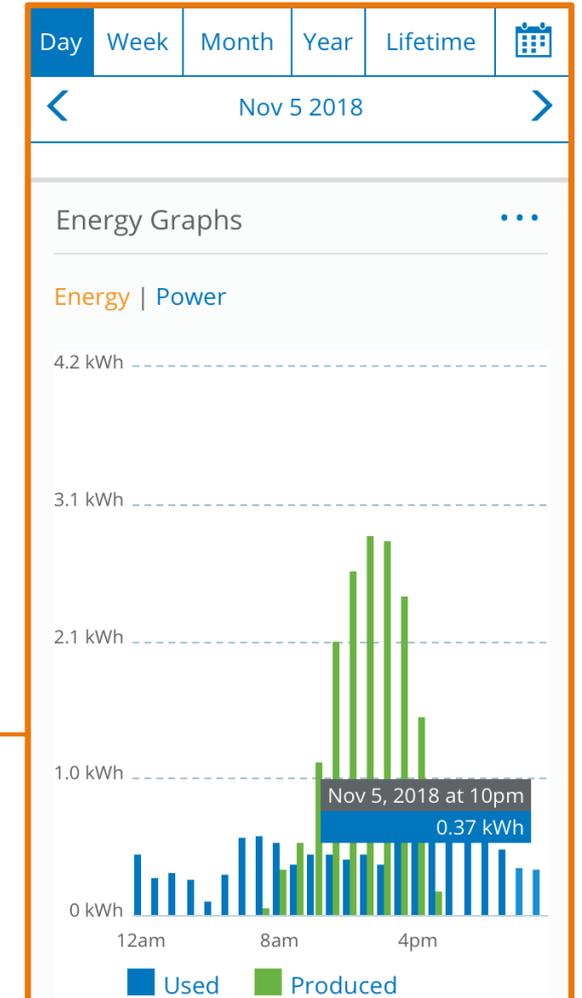
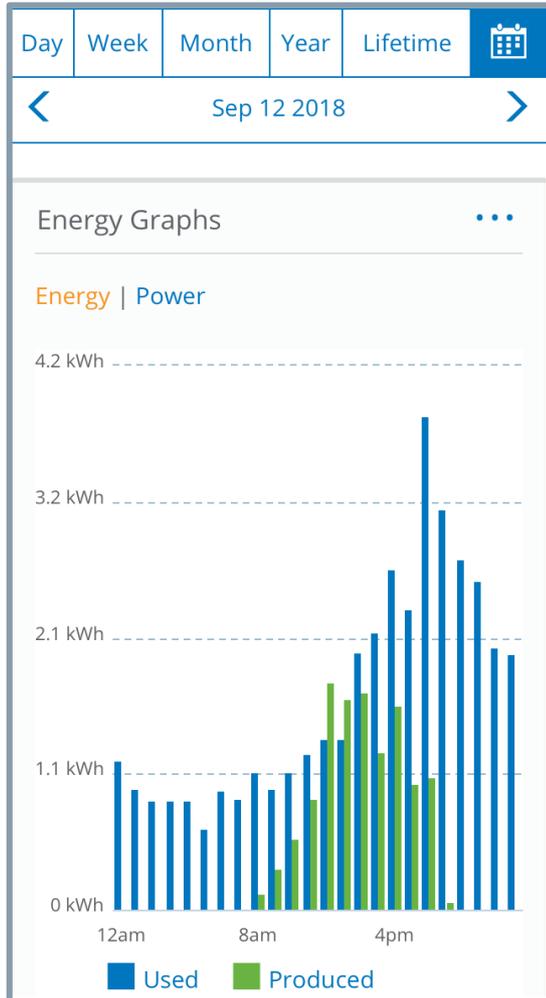


Benefits of CHP/Cogeneration for District Heating and Health Campuses in a Changing Energy Environment

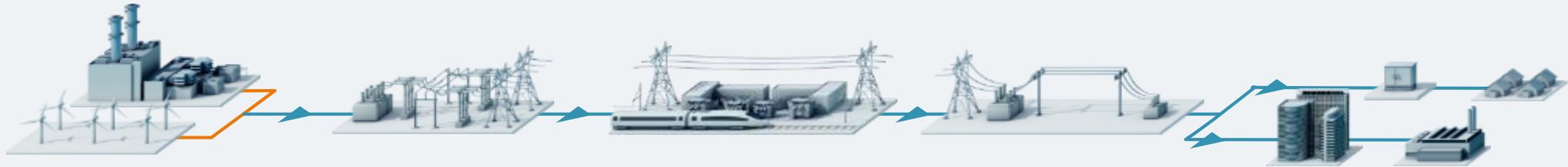
Robert Bouwens, Global Head of Sales SGT-A05

My Experience With Rooftop Solar Panels

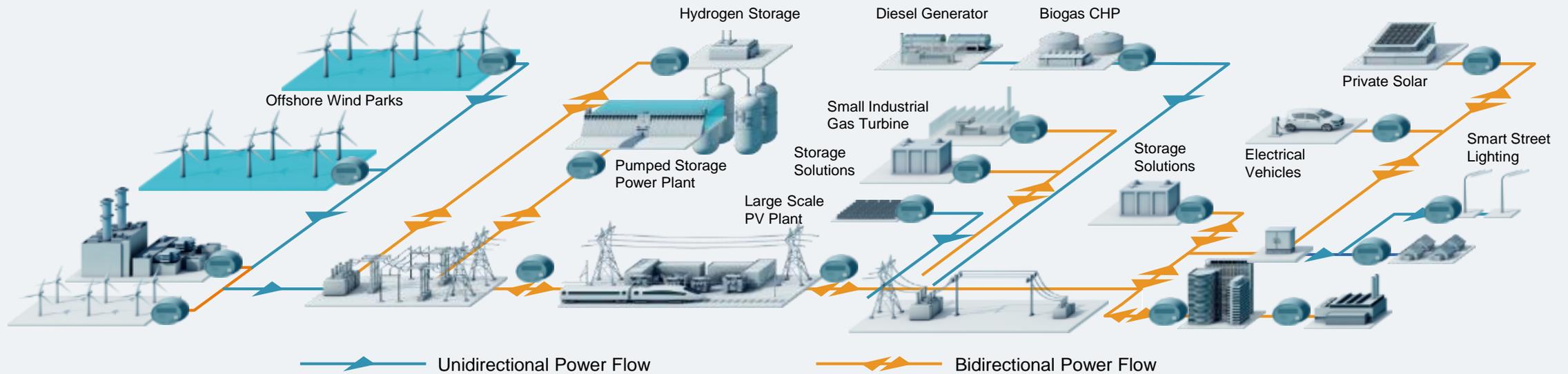


What's next...

From centralized, unidirectional grid ...



... to distributed energy and bidirectional energy balancing



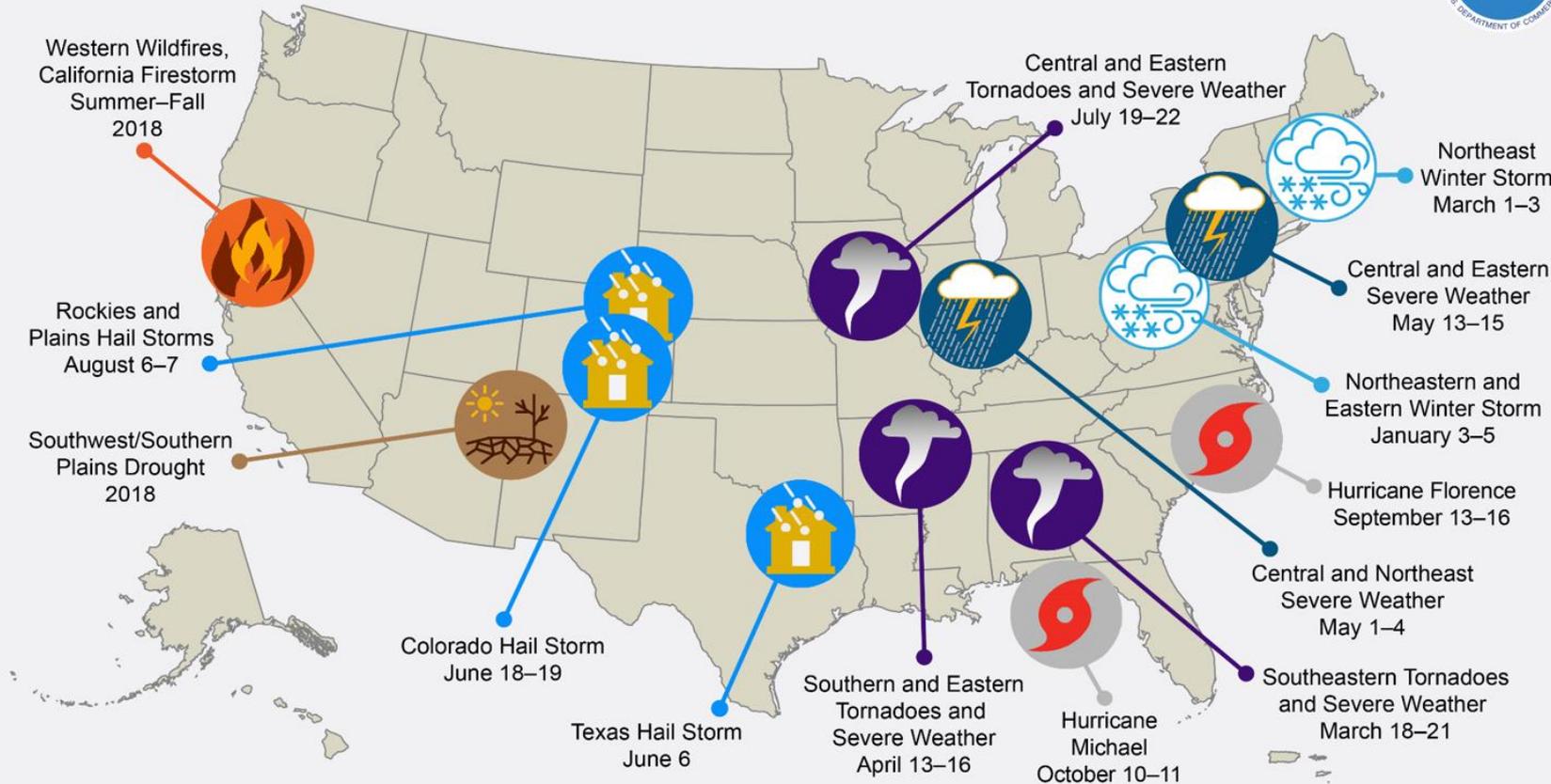
... to distributed energy and the rise of the prosumer

- **Increased reliability**
- **Reduced energy costs**
- **Improved resilience**
- **Reduced carbon footprint**
- **Enhanced control**
- **Financed solutions**

Energy resilience is on our minds

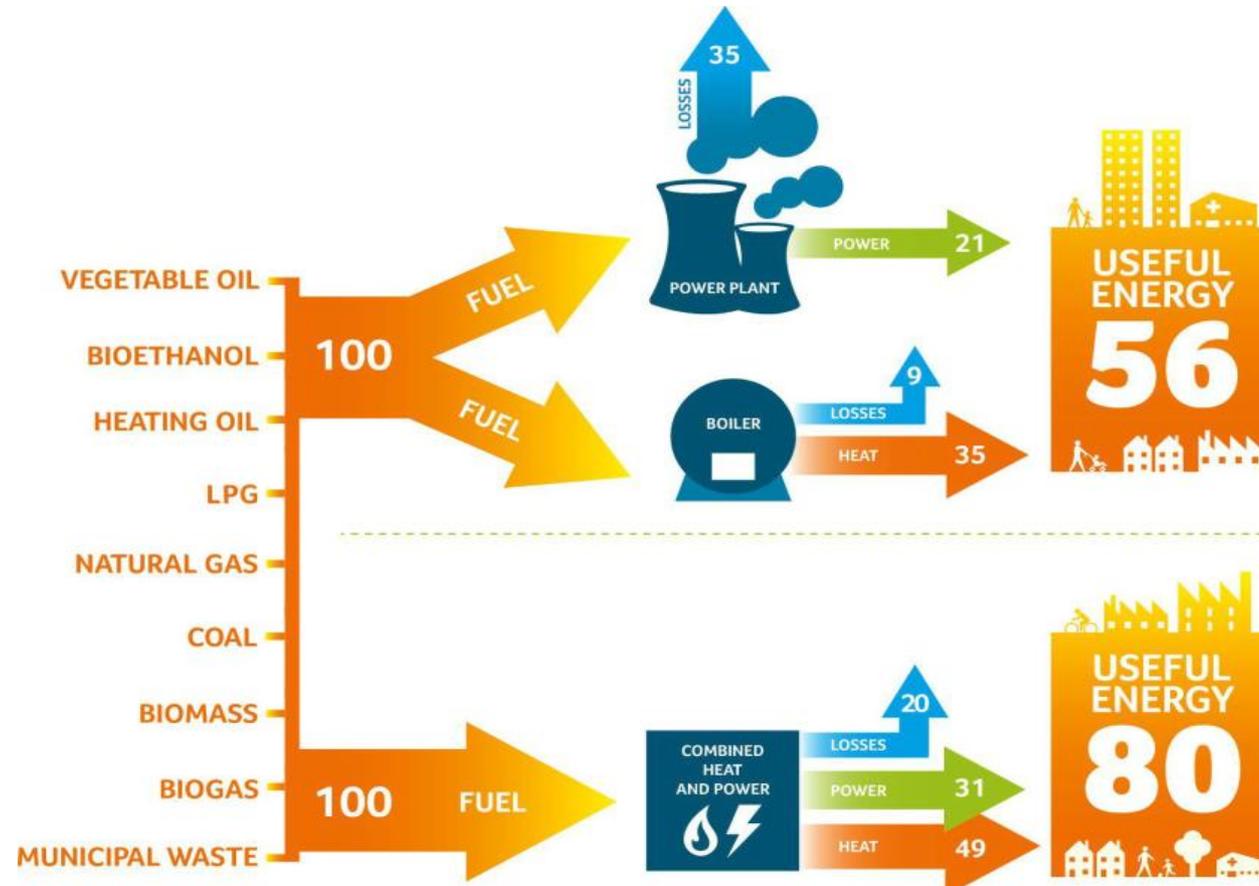


U.S. 2018 billion-dollar weather and climate disasters



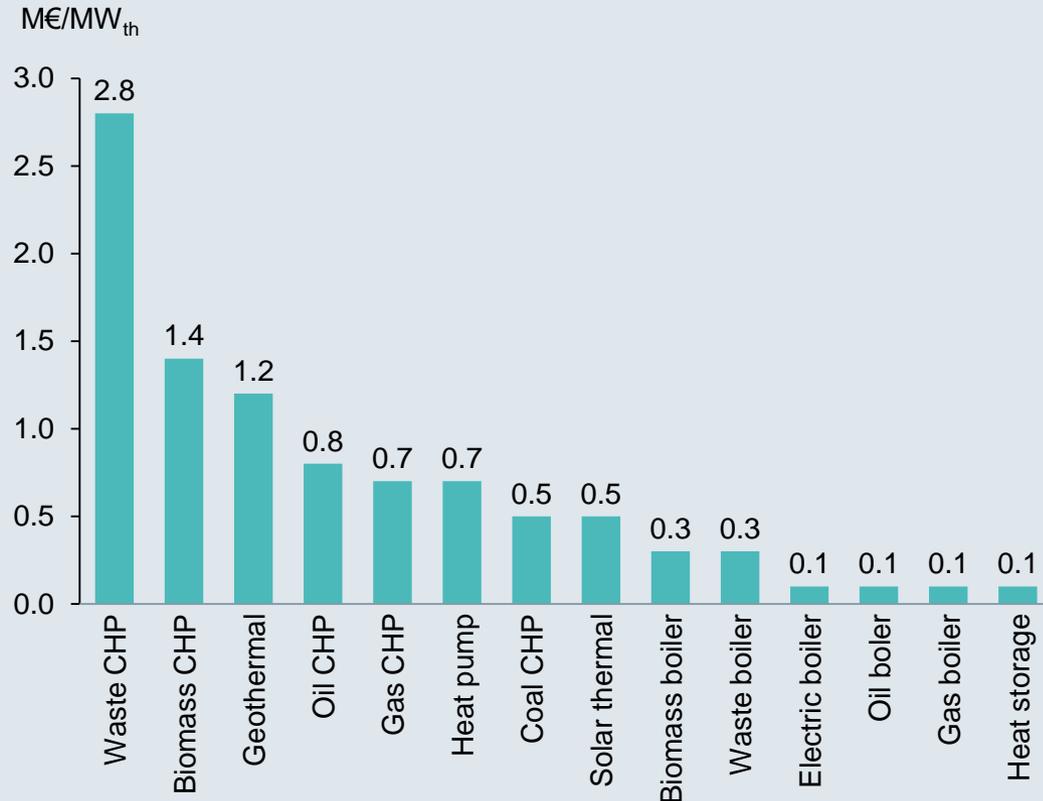
This map depicts the approximate location of each of the **14** separate **billion-dollar weather and climate disasters** that impacted the United States during 2018

Combined Heat and Power provides energy efficiency



Investment costs, heating load analysis (EU estimate)

Nominal investment costs



Nominal investment costs in M€/MW_{th} for large-scale heating technologies.
Source: (Grosse, Christopher, Stefan, Geyer, & Robbi, 2017)

Heat demand profile

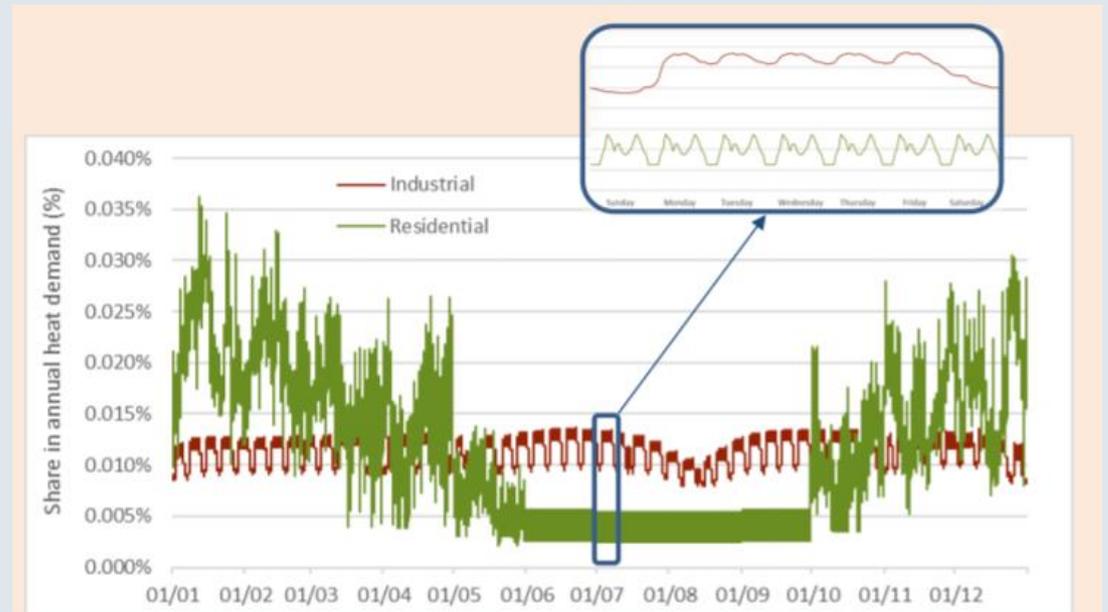


Figure 7 - Hourly heat demand profile for the industrial and the residential sector. Source: French DHN operator, (RTE, 2018)

Hourly heat demand profile for the industrial and the residential sector.
Source: French DHN operator, (RTE, 2018)

CHP Deployment in EU and USA

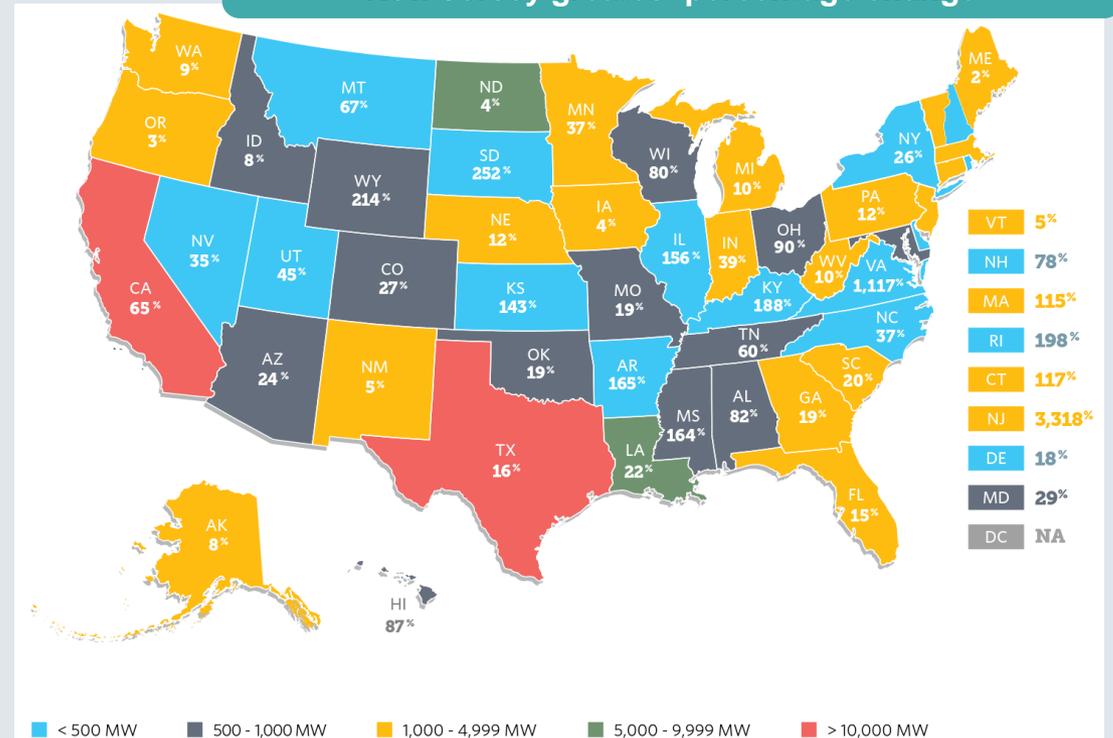
Electricity production in Europe

	CHP	All	% CHP
BE	12.2	85.52	14.3%
BG	3.6	45.28	8.0%
CZ	8.4	83.31	10.1%
0.1%DK	12.0	30.52	39.3%
DE	87.9	649.12	13.5%
IE	2.2	30.42	7.2%
EL	2.6	51.41	5.1%
ES	27.2	274.78	9.9%
FR	15.0	556.18	2.7%
IT	40.3	289.77	13.9%
HU	4.8	31.86	15.1%
NL	30.8	115.17	26.7%
AT	10.9	68.35	15.9%
PL	27.6	166.64	16.6%
SE	9.2	156.01	5.9%
UK	19.8	339.4	5.8%
Total	314.5	2973.74	10.6%
USA	324.24	4178.0	8%

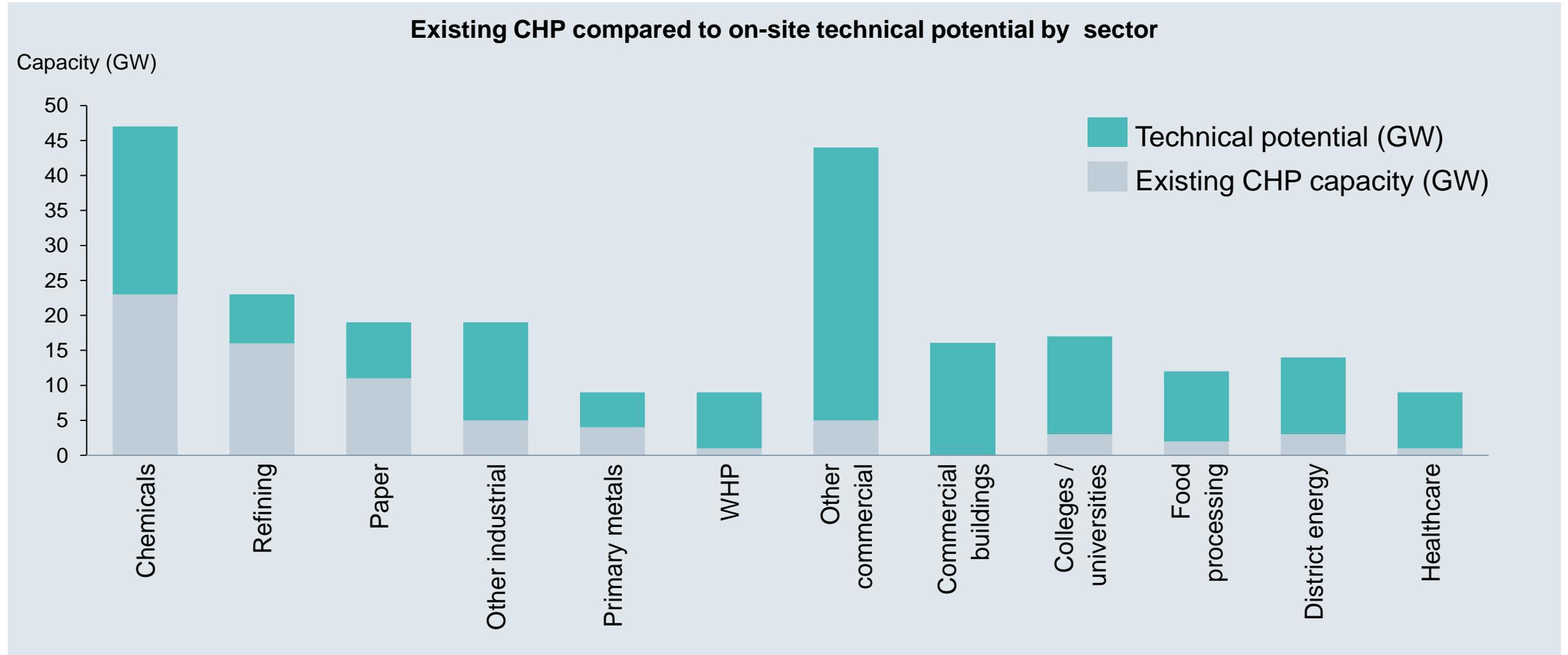
Source: Eurostat and ICF International
Unrestricted © Siemens AG 2019

Industrial energy efficiency market penetration and percentage growth in an improved policy landscape, 2030

California and Texas could see largest capacity gains,
New Jersey greatest percentage change



Potential CHP installations (USA)

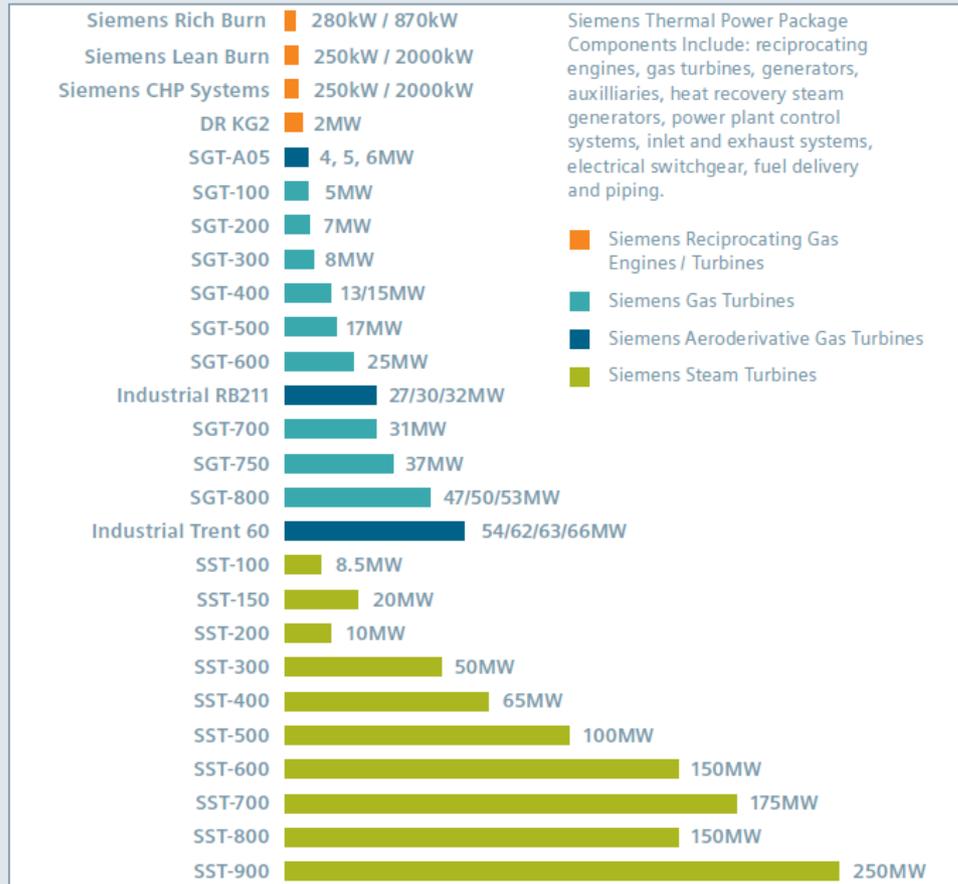


U.S. DOE CHP Deployment Program, 2016

Unrestricted © Siemens AG 2019

A range of power options and equipment choices

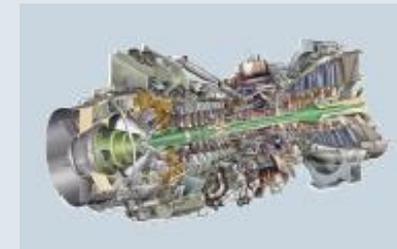
Siemens small power generation solutions



Gas turbine



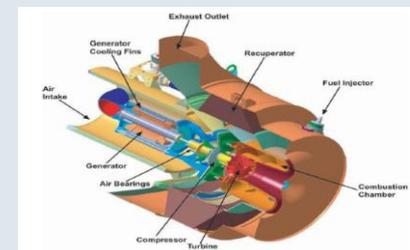
Reciprocating engine



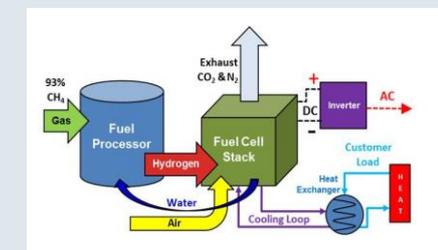
Aeroderivative gas turbine



Steam turbine

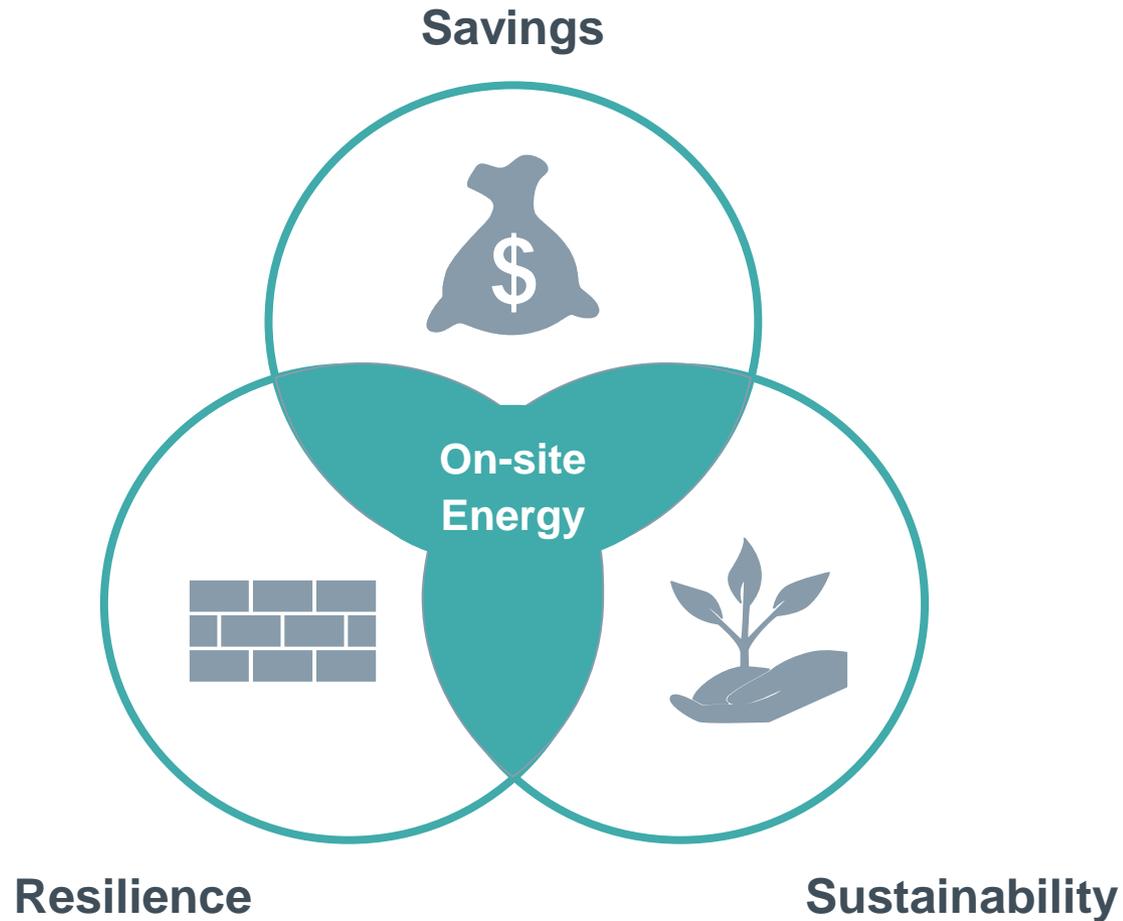


Microturbine



Fuel cell

Multiple value propositions



New business models are enabling partnerships with companies with experience and knowledge.



Turnkey approaches and financing solutions take the capex issues away.



Deep expertise is available for design, construction and asset management.



Customer could and should expect multiple benefits.

Case Studies



The Blackbird

City of Holland, Michigan Improves Downtown Economy Through Largest Snowmelt System in North America



Challenge	Solution
Coal-fired plant no longer met city energy needs	Two SGT-800 and One SST-400 provide cost-efficient power
Underground snowmelt system could not meet energy demands	Waste heat from circulating water system provides heat for snowmelt system
Growing industrial business base increasing energy demands	Siemens partner maintenance team access assured

115 MW

New power generated via CHP plant

20%

The maintained average rate advantage over competitors

Commercial CHP: University & Hospitals

Royal Aberdeen Infirmary



Challenge	Solution
2 existing boiler-houses were nearing the end of its lifetime	1 x SGT-A05 KB7S Gas Turbine combined with a waste heat recovery boiler
Security of electricity supply	Significant improvement in reliability of the plant. Reduction in maintenance costs resulting in cost savings of £2 million/ p.a.
Growing industrial business base increasing energy demands	Siemens partner maintenance team access assured

5.5 MW + 12t steam/h

Power Output

17%

Reduction in CO2 emissions

District Heating Cogeneration Hera: Multi-Utility Company



Challenge	Solution
The existing thermal power plant was nearing the end of its operational life	Increased capacity to double the amount of heat produced allows Hera to offer a greener option for heating in the winter.
Gaining incentives leading to additional economic benefits	Assured on time & on budget project handover
Low efficiency of existing equipment	Increased efficiency to 51%

7.8 MW

Power Output

51%

Efficiency

Thank you!

SIEMENS
Ingenuity for Life



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siemens.com

A variety of project implementation options are available to meet campus financial and strategic objectives



P3 Trends in Campus Utilities and Energy Management

- Preserve limited capital for campus core mission.
- Monetize existing utility assets; Capture tax benefits on investments.
- Shift financial and operational risks to third party partner(s).
- Outsource services **to address labor and skills shortages.**

A range of innovative financial structures available to meet campus customers objectives

