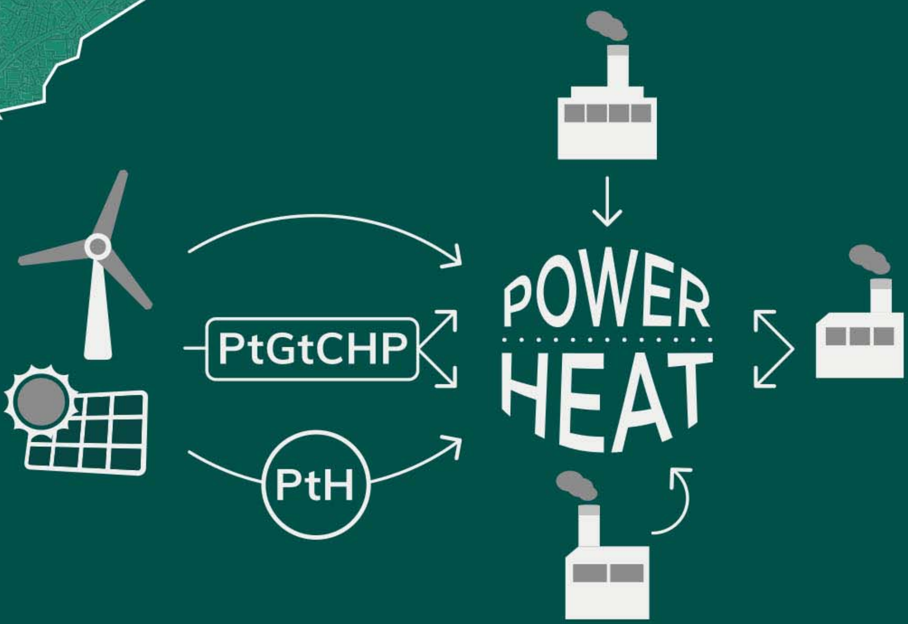
Ricardo Peniche Garcia

Analysis of renewable energy integration options in urban energy systems with centralized energy parks



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Hamburg, in July 2017
Ricardo Peniche Garcia

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Abbreviations and Symbols

Abbreviations

CHP	Combined Heat and Power
DHG	District Heating Grid
DSO	Distribution System Operator
EEG	Renewable Energy Sources Act
EG	Electric Grid
EnWG	Energy Industry Act
CCGT	Combined Cycle Power Plants
GG	Gas Grid
GHI	Global Horizontal Irradiance
GT	Gas Turbine
HRSG	Heat Recovery Steam Generator
IO	Input / Output
O&M	Operation and Maintenance
PEM	Polymer Electrolyte Membrane
PtG	Power to Gas
PtGtCHP	Power to Gas to Combined Heat and Power
PtH	Power to Heat
PV	Photovoltaic
RE	Renewable Energy
RE share DH	Share of RE in District Heating Consumption
RH	Renewable Hydrogen
ST	Steam Turbine
STOR	Storage
TSO	Transmission System Operator

Chemical Symbols

CO_2	Carbon dioxide
H_2	Hydrogen
KOH	Potassium hydroxide

Latin Symbols

c	Specific costs	€/MW, €/MWh, €/m, €/m^3
e	Specific CO_2 emissions	kg/MWh
E	Electric energy	MWh
HHV_{H2}	Higher heating value of hydro-	MJ/kg
LHV_{H2}	Lower heating value of hydro-	MJ/kg
$\dot{m}$	Mass flow	kg/s
M	Mass	kg
P	Electric power	MW_{el}
$\dot{Q}$	Heat flow	MW_{th}
Q	Heat	MJ
T	Temperature	°C
t	Time	s, h

Greek

η	Efficiency
σ	CHP coefficient
ζ	Fuel utilization efficiency

Indices

cons	Consumption
el	Electrical
ELY	Electrolyzer
fuel	fuel
H_2	Hydrogen
HP	Heating Plant
in	Input
out	Output
PtP	Power to Power
PtH	Power to Heat
PtCHP	Power to Combined Heat and Power
th	Thermal

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