

Micro-CHP in the Netherlands

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Context Micro-CHP

- Technology
 - natural gas -> heat + hot water + electricity
 - Stirling based + conventional
 - Combined with storage and solar thermal
 - 400000 units replaced per year
- Energy efficiency aspects (1970: 90 -> 1981: 107 (95) -> 2010: 140 (126 %))
- Carbon dioxide reduction perspective
- Subsidy and pricing
- Field test results



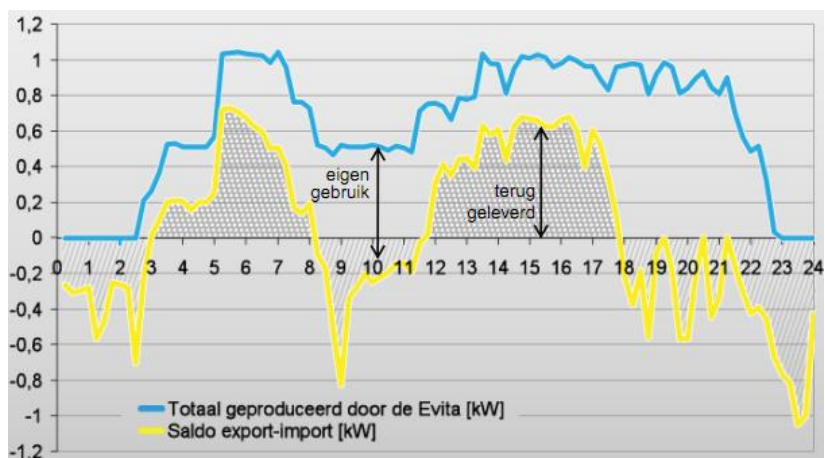
Technology

TNO innovation
for life

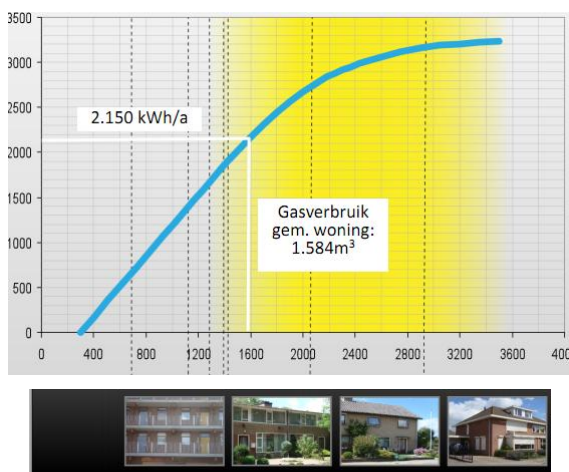


Electricity production profile on a winter day

TNO innovation
for life

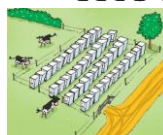


Annual Electricity production **TNO** innovation for life



Field test results (2009-2010) **TNO** innovation for life

- Green field testing
 - 52 micro-CHPs in laboratory micro-grid
 - No major grid issues expected
 - >2 kW local generations (in combination with PV) issues exist
- Smart Power City Apeldoorn
 - 171 households
 - Below 1600 m³ gas/yr ; efficiency lower



M3	kWh	Euro/year
1600	2022	329
2000	2507	409
2600	2976	485

- User technology interface is important

Scenario	Woonmilieu	Centrum-stedelijke Schilders-wijk	Buiten-centrum				Groen-stedelijk		Dorpse Epsee	Landelijk-perifeer Exels
			Stedelijk-vooroorlogse		Stedelijk-naoorlogse		Westbroek-park	Kijkduin		
			Statenkwartier	Betondorpe	Nootdorpe	Lombardijene				
Netstructuur	Vermaasde	Vermaasde	Radiaal	Radiaal	Radiaal	Vermaasde	Vermaasde	Radiaal	Radiaal	
1a	Inhoud-scenario E+G, alleen HR, geen airco, E-WP, DG, PV, EV's	OK	OK	OK	OK	OK	OK	OK	OK	
2a	E+G, 50% airco à 2kW, geen DG, E-WP, PV, EV's	NOK	OK	OK	OK	NOK	OK	OK	NOK	
3 voor-renovatie	E+G, alles HR, geen airco, E-WP, PV, EV's	OK	OK	OK	OK	OK	OK	OK	OK	
3 na-renovatie	E+G, alles HR, geen airco, E-WP, PV, EV's	OK	OK	OK	OK	OK	OK	OK	OK	
4 voor-renovatie	E+G, alles HR plus 15 m² PV, geen airco, E-WP, EV's	NOK	OK	NOK	NOK	NOK	OK	OK	NOK	
4 voor-renovatie	E+G, alles HR plus 8 m² PV, geen airco, E-WP, EV's	NOK	OK	OK	NOK	NOK	OK	OK	NOK	
4 na-renovatie	E+G, alles HR plus 15 m² PV, geen airco, E-WP, EV's	NOK	OK	NOK	NOK	NOK	OK	OK	NOK	
4 na-renovatie	E+G, alles HR plus 8 m² PV, geen airco, E-WP, EV's	NOK	OK	OK	NOK	NOK	OK	OK	NOK	
5 voor-renovatie	E, 15 m² PV plus E-WP, geen airco, EV's	OK	NOK	NOK	NOK	NOK	NOK	NOK	NOK	
5 voor-renovatie	E, 8 m² PV plus E-WP, geen airco, EV's	OK	NOK	NOK	NOK	NOK	NOK	NOK	NOK	
6a	E, E-WP, geen airco, HR, PV, EV's	OK	NOK	NOK	NOK	NOK	NOK	NOK	NOK	
7 voor-renovatie	E+G, 50% E-WP, 50% HR, geen airco, PV, EV's	OK	OK	NOK	OK	OK	OK	OK	NOK	
7 na-renovatie	E+G, 50% E-WP, 50% HR, geen airco, PV, EV's	OK	OK	NOK	OK	OK	OK	OK	NOK	

- CO₂ reduction:
 - From 5 -> 4 tons
 - 20 % thermal; 60 % w.r.t. electric power station
- Labelling (C or D -> B or C) will depend on control strategy
 - Heat demand following
 - Electricity demand following
- Currently: 4 kEuro subsidy ; 10 kEuro investment cost