Iron-air battery
Electricity from rust

Possibility for autarky and summer/ winter balancing

Project aims

A new type of iron-air battery is being developed as part of the project. It will have an energy density of 250 Wh/kg, an efficiency of at least 60 percent and be capable of 500 full charge/discharge cycles. To achieve this, the researchers are realizing the battery as a stack with bipolar plates. In addition, a novel galvanic manufacturing process for the iron electrode is intended to achieve a significantly higher specific capacity of the iron-air battery and thus a higher energy density.

CO_2 reduction through the use of batteries?

In addition to the actual battery development, another focus of the UMSICHT scientists is the question of how much greenhouse gas minimization can be achieved by using iron-air batteries. They are looking at the use of the storage to increase the degree of self-sufficiency of photovoltaic systems.

Benefits

A characteristic feature of electricity generation from renewable sources such as wind or sun is its fluctuation. In order to compensate for these fluctuations and to ensure a stable energy supply, new cost-effective storage technologies are needed that store electrical energy in the gigawatt range and feed it back into the grid. One possibility is stationary battery storage systems that are easy to handle. In addition, they provide sufficient resources for large-scale use.

High development potential of iron-air batteries

This is where iron-air batteries come in. They offer a high development potential, since both iron and potassium - the basis for the alkaline electrolytes - are present in bulk quantities. At the same time, the iron electrodes are very robust and can survive more than 10,000 charge/discharge cycles. This corresponds to a service life of about 30 years. In addition, iron-air batteries are insensitive to overcharging, partial and deep discharge.


Off-Grid

600 kWh per month for household, hot water and electric cars additional demand for space heating and cooling:

General monthly consumption kWh	600												
Extra usage for heating and cooling	January	Feb.	March	April	May	June	July	August	Sept.	October	Nov.	Dec.	Total
Oslo	500	300	100							100	300	500	1,800
Berlin	400	200									200	400	1,200
Vienna	400	200				50	50				200	400	1,300
Rome	150	100			100	200	200	100			100	150	1,100
Athens	150	100			100	200	200	100			100	150	1,100
Tel Aviv	100	100	150	200	200	200	200	200	200	150	100	100	1,900
Cairo	50	100	150	200	250	250	250	250	200	150	100	50	2,000
Electricity balance	January	Feb.	March	April	May	June	July	August	Sept.	October	Nov.	Dec.	Total
Oslo	-989	-443	869	2,012	2,956	3,376	2,969	2,196	1,222	73	-697	-1,036	12,510
Berlin	-575	66	1,281	2,478	3,108	3,327	3,184	2,657	1,747	716	-254	-676	17,060
Vienna	-341	326	1,701	2,873	3,410	3,508	3,593	3,017	2,051	998	-23	-435	20,678
Rome	586	1,130	2,317	3,204	4,003	4,171	4,533	3,959	2,714	1,790	801	488	29,695
Athens	933	1,313	2,738	3,692	4,390	4,619	4,941	4,480	3,223	2,087	1,147	697	34,259
Tel Aviv	1,491	1,800	3,073	3,657	4,369	4,624	4,684	4,254	3,412	2,606	1,726	1,353	37,049
Cairo	2,099	2,313	3,557	4,024	4,578	4,723	4,799	4,410	3,679	2,995	2,154	1,906	41,237

Summer / winter compensation only required from Vienna to Oslo

~ 175 kWh electricity at 39 % ~ 700 kg with iron-air battery

Home > Gase kaufen > Schneid- und Schweißgase > Wasserstoff > Wasserstoff 3.0 LIPAC®duo

Wasserstoff 3.0 LIPAC®duo

12 x 50l mit 200 und 300 bar-Anschluss für mehr Flexibilität

Mehr Informationen ▼

Flascheninhalt: 12x50l [300 bar]

Menge: 1

Material-Nr. **31805253**

1.616,00 €

pro Bündel

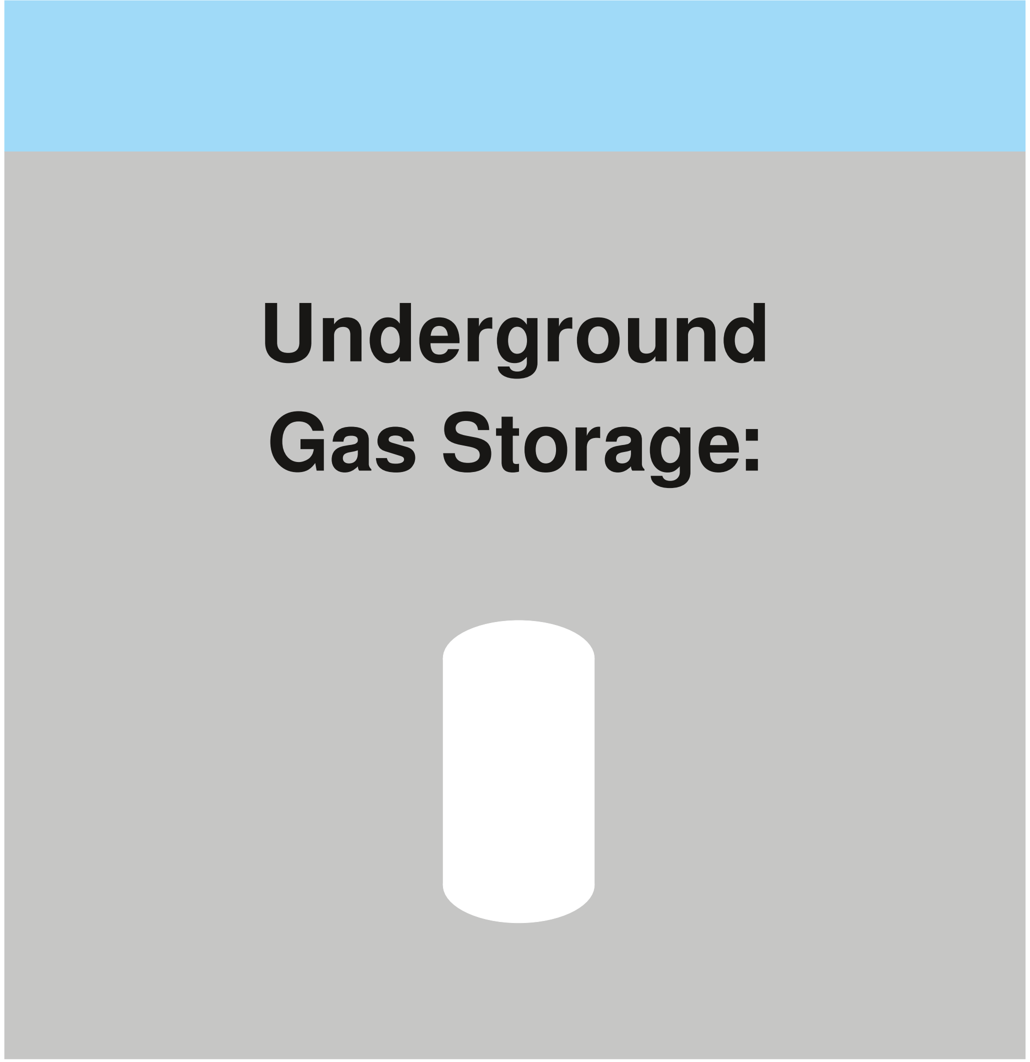
exkl. MwSt. / *Preis zzgl. Miete, Transportkosten und Zuschläge*

In den Warenkorb

LIPAC® duo

Rauminhalt, [Liter]	Füllmenge, ca. [m³]	Fülldruck, ca. [bar]	Anzahl Flaschen im Bündel	Gesamtgewicht, mit Füllung ca. [kg]	Maße ca. (H x L x B)[mm]
600	151	300	12	1460	1900 x 1000 x 770


Simulation with solar data from 2008:
900 TWh electricity demand
1400 GW Photovoltaics
4000 GWh Batteries
180 GW Power to methane
50 km³ methane storage
80 GW CCPP
VS

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CCPP - Combined Cycle Power Plant

< 1 € / m^3

1 m^3 methane = 9.97 kWh

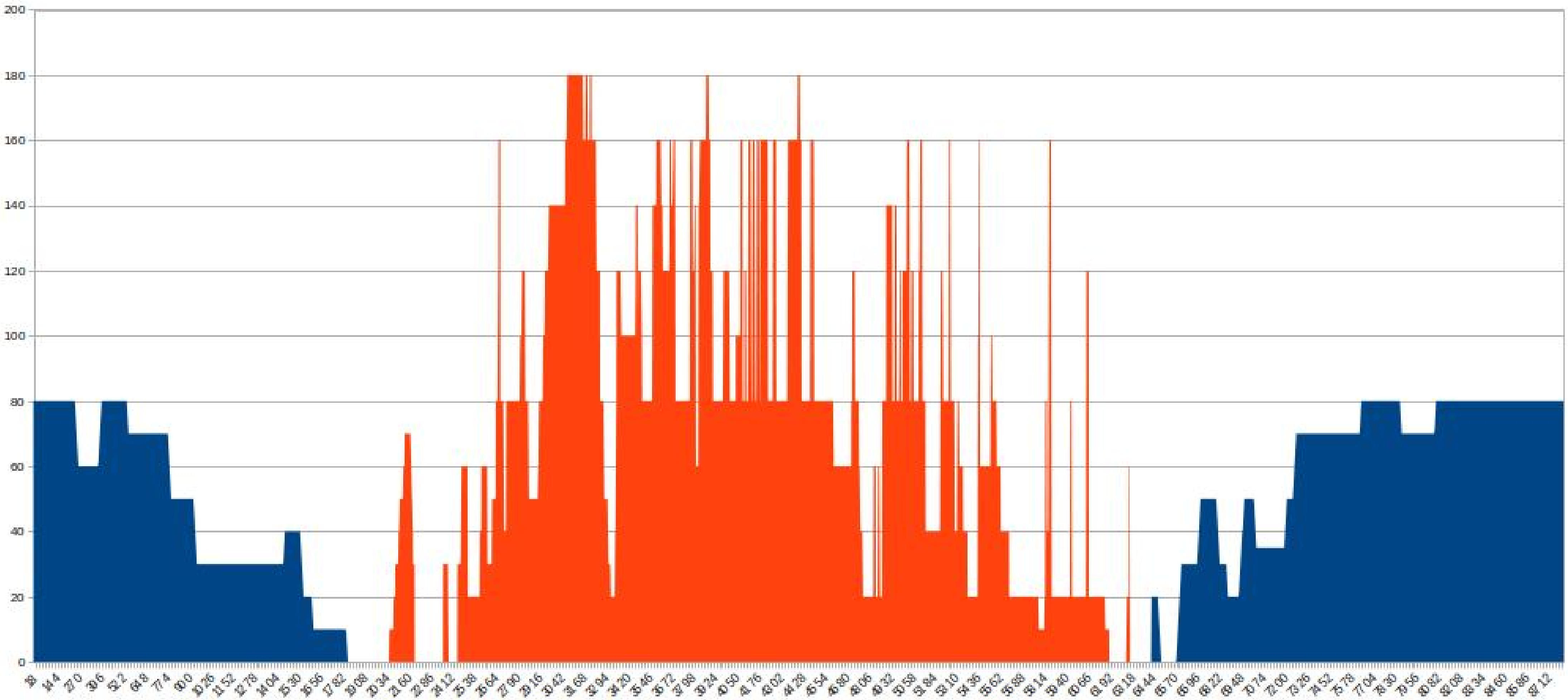
see study linked PDF

1.000 € / kW

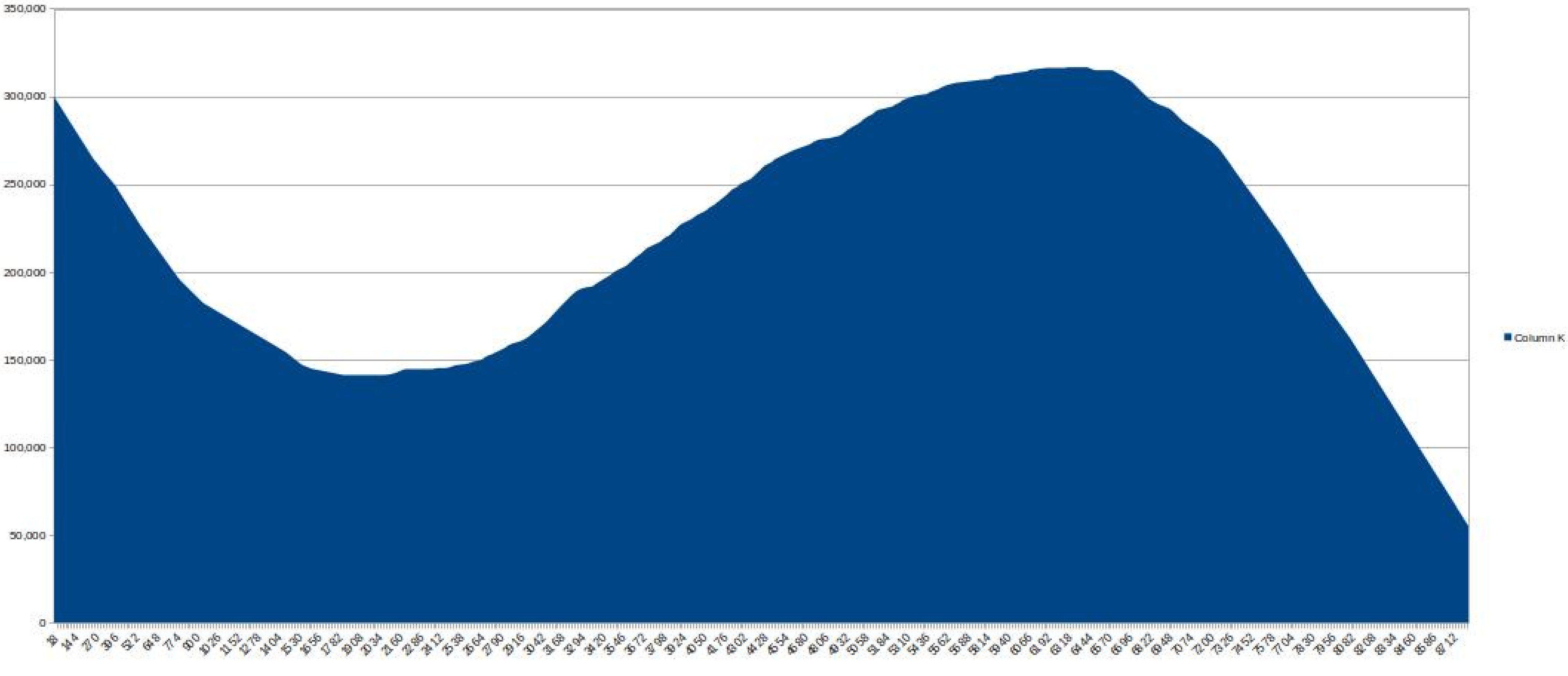
60 % efficiency

see study linked PDF

Use of CCGT power plants and power to gas are clearly separated in terms of time



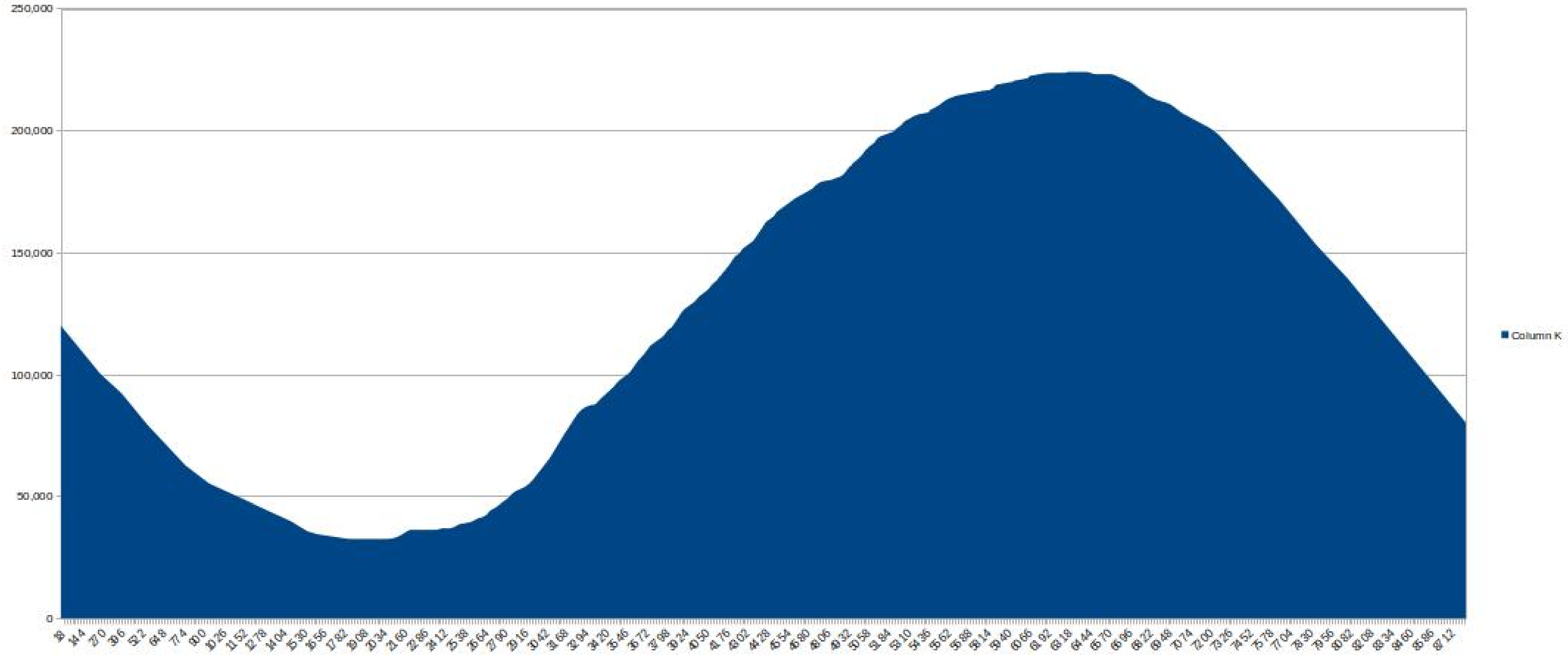
Methane storage would need to be supplemented by 245 TWh in the summer half-year.



Southern countries are pleased with the decrease in surpluses.

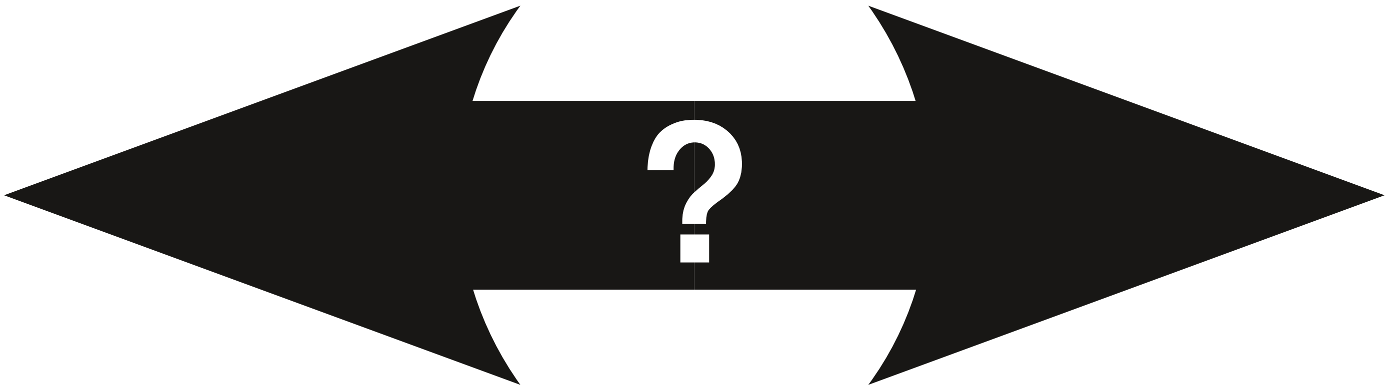
With the iron-air battery only 40 TWh of electricity are missing

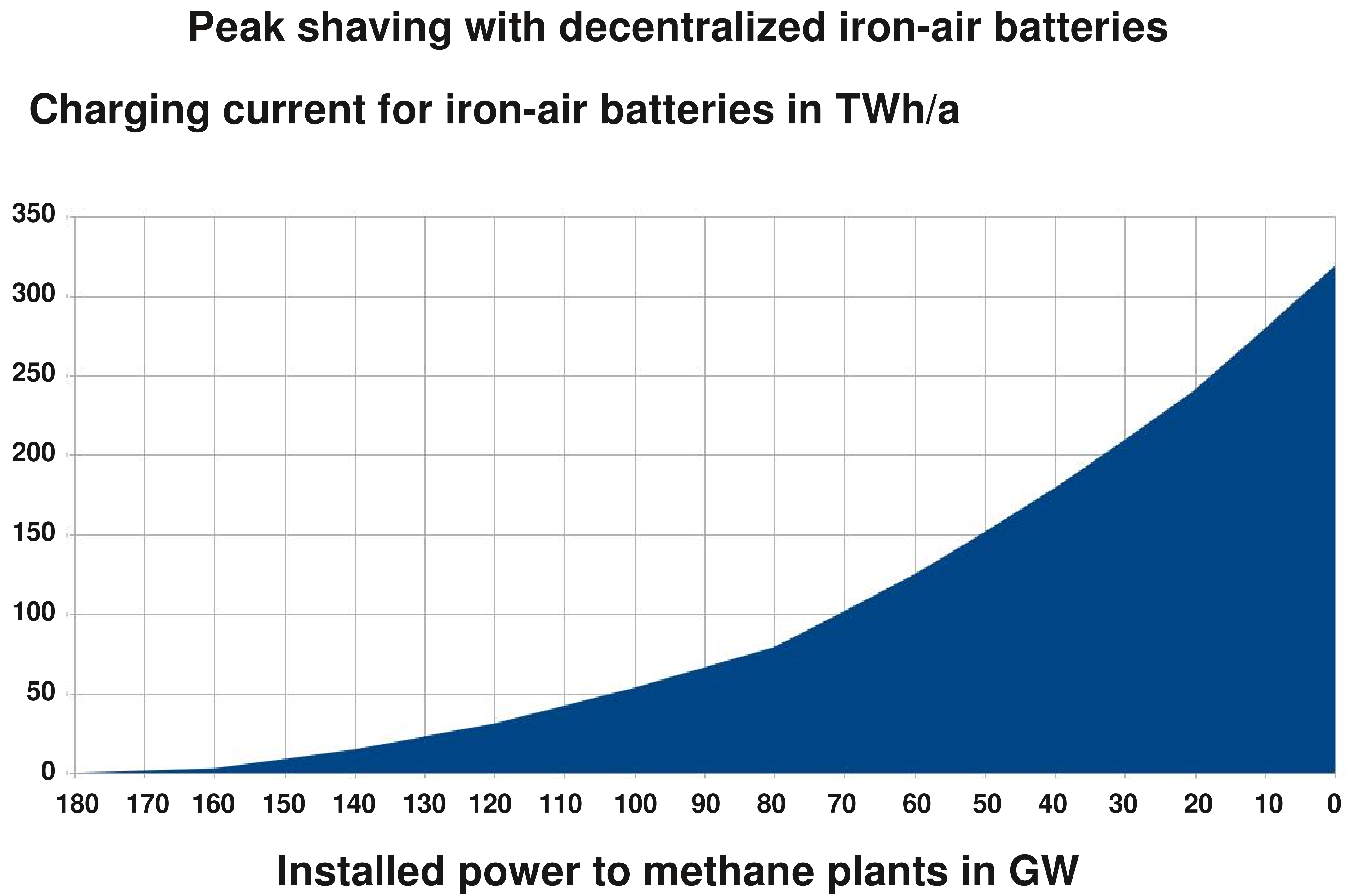
But even with only 8 € / kWh are
250 TWh 2,000,000,000,000 €

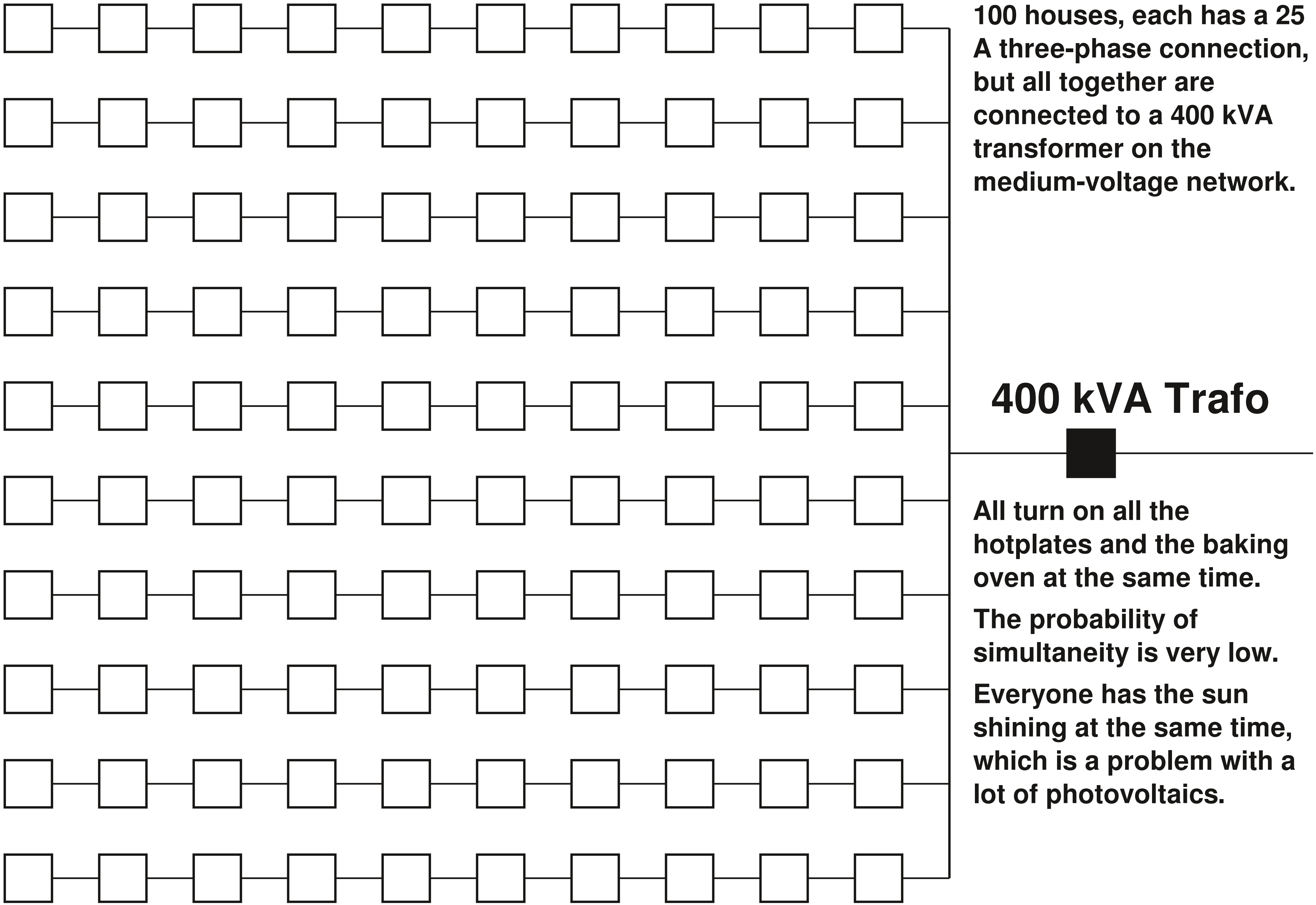


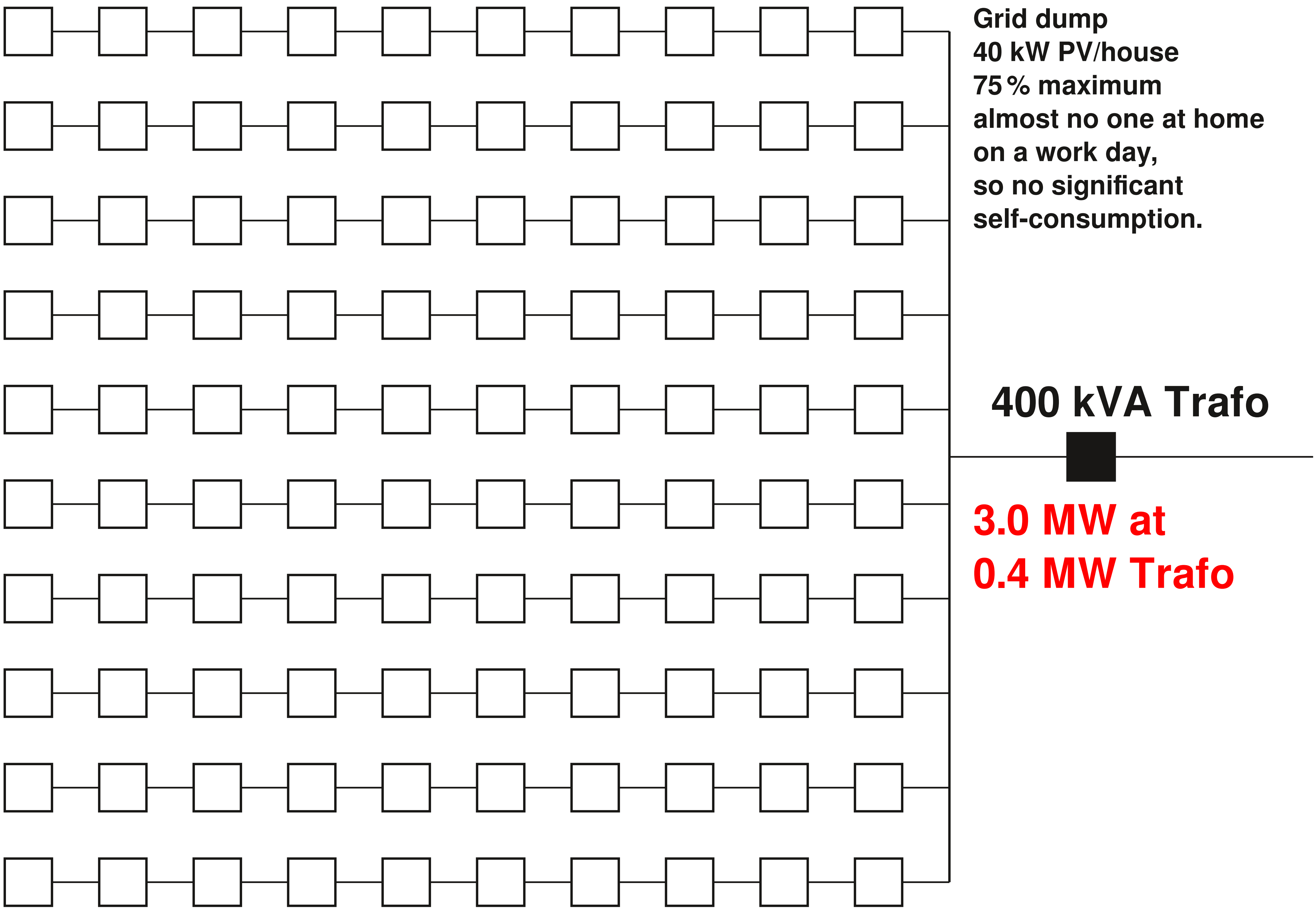
Where is the cost optimum in the mix?

Cost Optimum?	decentral iron-air	Central Power to CH4
Grid expansion	Almost none	~ 3 times the grid load
Power to Methane	0 GW	180 GW
Methane storage	0 km^3	50 km^3
Iron Air Batteries	250 TWh	0 TWH
CCGT power plants	0 GW	80 GW
Electricity import	40 TWh	0 TWh
Methane importt	0 TWh	245 TWh

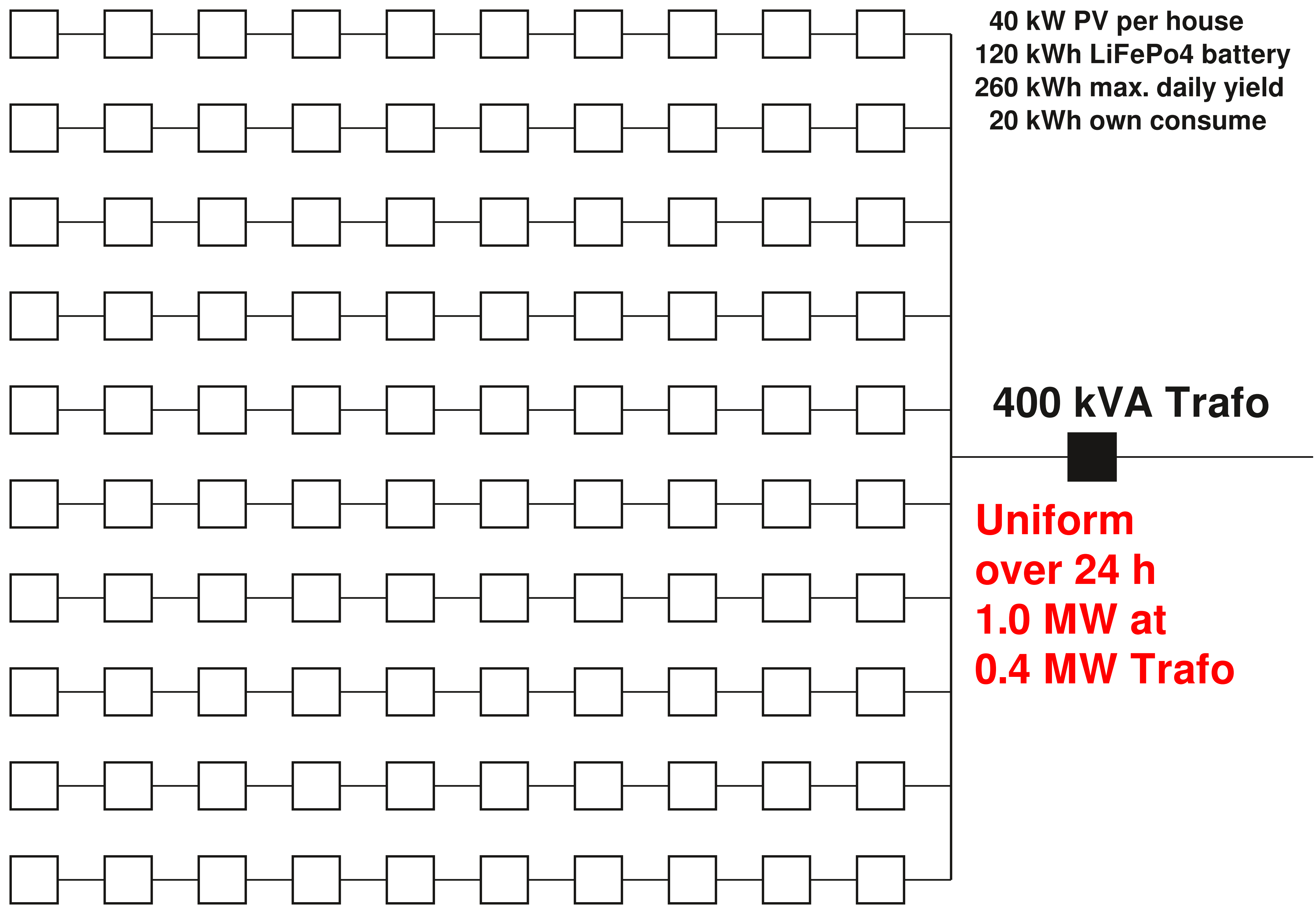


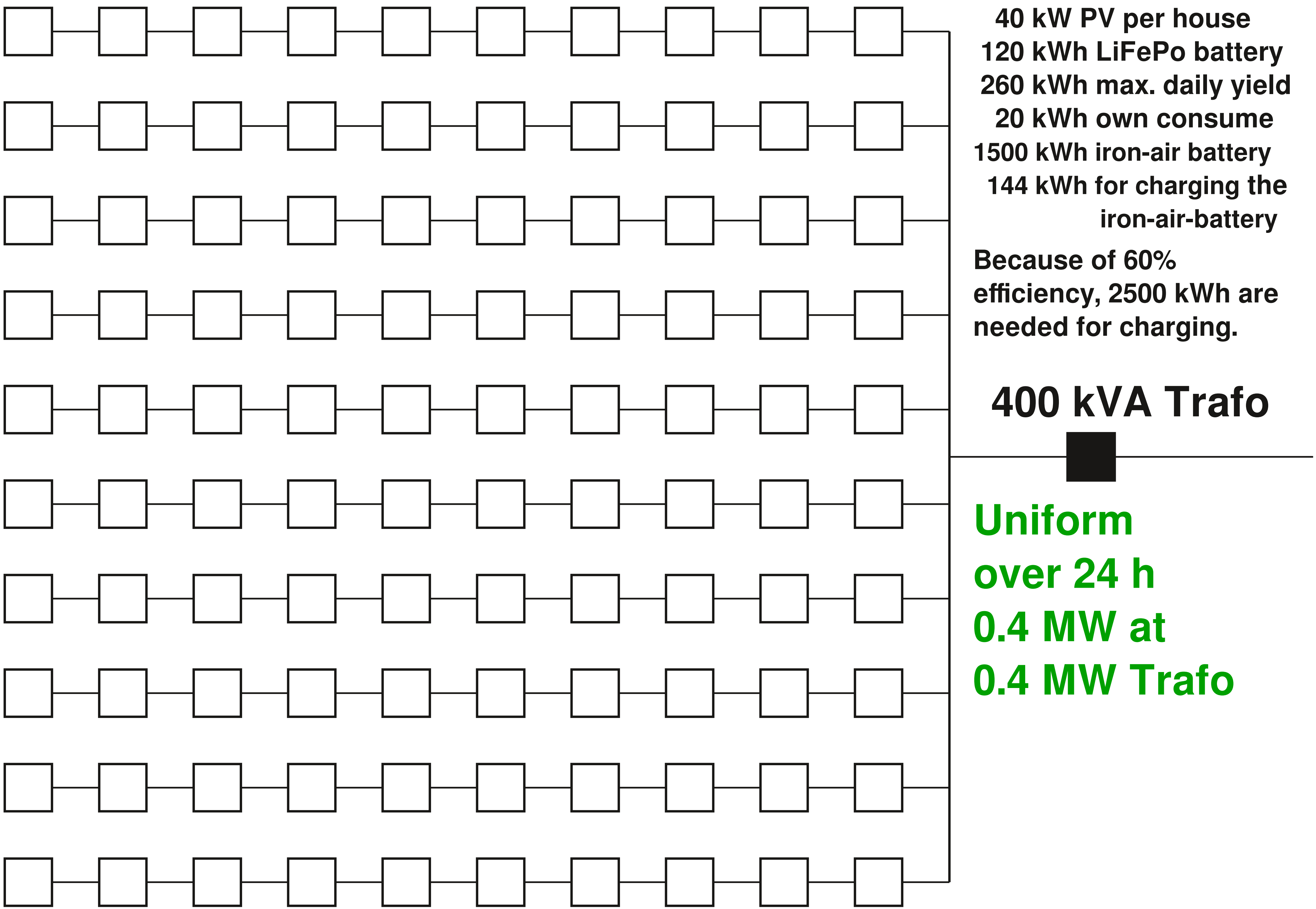

Peak shaving with decentralized iron-air batteries
Charging current for iron-air batteries in TWh/a
350
300
250
200
150
100
50
0
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Installed power to methane plants in GW

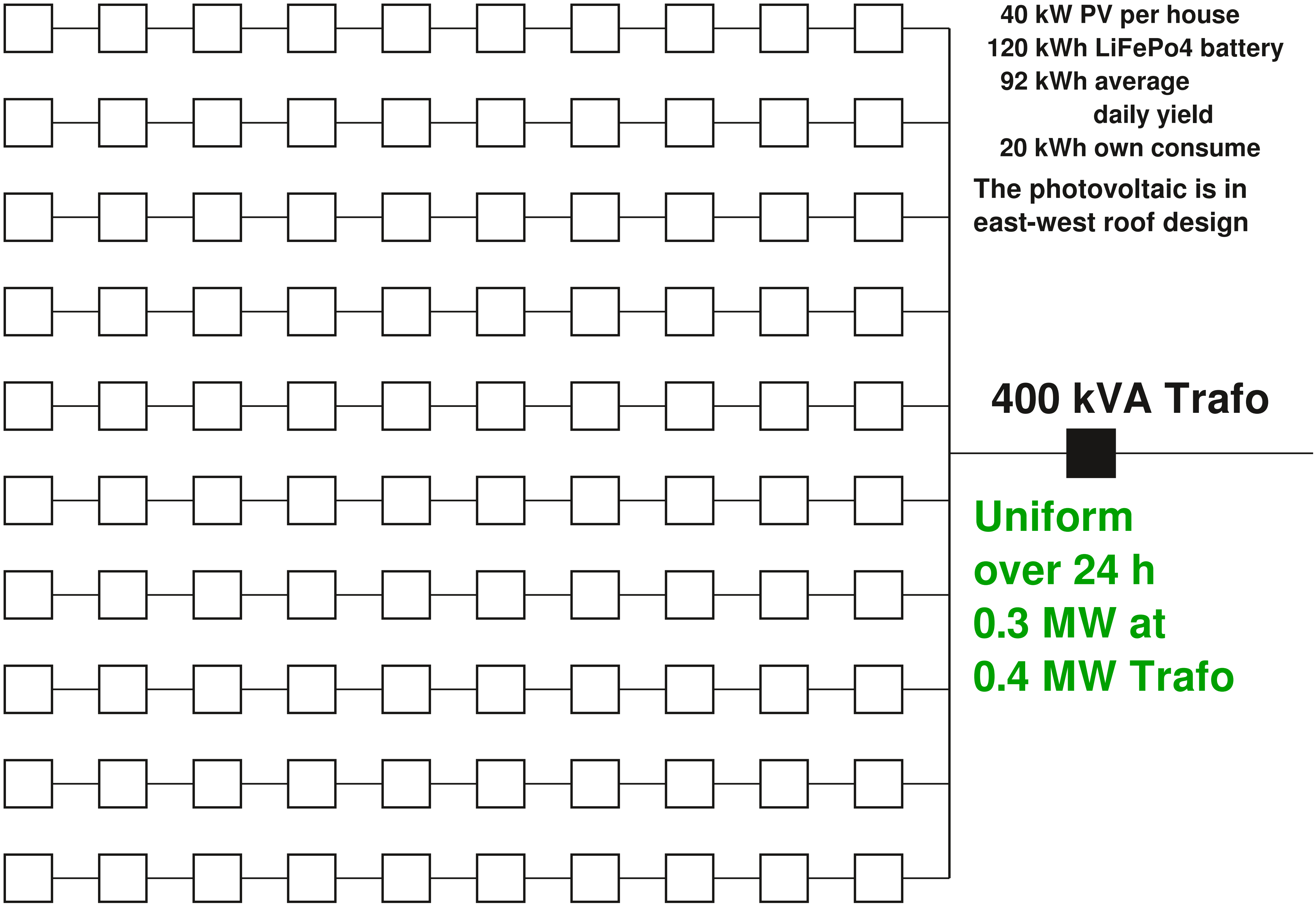

100 houses, each has a 25 A three-phase connection, but all together are connected to a 400 kVA transformer on the medium-voltage network.
400 kVA Trafo
All turn on all the hotplates and the baking oven at the same time.
The probability of simultaneity is very low.
Everyone has the sun shining at the same time, which is a problem with a lot of photovoltaics.

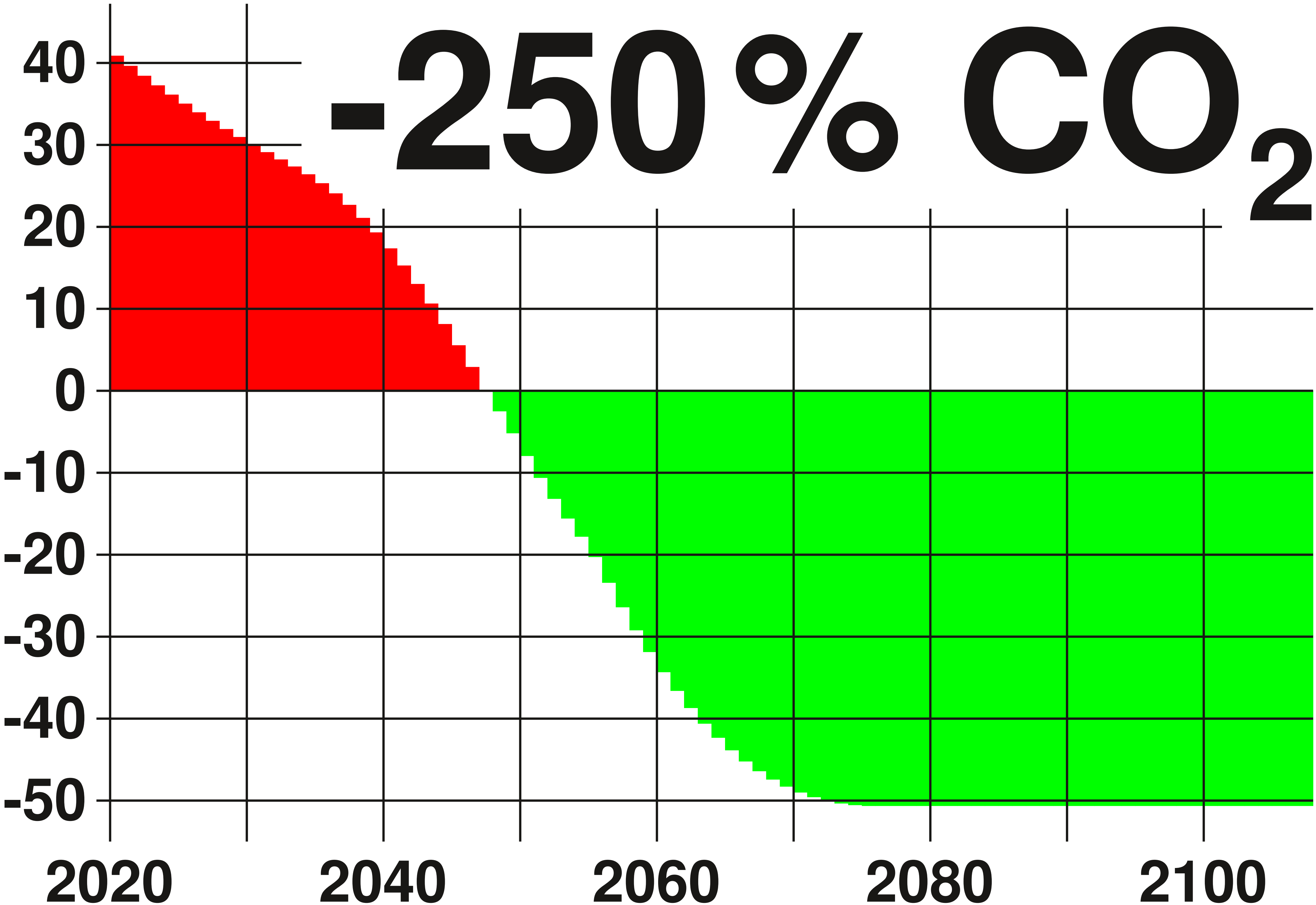


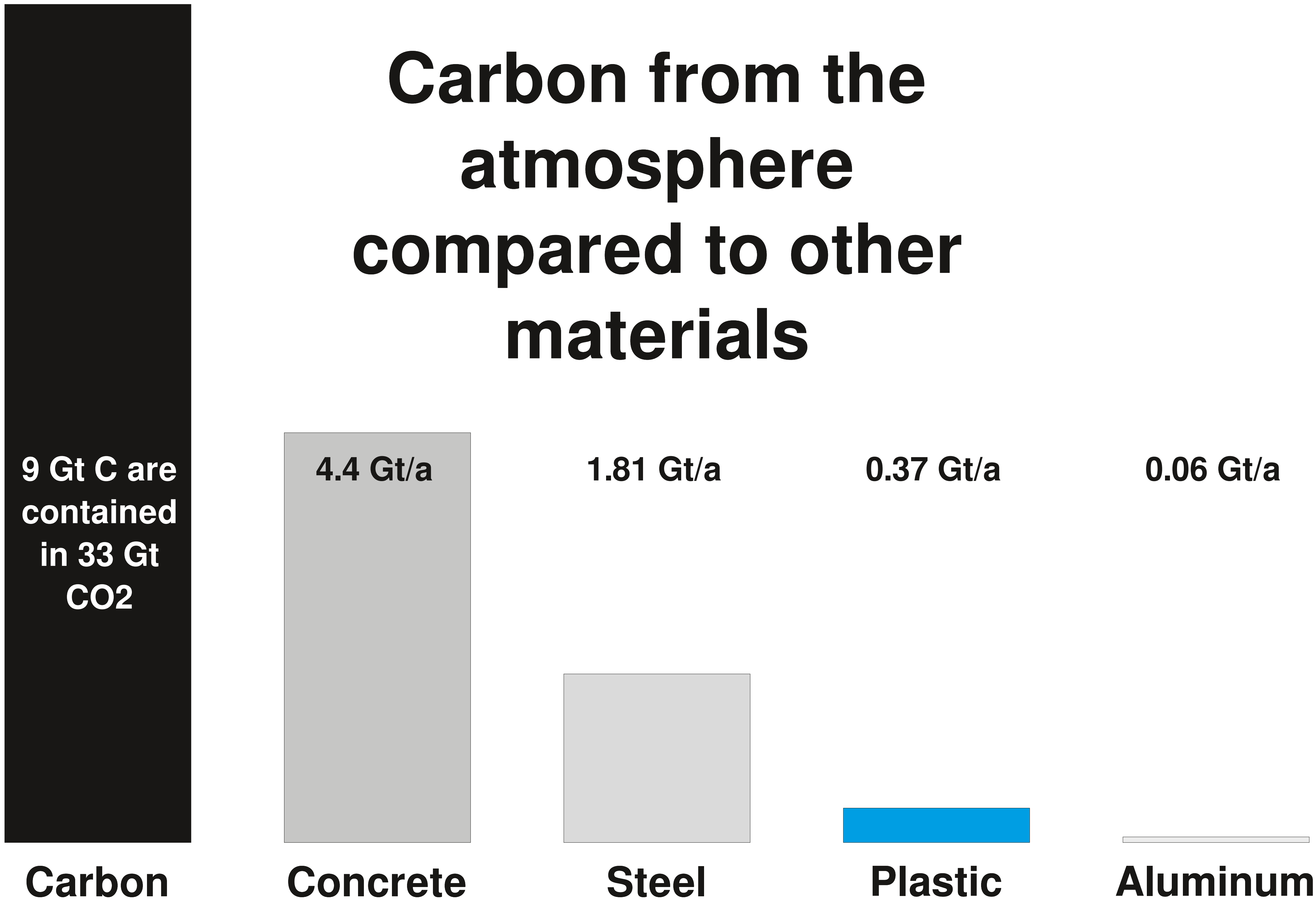
Grid dump
40 kW PV/house
75 % maximum
almost no one at home
on a work day,
so no significant
self-consumption.
400 kVA Trafo
3.0 MW at
0.4 MW Trafo


40 kW PV per house
120 kWh LiFePo4 battery
260 kWh max. daily yield
20 kWh own consume
400 kVA Trafo
Uniform
over 24 h
1.0 MW at
0.4 MW Trafo


40 kW PV per house
120 kWh LiFePo battery
260 kWh max. daily yield
20 kWh own consume
1500 kWh iron-air battery
144 kWh for charging the iron-air-battery
Because of 60% efficiency, 2500 kWh are needed for charging.
400 kVA Trafo
Uniform over 24 h
0.4 MW at
0.4 MW Trafo

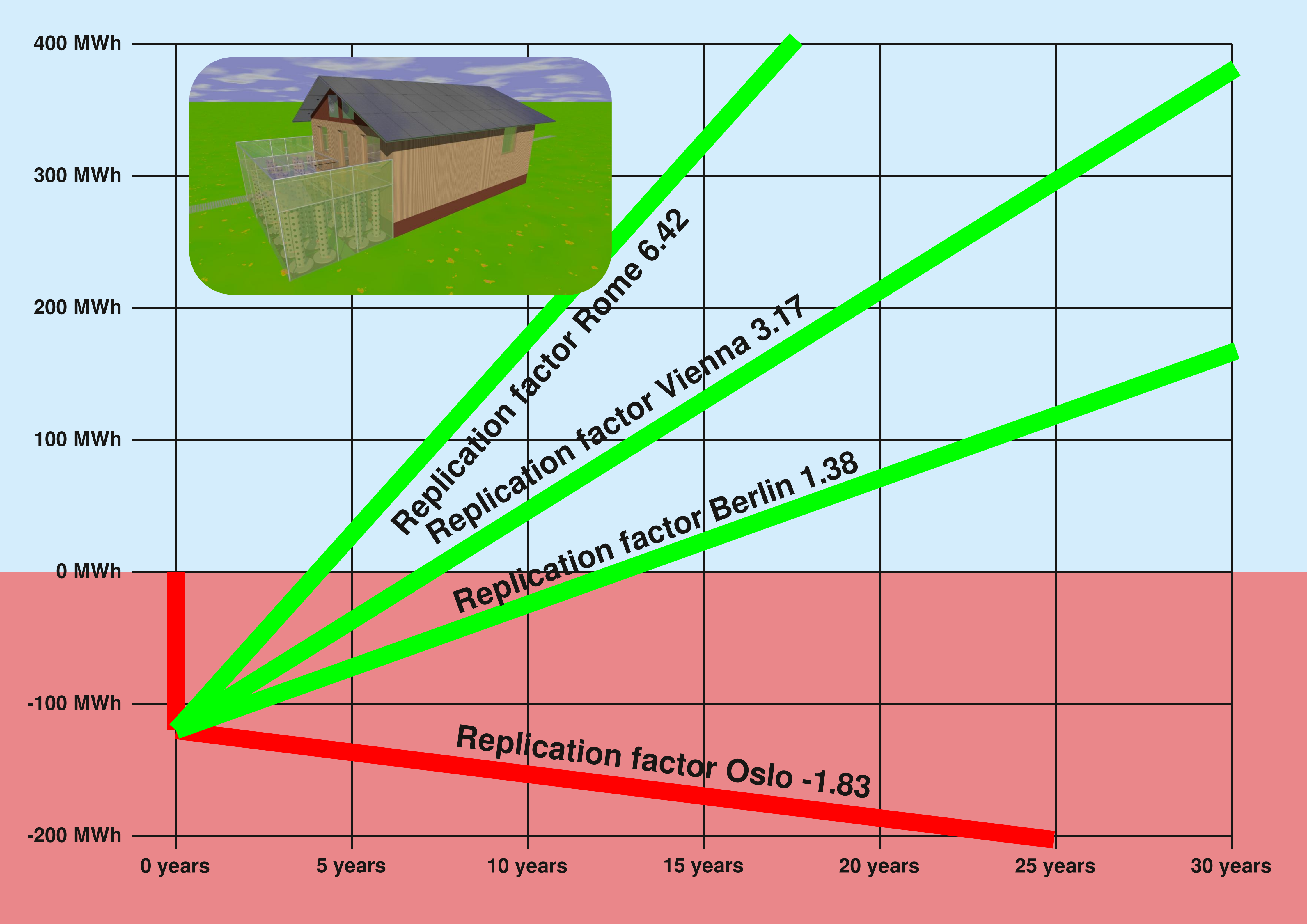

40 kW PV per house
120 kWh LiFePo4 battery
92 kWh average daily yield
20 kWh own consume
The photovoltaic is in east-west roof design
400 kVA Trafo
Uniform over 24 h
0.3 MW at
0.4 MW Trafo


-250 % CO2
40
30
20
10
0
-10
-20
-30
-40
-50
2020
2040
2060
2080
2100


Carbon from the atmosphere compared to other materials
9 Gt C are contained in 33 Gt CO2
4.4 Gt/a
1.81 Gt/a
0.37 Gt/a
0.06 Gt/a
Carbon
Concrete
Steel
Plastic
Aluminum

General requirements

Climate Protection Superiority House


400 MWh
300 MWh
200 MWh
100 MWh
0 MWh
-100 MWh
-200 MWh
0 years
5 years
10 years
15 years
20 years
25 years
30 years
Replication factor Rome 6.42
Replication factor Vienna 3.17
Replication factor Berlin 1.38
Replication factor Oslo -1.83

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Possibility for autarky and summer/winter balancing