 cm

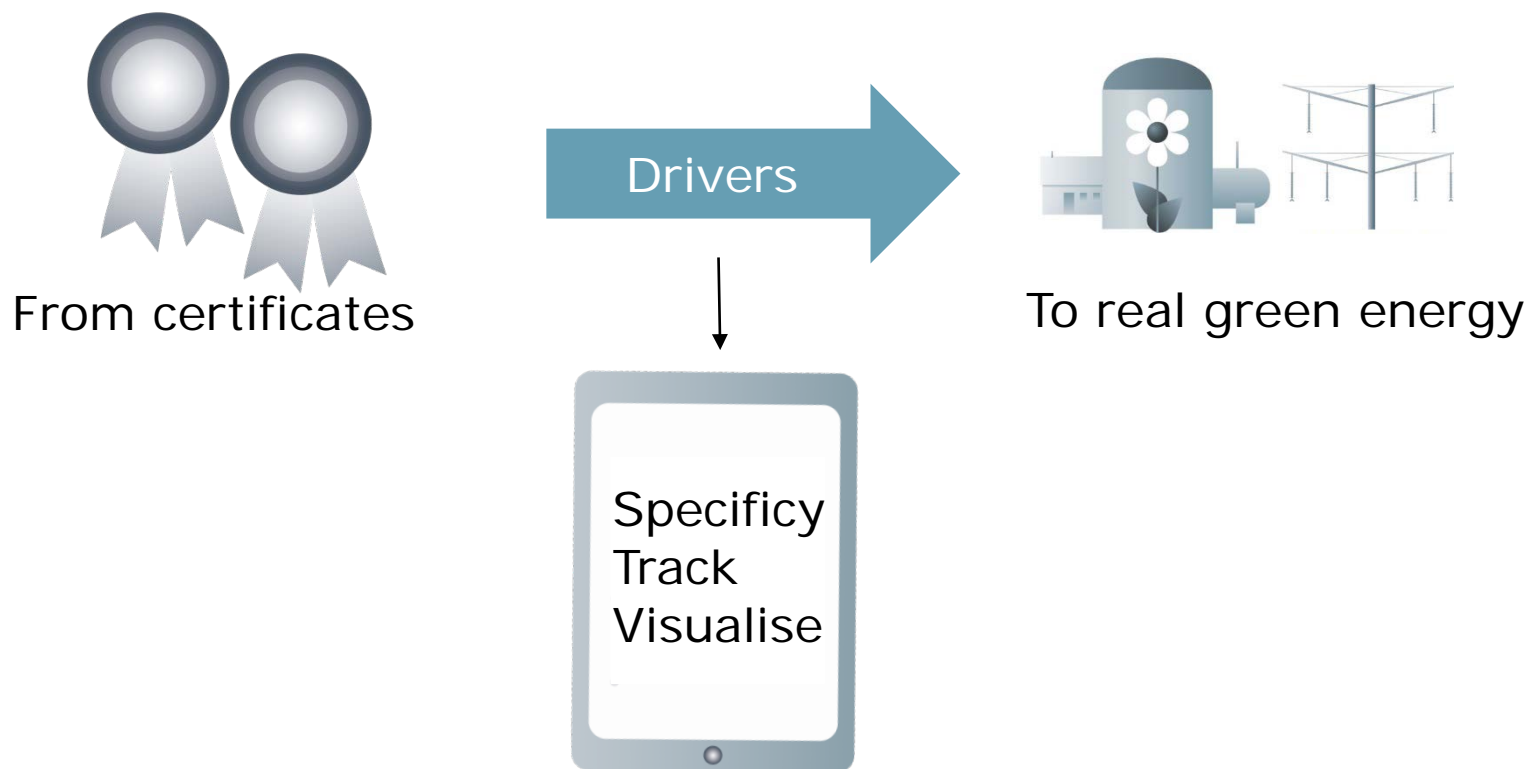
Certifications

UL listed

Added value



Value upgrade – IT as vehicle



Real Green Energy

Real green energy app



Prototype

User tests:

- 1) What's important for you today?
- 2) What will be important for you tomorrow?

New prototype

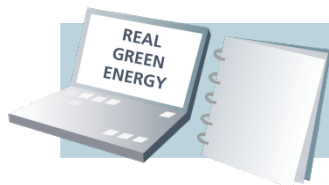
Research energy dashboards



Research devices for municipalities, companies and end users

Design

Communication and marketing

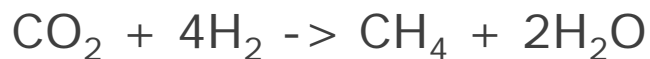


Development

Power2Gas



Power2Gas on top of bio gas



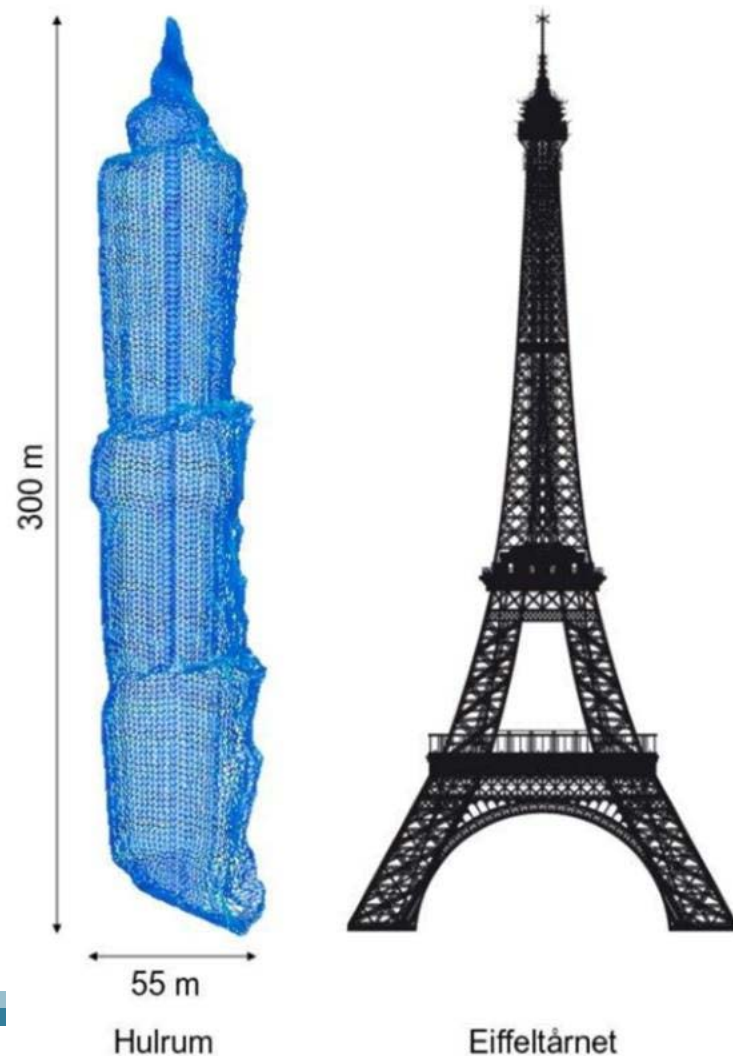
CO₂ from biogas + Hydrogen from electrolysis

100 MNm³ CO₂ + 400 MNm³ Hydrogen
=> 100 MNm³ Methane

Renewable methane boost of 50%.

Electrolyzer: 350-400 MW ~1,5 TWh
power

Storage: One cavern of 500,000 m³



Thank you

Energinet.dk Gas Storage

*Hans-Åge Nielsen hni@energinet.dk
gaslager.energinet.dk*

