

DC Second grid

By Harry Stokman

CurrentCS

Current/OS foundation

- Non-profit, open, independent foundation for the promotion and adoption of Current OS protocol.
 - Creating awareness of Current OS
 - Promoting the adoption of Current OS.
 - Enabling faster adoption of DC systems, maximizing users and installers benefits.
 - Integrating to the IEC.

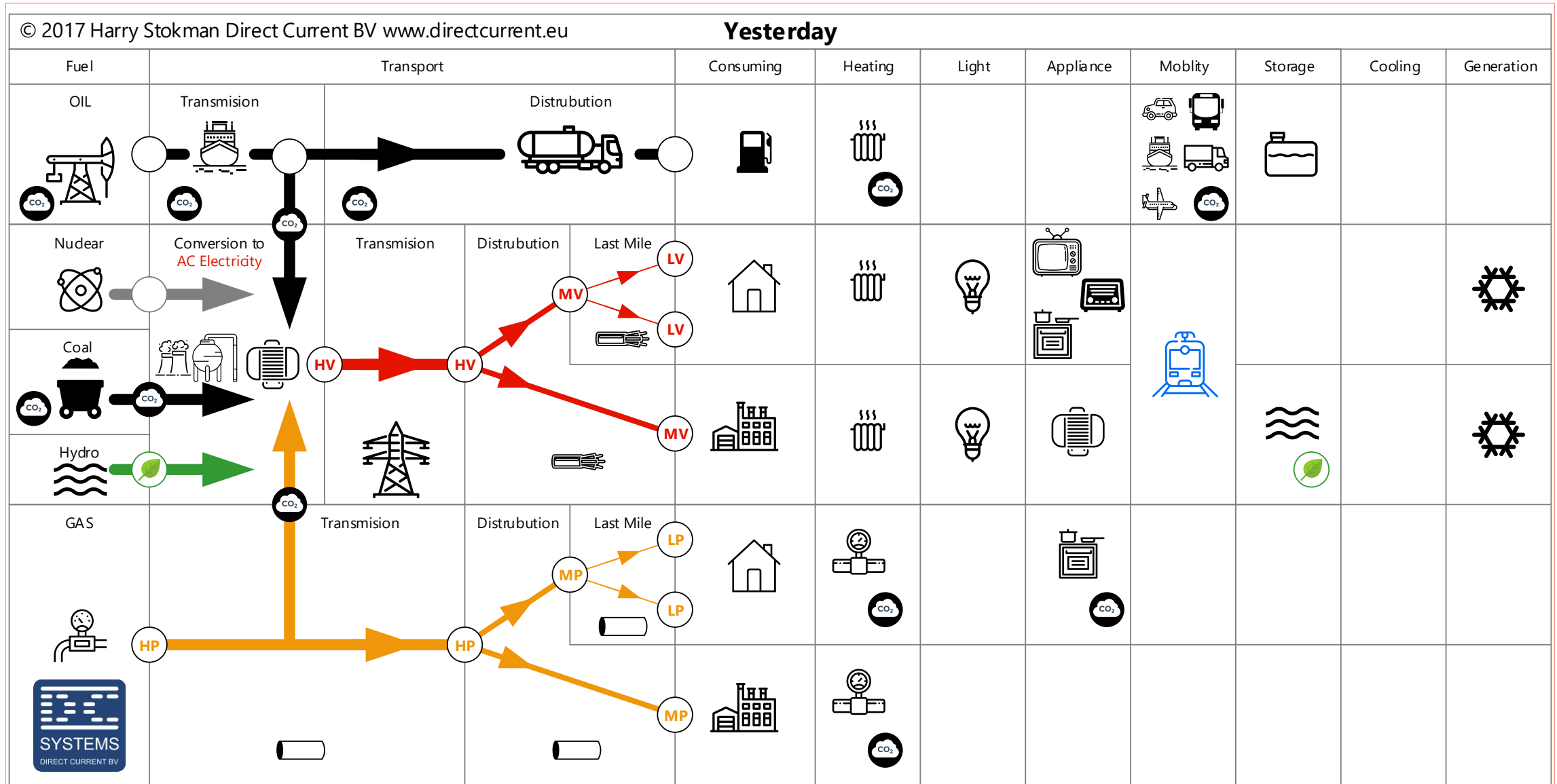
○ Founded by:  



- Encouraging other companies to join to:
 - aim at the best customer experience
 - leverage technology and market knowledge of members
 - enrich/ensure scalability of the new DC standard



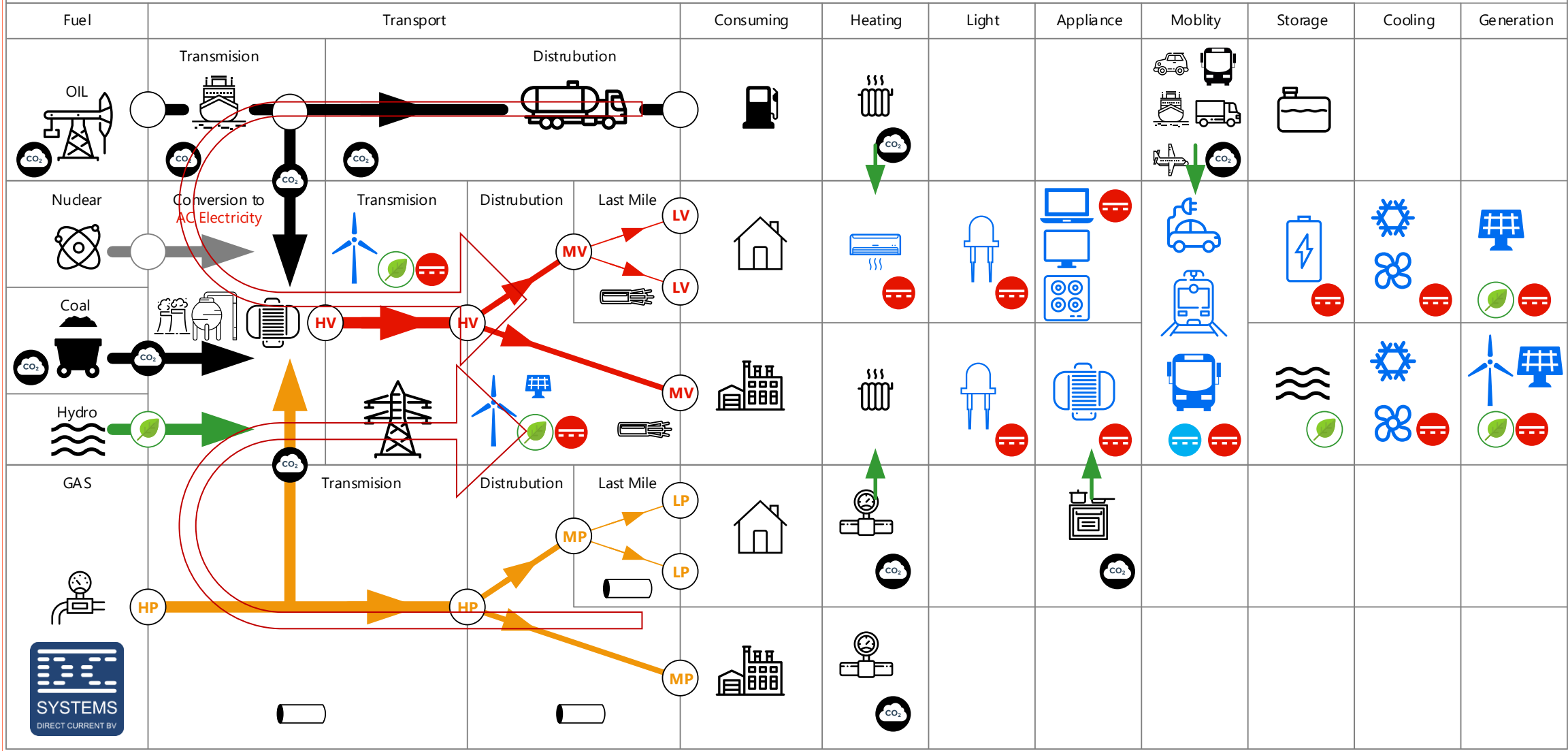
Initial design of the energy landscape



Issue

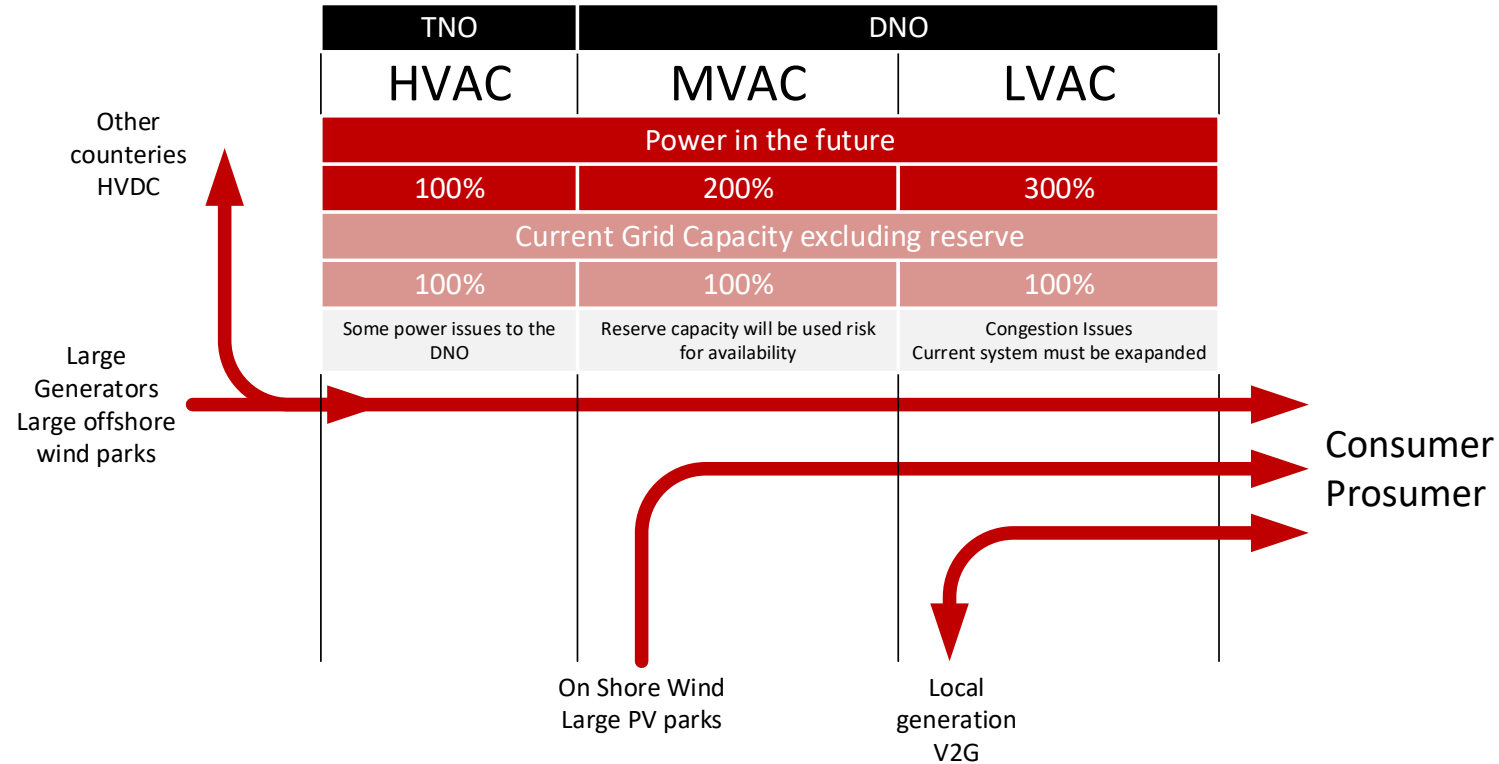
© 2017 Harry Stokman Direct Current BV www.directcurrent.eu

Today

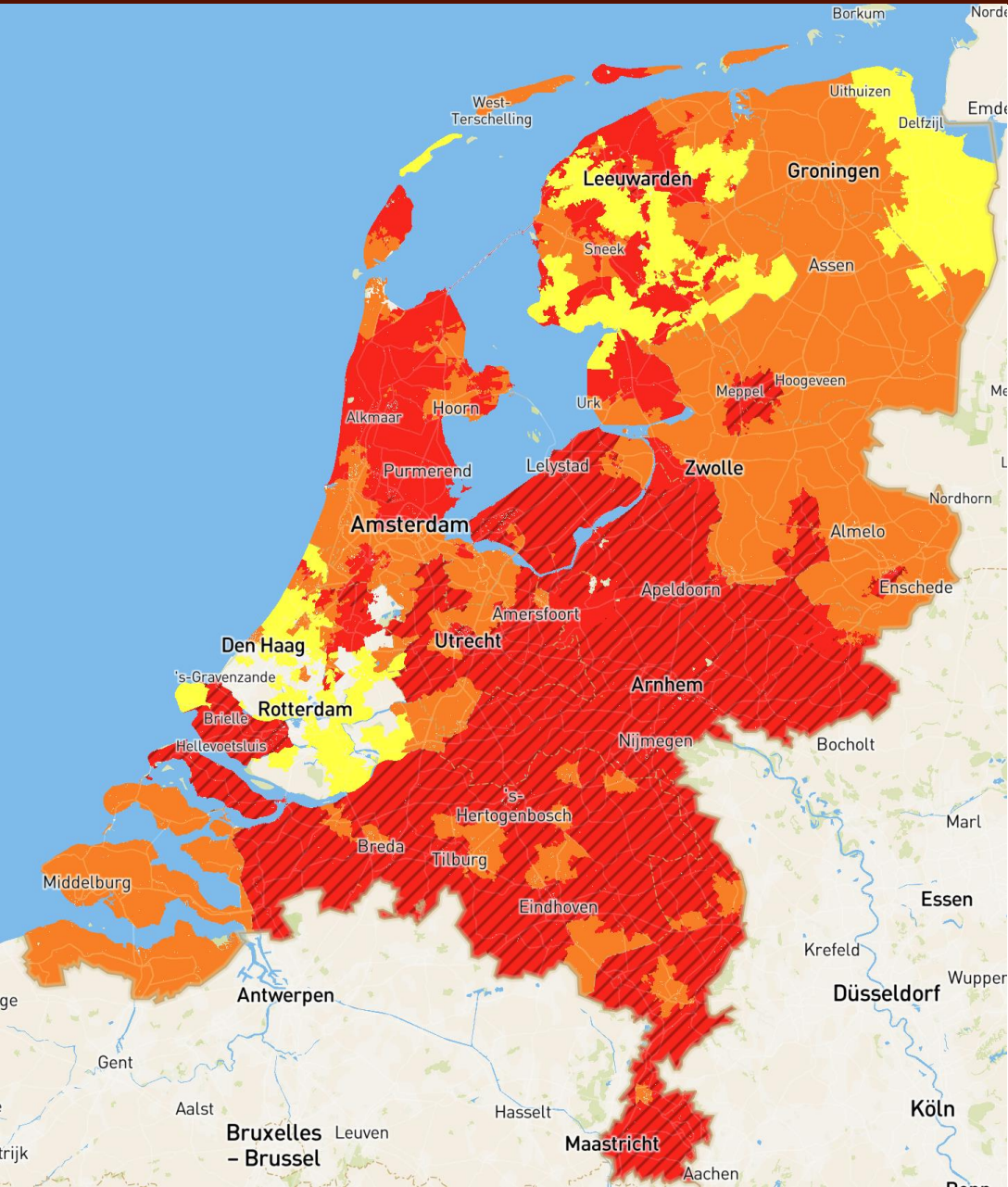


Effect for the existing system due move to all electrical.

- Last mile bidirectional
- Earthing system
- Common mode EMC
- Overload of cables
- Island mode
- How to deal with ICT before the meter
- Inertia not predicable
- Fast increase of electronic devices



Current Issue a how the Second grid can help



- 6.000 companies on the waiting list. For a consumption 2.200 of them asking for a new connection
- 8.000 companies on the waiting list. For a new connection for generation.
- Waiting time more than 1.5 year
- List is growing ~90...150 companies per week
- New houses projects face the same. The plan in NL was to build 1.000.000 houses before 2030.

Social impact



Home charge ←



Public charge ←

- Split in the society
- Difference between home chargers and public chargers and with or without PV
- Issues and fighting for places, because lack of public charging space
- Huge cost differences between charging methods
- How lower the income the higher the driving cost

example of a car 200Wh/km battery 90kWh

- Home 0,045 euro / km < 18 euro full charge or lower with PV
- public 0,09 euro/km 40 euro full charge
- Highway 0,16 euro/km 72 euro full charge
- Based on prices 1-1-2022

Actual small POC private cost NL 2024

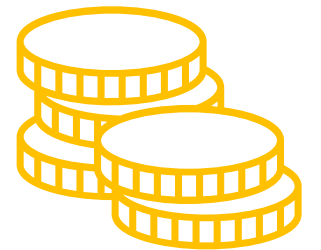
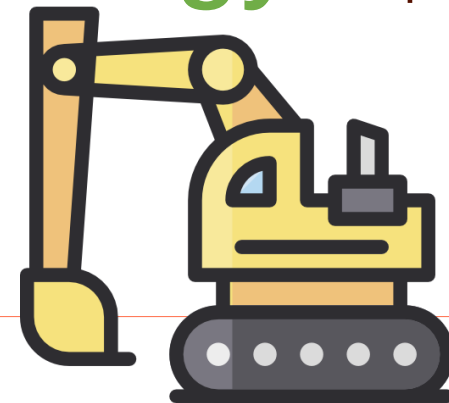
	Year 2024		Year 2023		
Capacity	Incl VAT/Year	Cost POC /Mnd	Incl VAT/Year		Rise
Single phase					
25A,40A	€ 400,92	€ 33,41	€ 346,386		16%
3 Phases					
25A	€ 400,92	€ 33,41	€ 346,386		16%
35A,40A	€ 1.731,67	€ 144,31	€ 1.459,0349		19%
50A	€ 2.555,39	€ 212,95	€ 2.148,0089		19%
63A	€ 3.386,95	€ 282,25	€ 2.843,7843		19%
80A	€ 4.210,67	€ 350,89	€ 3.532,7583		19%

For the energy transition on the current way houses have to upgrade to 40A connections, most houses has a 3x25A or 1x40A this means 1331 € per year rise, the coming years the cost will rise fast expected 10 .. 30% due grid expansion.

Economic impact of grid expansion

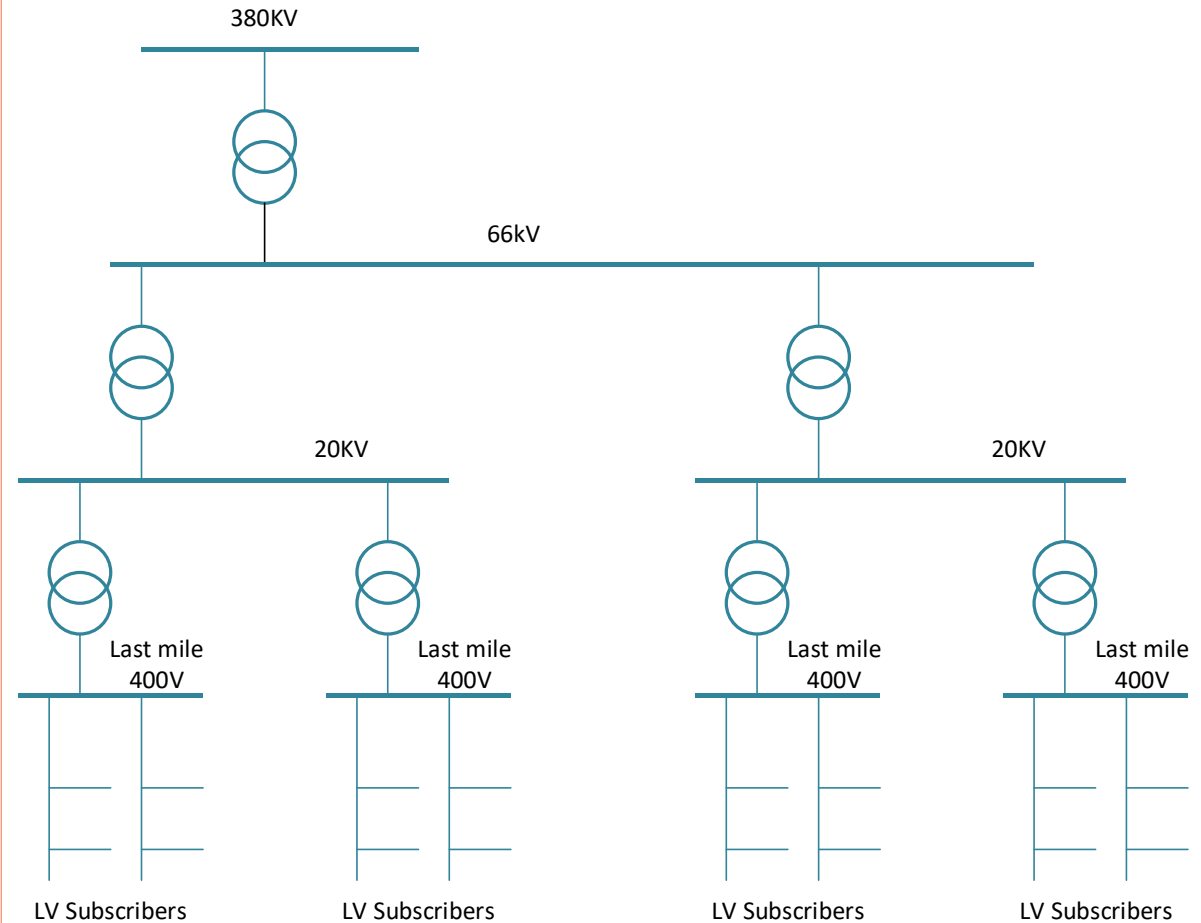


- Cities become **unavailable**
- Worldwide impact on **raw materials**
- Huge money invested in low economic value **digging**.
- Missed opportunity to invest in **technology** to prevent this.

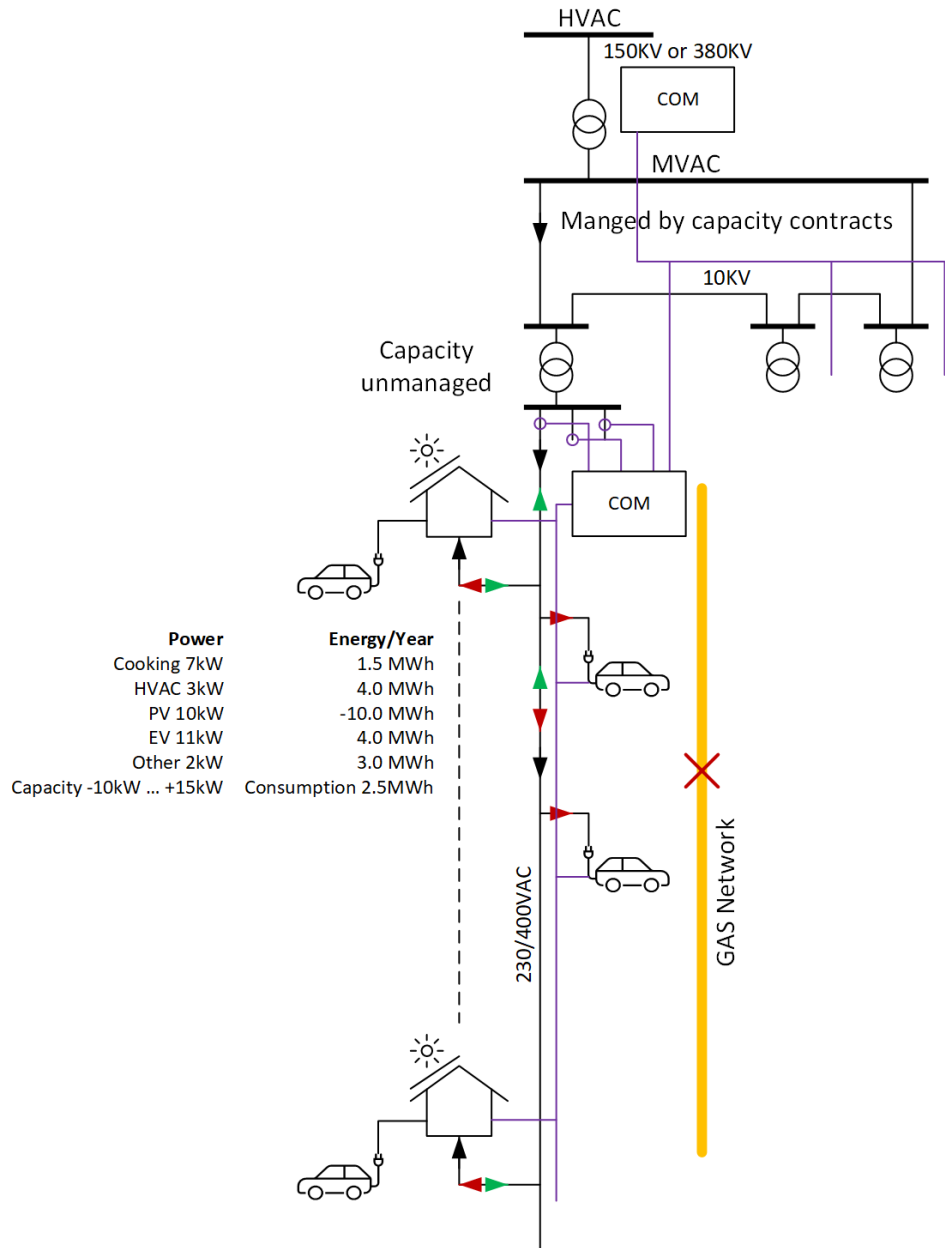


Expansion solution (and issues)

- Upgrading 400V 400kVA -> 1600kVA
- Upgrading 10kV -> 20kV
 - Add more MVAC/LVAC transformers (Very limited)
 - Replace the 10kV by a 20kV MV distribution and replace all transformers (huge impact)
 - Increase transmission station capacity (Time consumer and limited space available)
 - Add more transmission capacity (high resistance from society process time >30 years)
- Upgrading 50kV -> 66kV



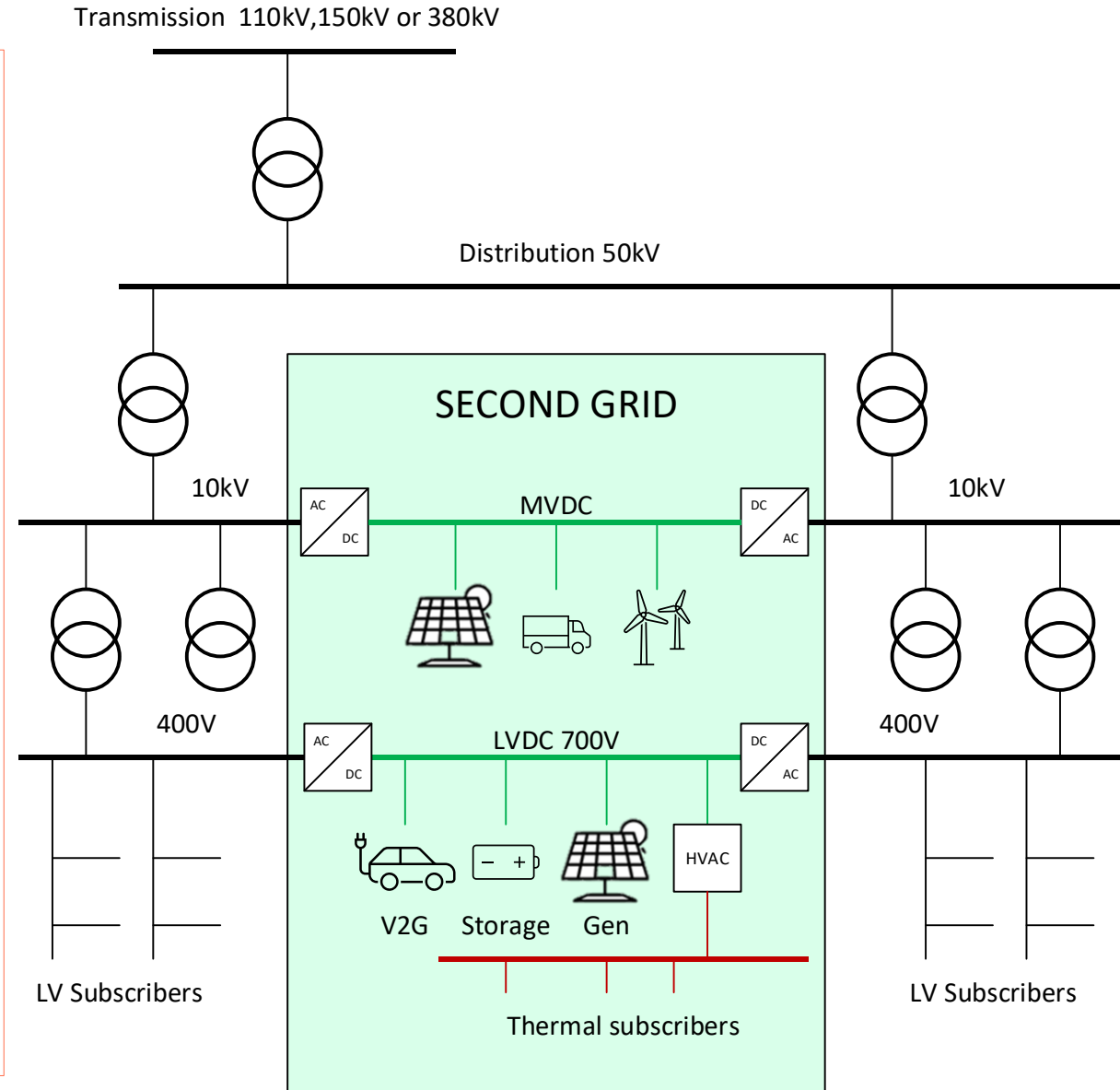
Digitalisation solution



- System initial is designed to be simple and robust
- Add more vulnerable failure points
- Risk of unwanted tripping of breakers
- Risk of overloaded cables
- Cyber security issues
- Needs new regulation to protect the private information
- More expensive to manage (just think about firmware updated,
- Advisable to build a new communication network outside the existing internet
- Discrimination of subscribers in congested area's

Best solution (a little bit biased 😊)

- Keep the existing system
 - And keep the existing use
 - The new loads and sources are pushed to the second grid
- MV DC for large systems
 - Connect large scale PV and wind and combine this with megawatt chargers as new loads in the system
- LV DC for socialized new energy landscape
 - Make it fair by socializing the PV generate and V2G in the last mile between apartments and other buildings and subscribers



Advantage of the second grid

- The existing system get more a storage function, charged by the base generation.
- With other words the AC system becomes an energy system, and the DC system becomes the power system.
- This will remove the volatility on the energy market with as result that renewables directly reduce the CO₂
- Negative prices events are dramatical reduced.
- Estimated cost of the second grid is ~20% of the cost of expansion
- It enables a compatibility of prosumers in different geographies like V2x use
- It link different use-cases

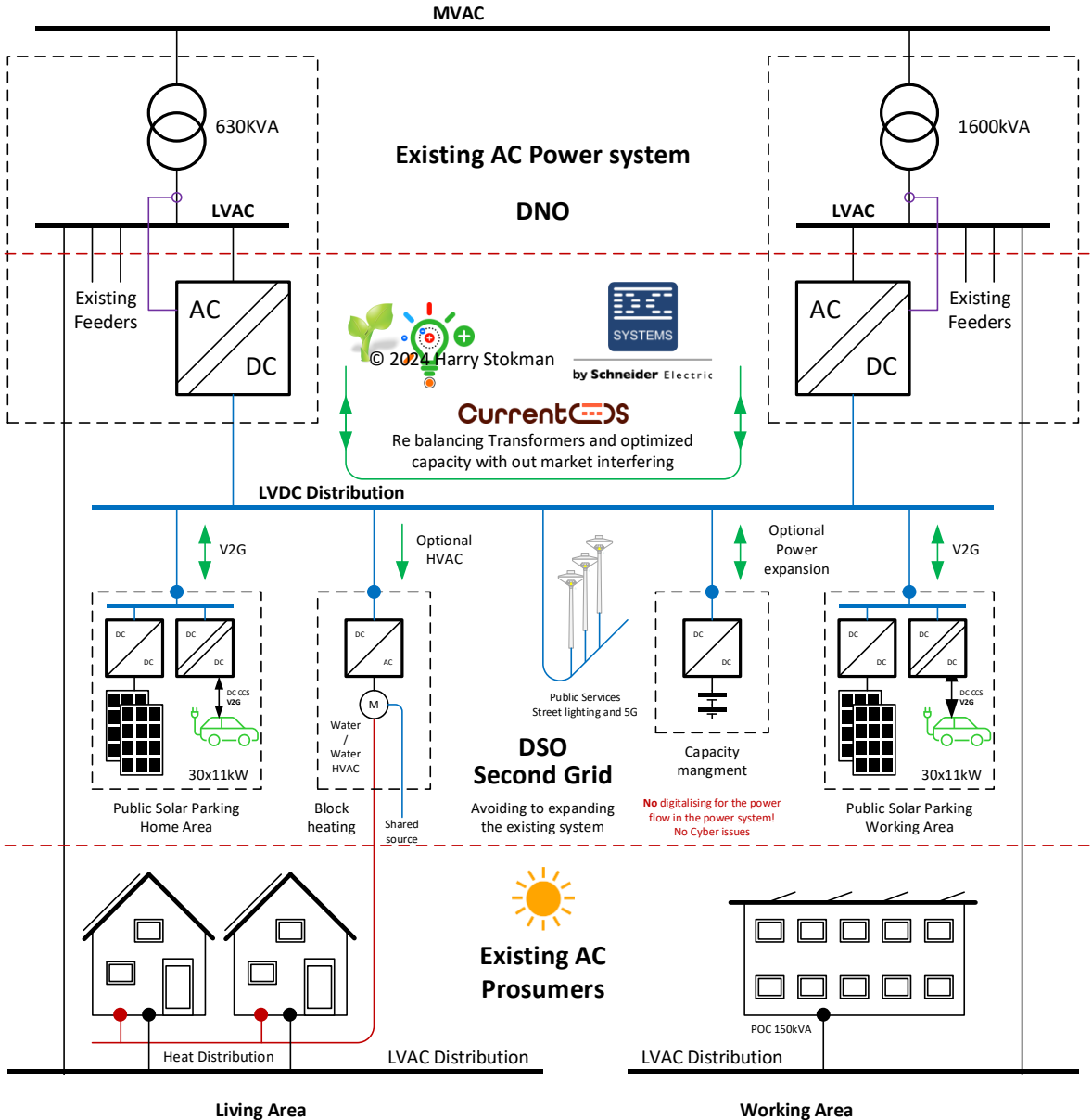
System **advantage** for the grid operator

- 20% cost compared of expansion LV and MV part
- No impact to subscribers during installation
 - Limited area to expand
- Limited area to install
- 2x more capacity in the existing LVAC cable without impact on the MV part. In feeding on the other end of the cable (enables electrical cooking)
- Physical energy hubs not managed by administration functions
- Enable the role for a DSO
 - DNO's are responsible for the PQ and capacity this is strong regulated and the don't have a matchmaker possibility to avoid differences in the regions of supply
 - That's why the DSO does not exist in the AC system today
 - A DC microgrid needs a operator enables the possibility to create the DSO
 - The DSO can in this case manage the PQ
 - Optimize the capacity, by temporary increase the power
 - Expand the lifetime of existing investments in the AC system
 - Easy V2x implementation (this is a huge technical problem in AC)

Technical services of the DC Second grid

- Integration HVAC for block heating
- Socialized PV generation
- Enabling V2x
- Streetlights Linked with 5G and sensors for smart cities
- Temporary power delivery to add supporting point to existing AC cables
- Technical possible to run AC temporally island to fix issues at MV
- Integration of local storage
 - Avoid home storage
 - More fair
 - Less overall storage needed
 - Storage can provide by different stakeholders
- Power Quality management
 - Line unbalance
 - Voltage
 - Harmonics
 - Reactive power

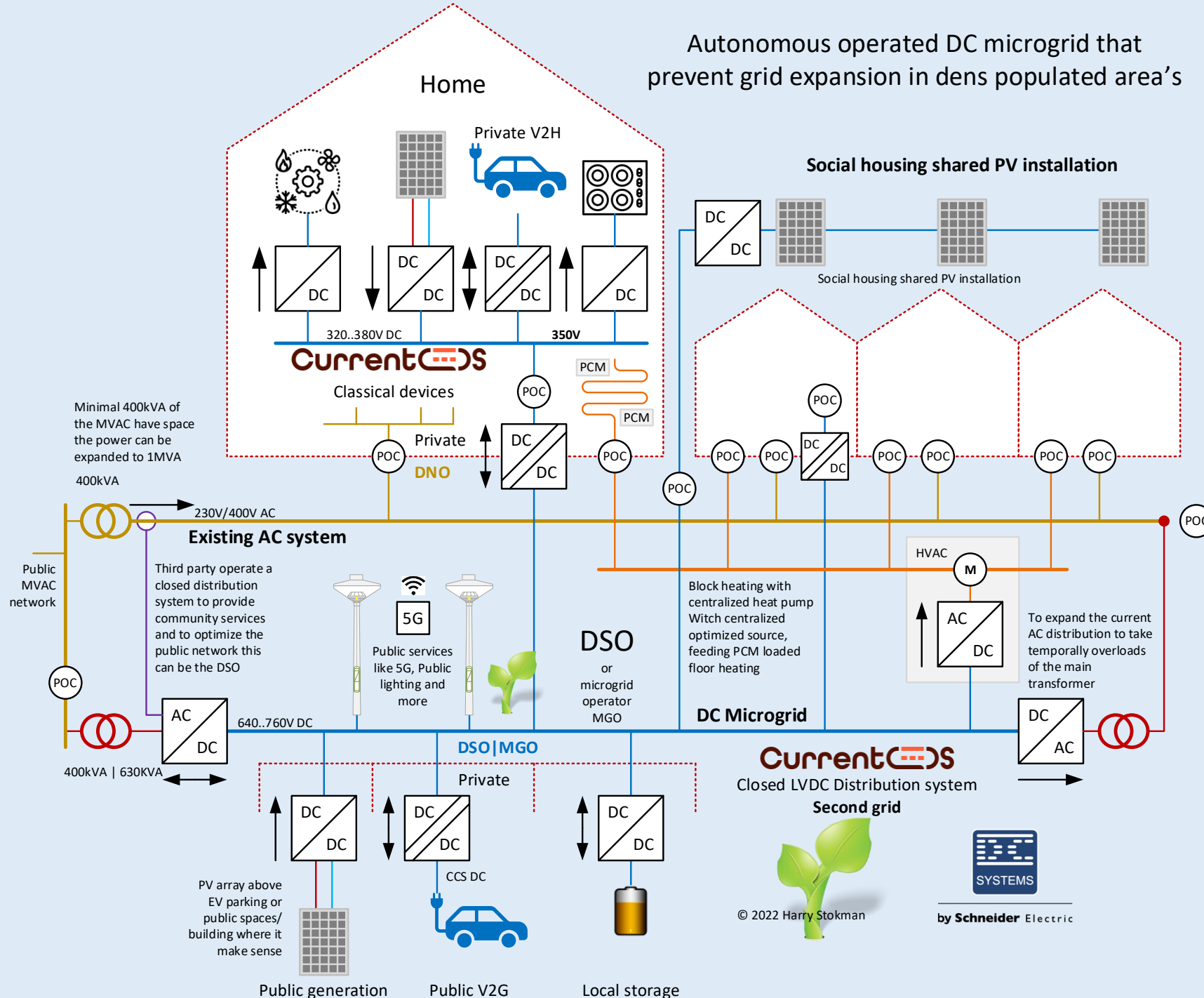
Example for the LV DC Second grid



- For MV it's the same principle
- Balancing stations with anticyclic use
- Showing the follow socialised function:
 - Heat pumps for block heating
 - V2G support power energy balance in the DC cell
 - Optional storage for power balancing to increase comfort
 - Connect Public PV
 - Optional prive PV connection
- Create a role for the DSO to support the DNO

Hybrid Homes

Autonomous operated DC microgrid that prevent grid expansion in dens populated area's

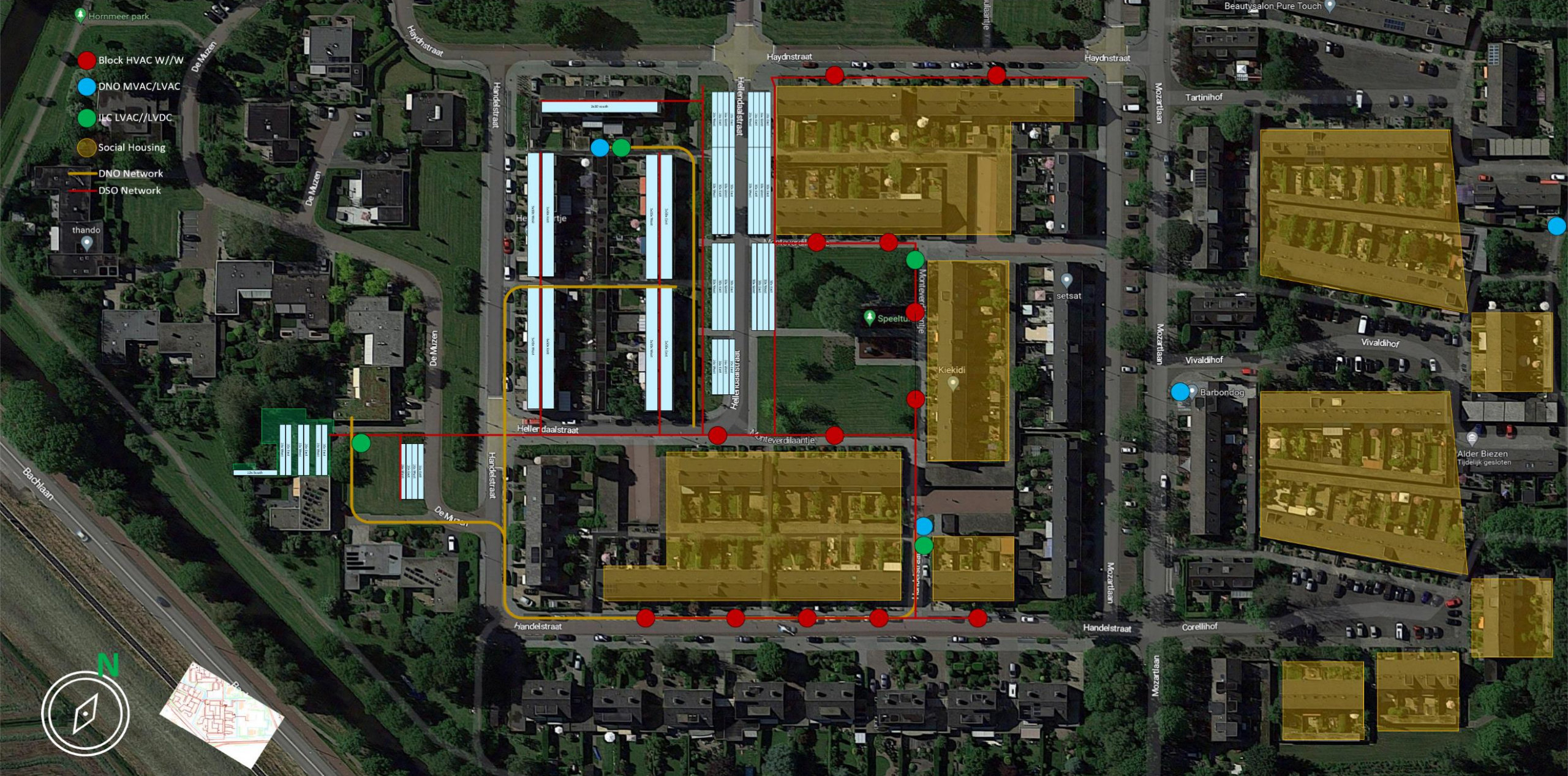


- Future proof design enabling V2x
- Create a local hybrid system
- Opens the door to DC POC for subscribers
- Create new market possibilities
- Speedup the energy transition



Village concept linked to DC Muzen

by Schneider Electric



Advantages for neighbourhood (social domain)

- Solve many negative aspects created by the energy transition for ordinary people
 - Differences between homes and orientation
 - Energy labelling for houses and value of the property
 - Effect shades by building or trees make differences for the users
 - Differences in cost-of-living due unequal access to generation
 - Differences is between EV charging (prices based on 200Wh/km)
 - Home (can be almost free when PV installed) or have special contracts (€ 0···€4/100km)
 - Public slow charging (not always access due lack of chargers) prices different per region (€8···€14/100km)
 - If car owners cannot charge local, they need to go to fast chargers (€14···€25/100km)
- Bring back social engagement by common energy system
- Shared PV installation and EV charging.
- Block heating by HVAC in existing gas heated buildings
- Can be become a capacity tariff no differences between people how and where the life
- Most efficient way to upgrade existing buildings to become energy efficient in most fair way.
- Municipalities don't 'need to invest directly into families but invest in the public domain.

I ♥ CurrentOS

**DC is the
Last Chance for a
compatible system**

**Current Operated System
Open organisation**



DC and Current/OS makes it make it happen.
This is a key element to make the energy transition successful.

WWW.CURRENTOS.FOUNDATION