10-11 September 2019, SES 2019, Copenhagen, Denmark Power to X

A novel, reliable, affordable and clean energy and water system for a neighbourhood

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KWR

Bridging Science to Practice

\sim The neighbourhood of the future



\sim Why are we doing this?









\sim Project location



 \sim

Project: Solar Power to the People (2017-2019)





Heat storage Low temperature versus high temperature



\sim Model scheme of Power-to-X system



\sim Model scheme of Power-to-X system





Aug Sep Oct Nov Dec

9,6 MW Wind

1500

1000

500

-500

-1000

-1500

Jan

Feb

Mar

Apr May Jun Jul

0

\sim Results – Renewable energy distribution



\sim Zoom in on heat storage





Heat storage			
efficiency	Sun	Wir	nd
Overall		79%	73%
Year 1		47%	39%
Year 2		73%	70%
Year 3		88%	77%
Year 4		94%	92%
Year 5		96%	88%
Year 6		76%	72%



\sim Results – demand, supply and costs

	Demand	Supply – Sun	Supply- Wind
Electricity - GWh	9.3	3.25	4.3
Hydrogen - tonne	130	131	131
Heat - GWh	13	17.9	13.8
Water- Mm ³	82	80	28

Fair comparison? No grid cost taken into account yet...

	Ref. Price	Price - Sun	Price - Wind
Electricity - €¢/kWh	17.4	13.1	14.2
Hydrogen - €/kg	10	8.9	11.4
Heat – €/GJ	30	12.4	15.8
Water- €/m³	1.4	1.3	1.2
Costs per household (€/year)	2220	1530	1820

Next research question

How to find the optimal combination of system balance and cost in a Power-to-X system for a neighbourhood?



All scenarios are energy neutral over the year

Take avoided costs into account

System balance

\sim What is happening already?



\sim Take home message

It is possible to create a neighbourhood that runs on solar power and rain water

Avoided costs can become important factors within the business cases of Power-to-X systems

To really learn about a concept, one can best start to realize it. And that's what we are trying to do.

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More information?

https://www.alliedwaters.com/news/solar-powerto-the-people/

https://www.kwrwater.nl/en/projecten/systemdesign-power-to-x/

Results – Energy balance

12 MWp Sun PV

\sim Energy balance houses

\sim Build up of hydrogen demand

700 600 500 MWh electricity 000 000 000 200 100 0 Jan Feb Sep Oct Nov Dec Mar Apr May Jun Jul Aug Grid to H2 Ren to H2

12 MWp Sun PV

\sim Water supply vs demand

Demiwater dem Rain

Demiwater dem Rain

\sim Distribution of energy to heat

12 MWp Sun PV