



Energy Efficiency through Demand Response in Europe

Tom Schulz, Co-founder and COO
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www.entelios.com

Germany's First Demand Response Aggregator

Entelios Overview

- **Founded 2010**
- **Locations:** Munich and Berlin
- **Service:** Entelios is managing a **large network of electrical devices** at industrial power users, by **time-shifting loads**, and thereby creating **virtual power storage**. This platform enables Entelios to market energy products and services to grid operators and utilities.
- **Focus:** Commercial and industrial sector; German speaking countries



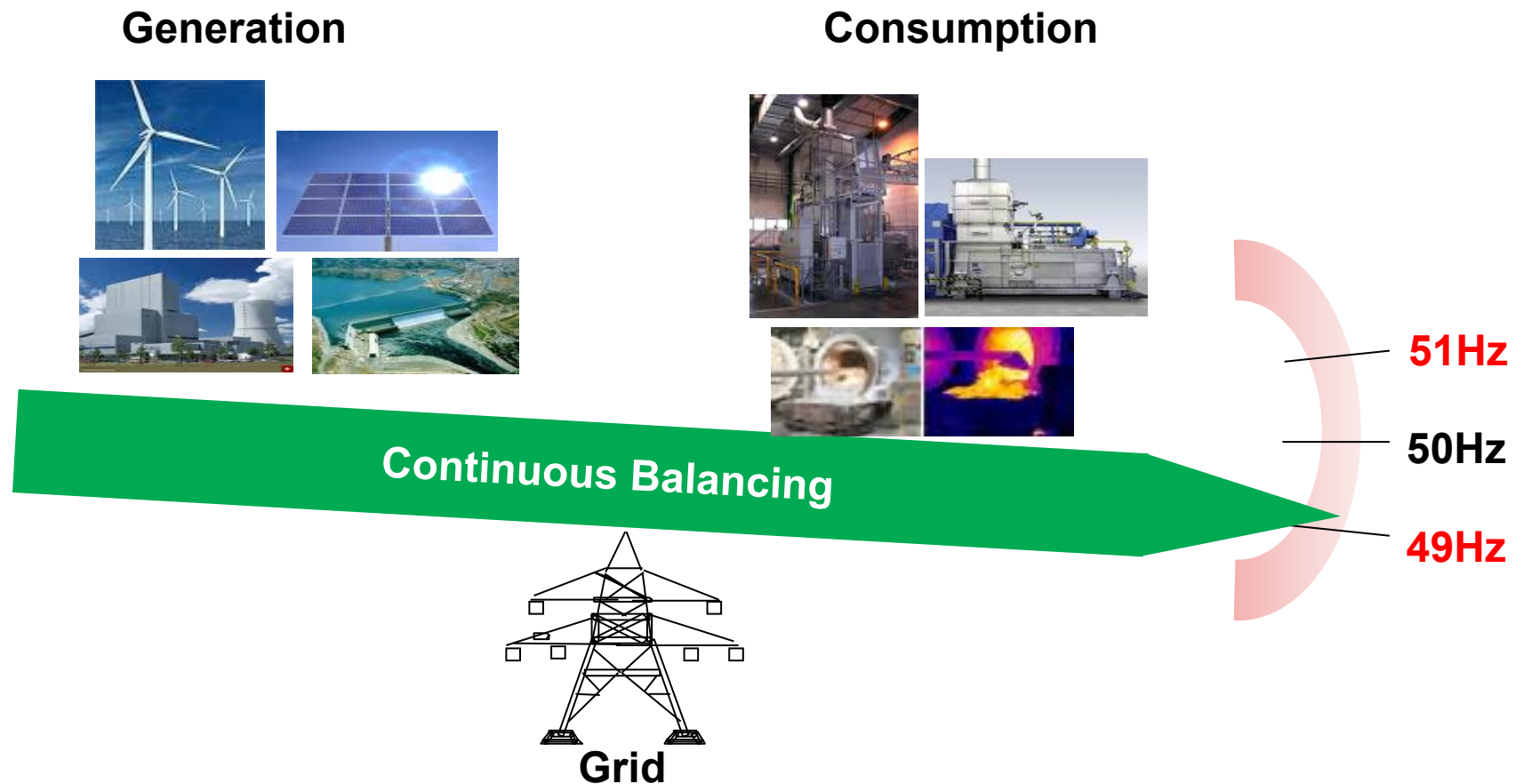
Agenda

Demand Response

Entelios AG – A Short History

Every minute, power generation and consumption must be perfectly balanced

The Balancing Act



- Practically no buffer
- Reserve power is expensive

A Dirty Secret



A Dirty Secret



Introducing Demand Response

In electricity grids, Demand Response is a process to manage customer consumption (*demand*) of electricity in *response* to supply conditions,

for example, having electricity customers reduce their consumption at critical times or in response to market prices.

A Paradigm Shift

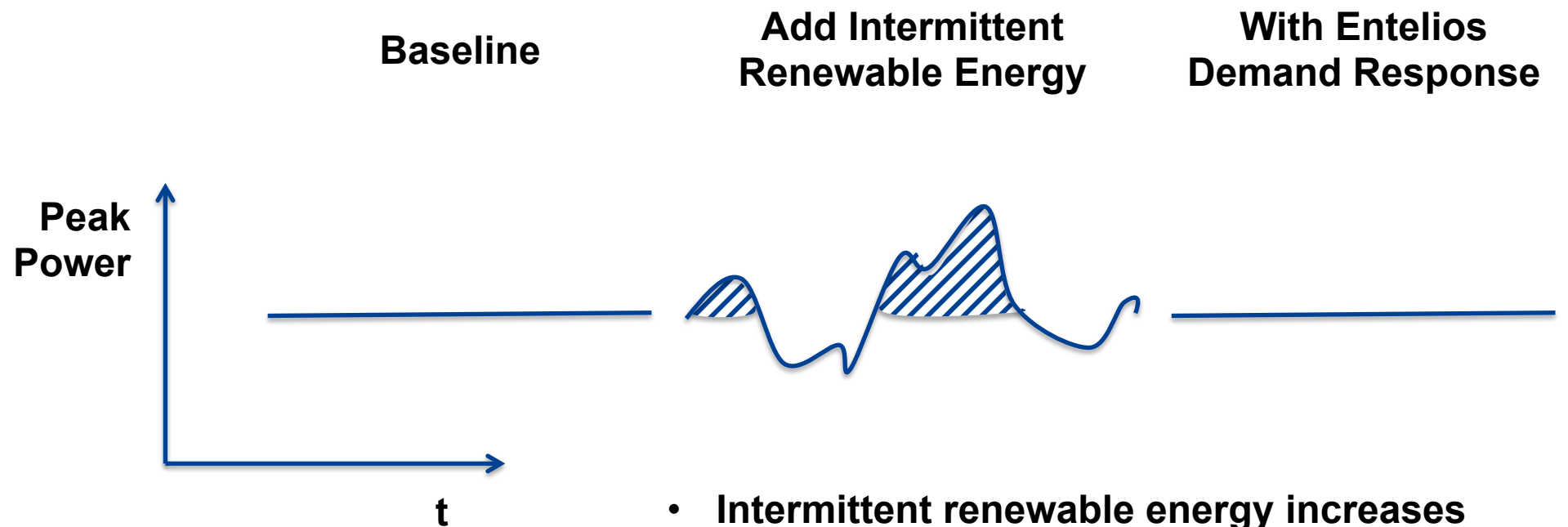
Before DR:

- demand side can consume as much power as they want when they want;
- supply side is controlled to follow the demand exactly;
- **reserve power** plants are needed.

With DR:

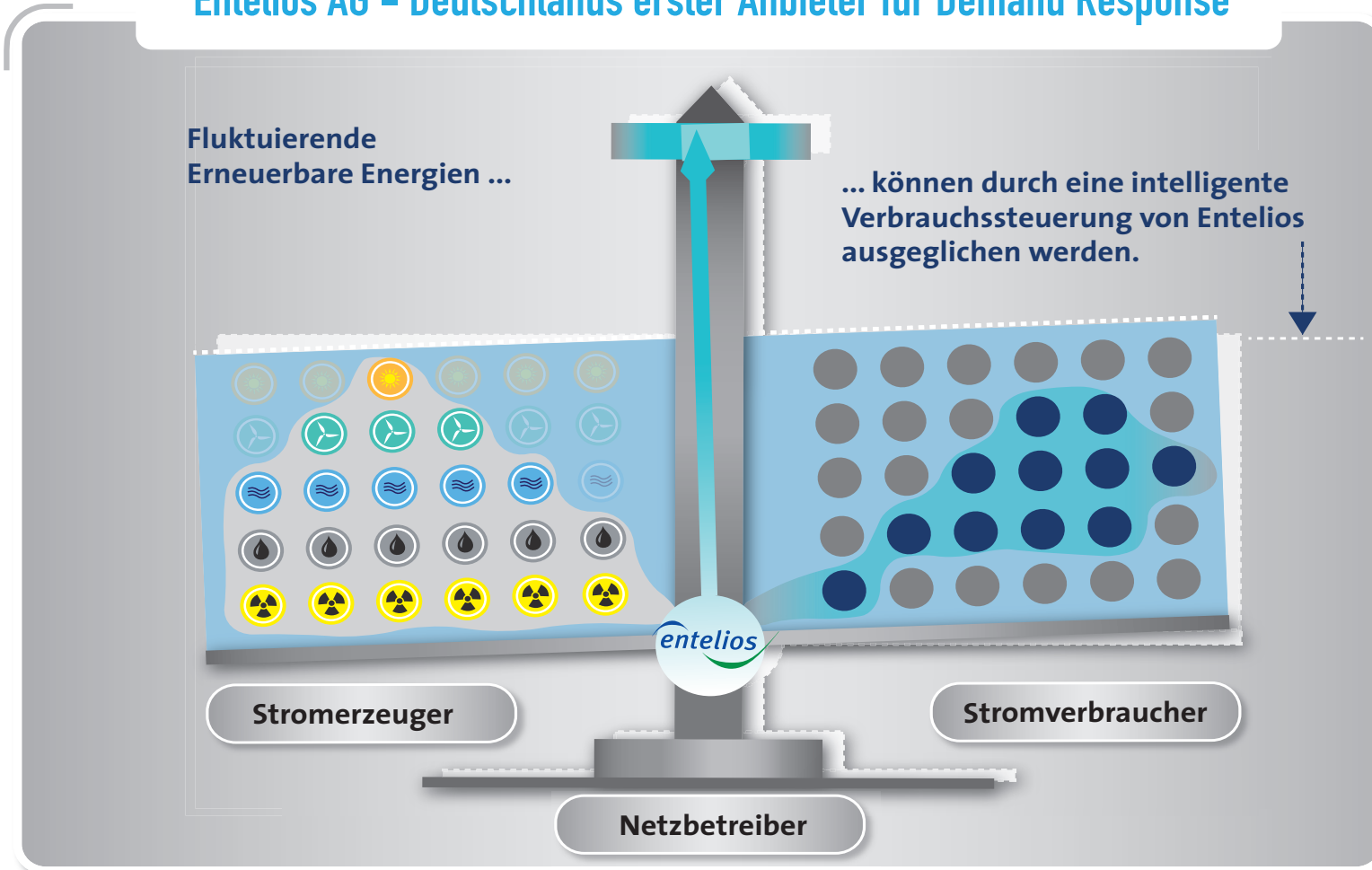
- Supply side controls demand side's consumption to follow current generation

Demand Response reduces the need for fossil fuel reserve power plants



- Intermittent renewable energy increases demand for reserve power
- Reserve power plants produce CO₂
- Demand Response is cheaper, faster, greener

Entelios AG – Deutschlands erster Anbieter für Demand Response



Entelios Network Operation Center (NOC)



Sonnenenergie



Fossile Brennstoffe



Stromverbraucher



Windenergie



Atomenergie



Mit dem NOC vernetzte Stromverbraucher

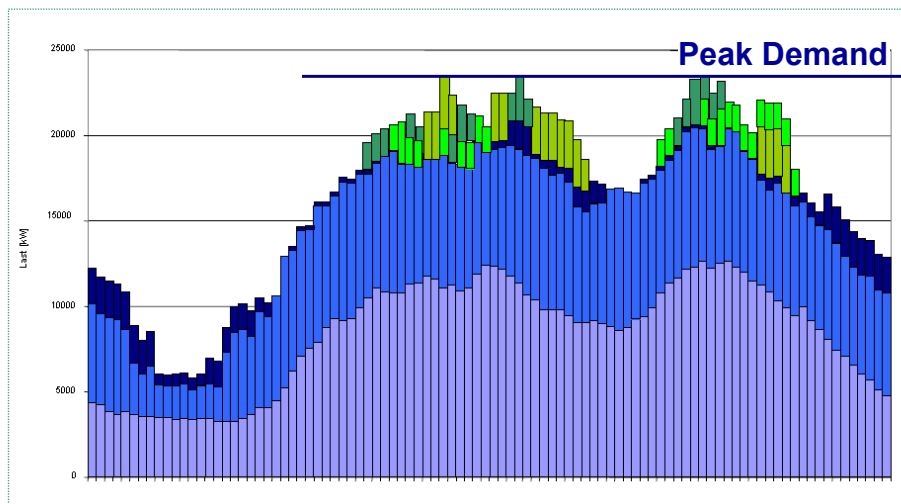


Wasserkraft

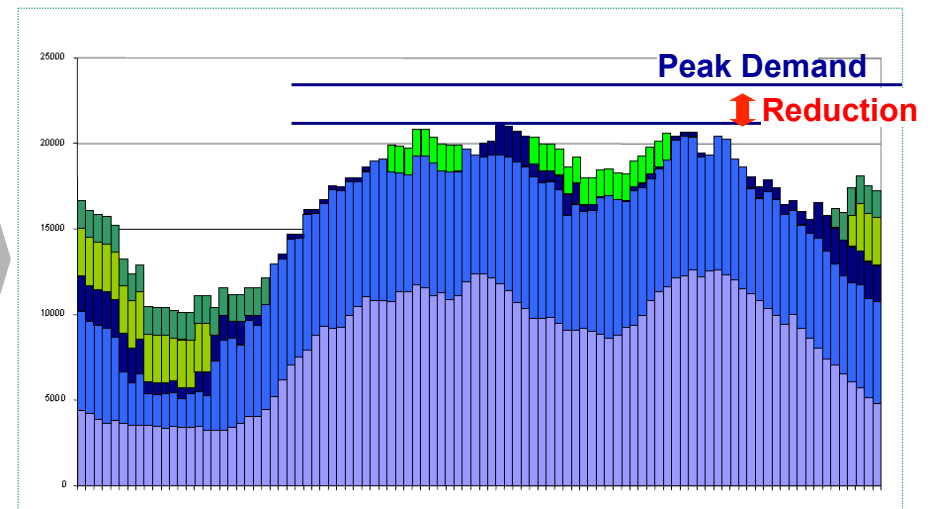
Entelios shifts electrical load into optimum time slots, acting as virtual power storage

How peak shaving works

Electricity Peaks on the Grid



System / Grid Balanced



Entelios — the intelligent connection between the supply side and the demand side of the energy equation

Network Operations Center (NOC)



Commercial and industrial participants provide different types of manageable load

Storage, shiftable processes



Ventilation



Cooling



Storage



**Compressed
Air**



A/C



Heating



Lighting



Pumping

Selection of industries and businesses with a high potential for Demand Response.

DR Suited Industries



Chemical Industry



Breweries



Cold Stores



Hotels



Public Buildings / Facilities



Food Processing Industries



Foundry / Furnace



Lumber Mills



Shopping Centers



Printing Plants



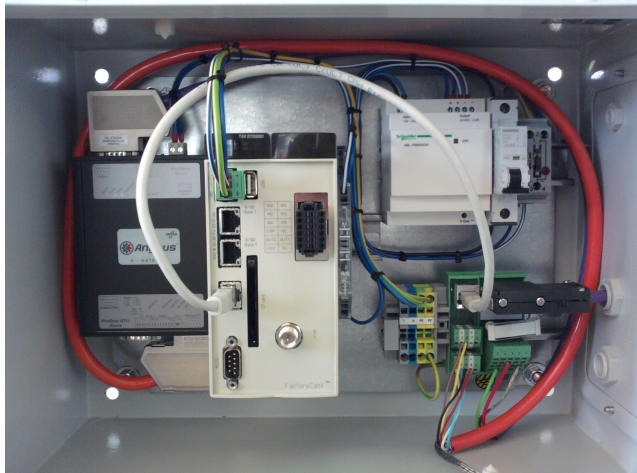
Water- / Air Treatment



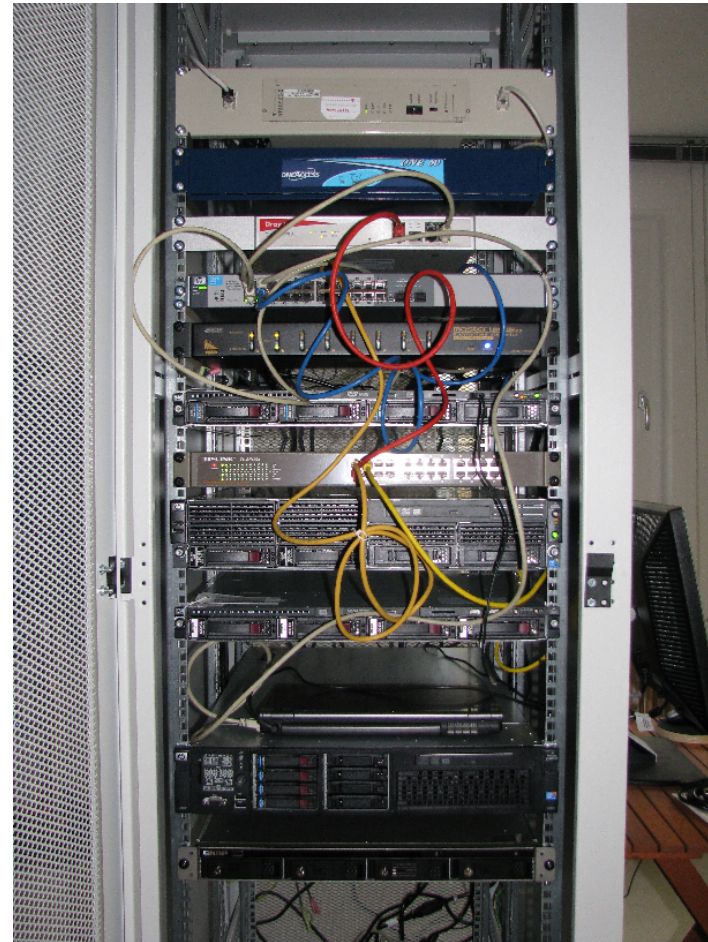
Concrete Factories

Entelios develops a solution in a „best of breed“ approach, together with strong partners

Hardware Impressions



Participant Station (UMTS-based)



Pilot Server Rack

DR addresses the current energy challenges: reserve capacity, peak capacity, grid stability, climate neutrality

The Problem



THE SITUATION

- High EU targets for renewable energy sources
- Challenging CO₂ and energy efficiency targets
- Costly reserve capacities to balance intermittent power sources
- Increasing peak electricity demands and electricity prices
- Demand-side is merely treated as a forecasted load



THE CHALLENGE

- Businesses face high electricity costs
- High investments in “smart grid” needed
 - ICT infrastructure
 - Smart metering
 - Peaking power plants
 - Data analytics
- Governments won't reach CO₂ emission targets without demand side energy efficiency measures

Significant potential for reducing peak load

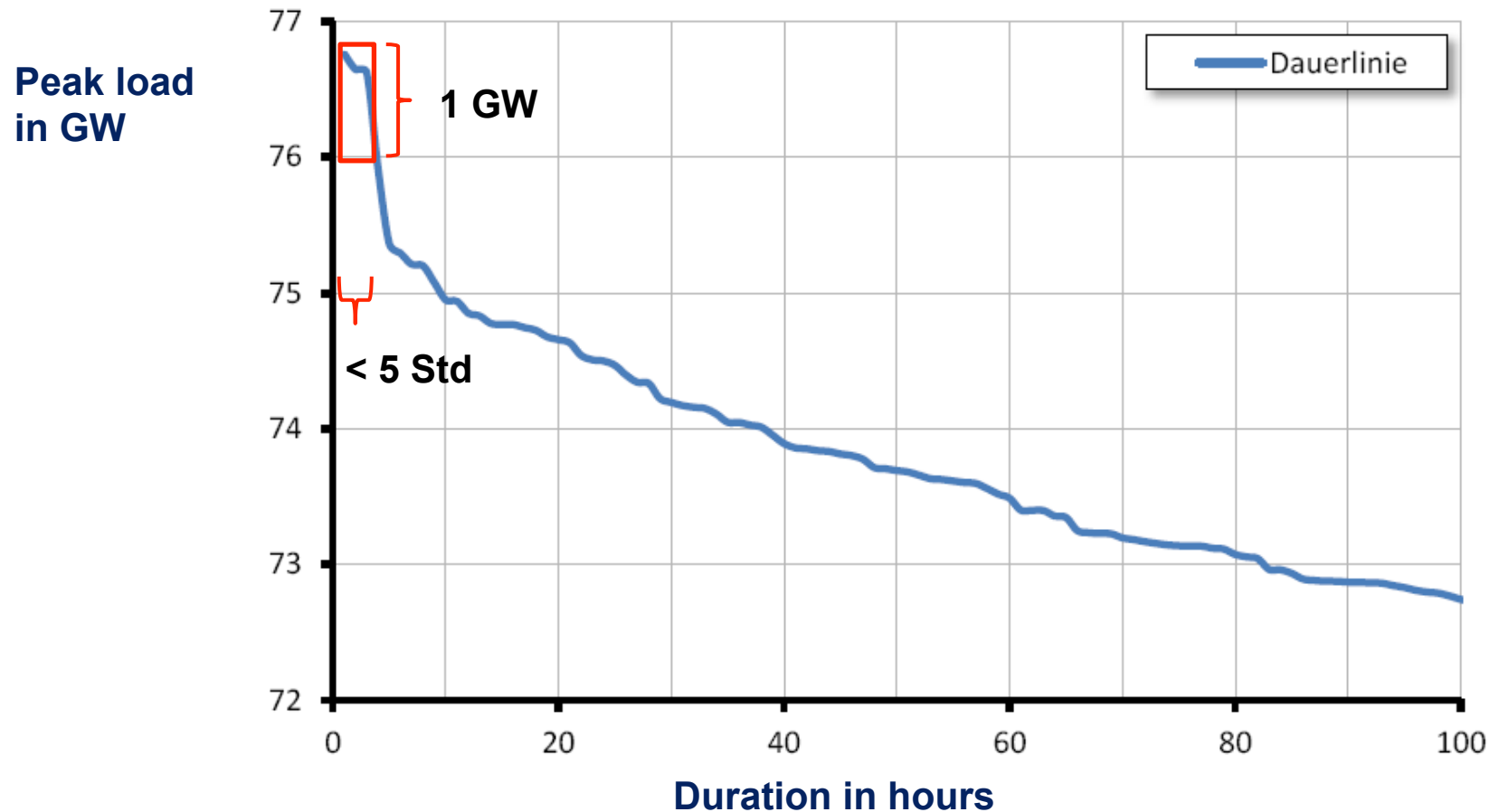


Abbildung 4-4: Dauerlinie der 100 Stunden mit der höchsten Verbraucherlast in Deutschland 2008 /eigene Darstellung nach ENTSOE-01 09/

Demand Response, renewable energy and energy efficiency are the levers to reducing peak load

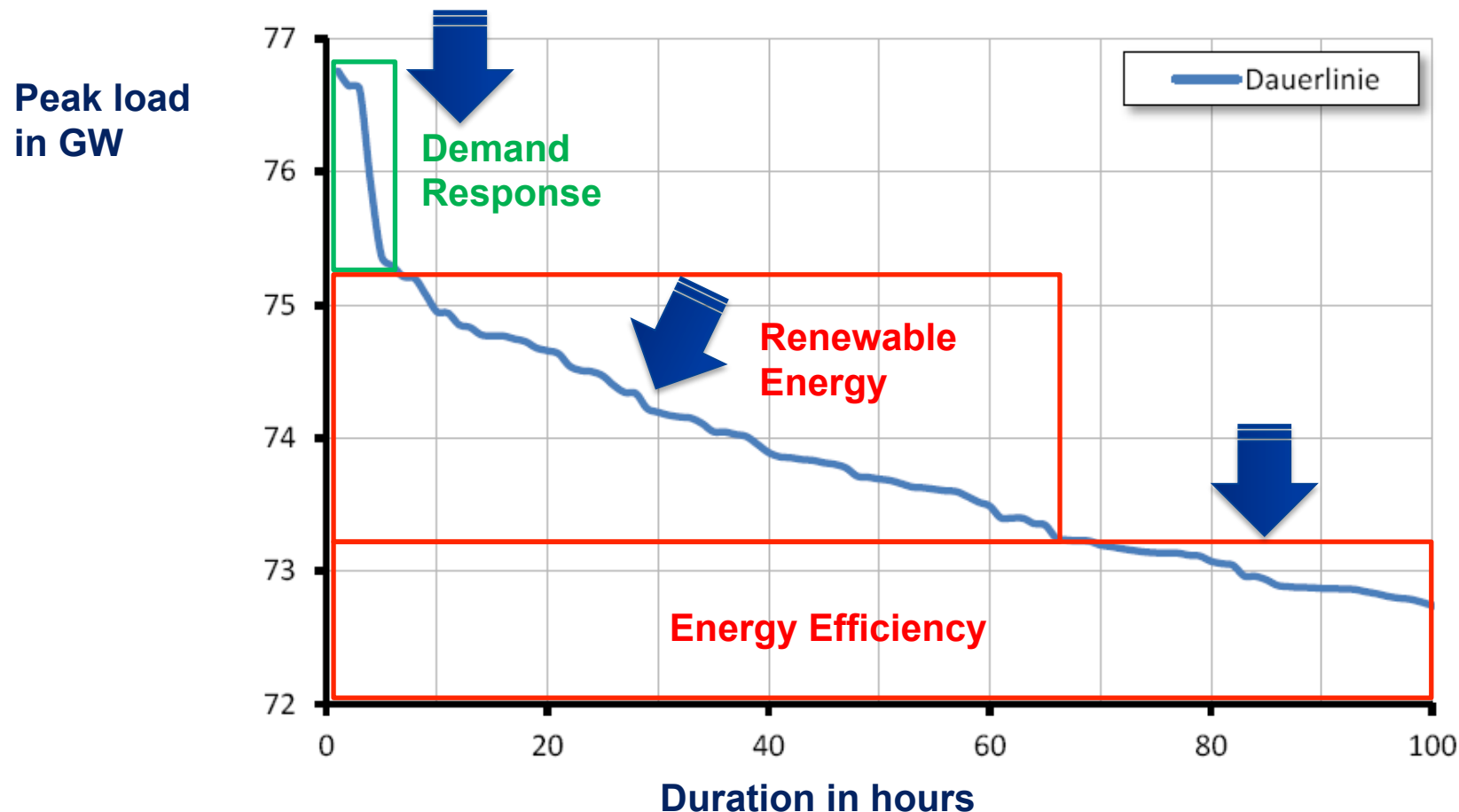
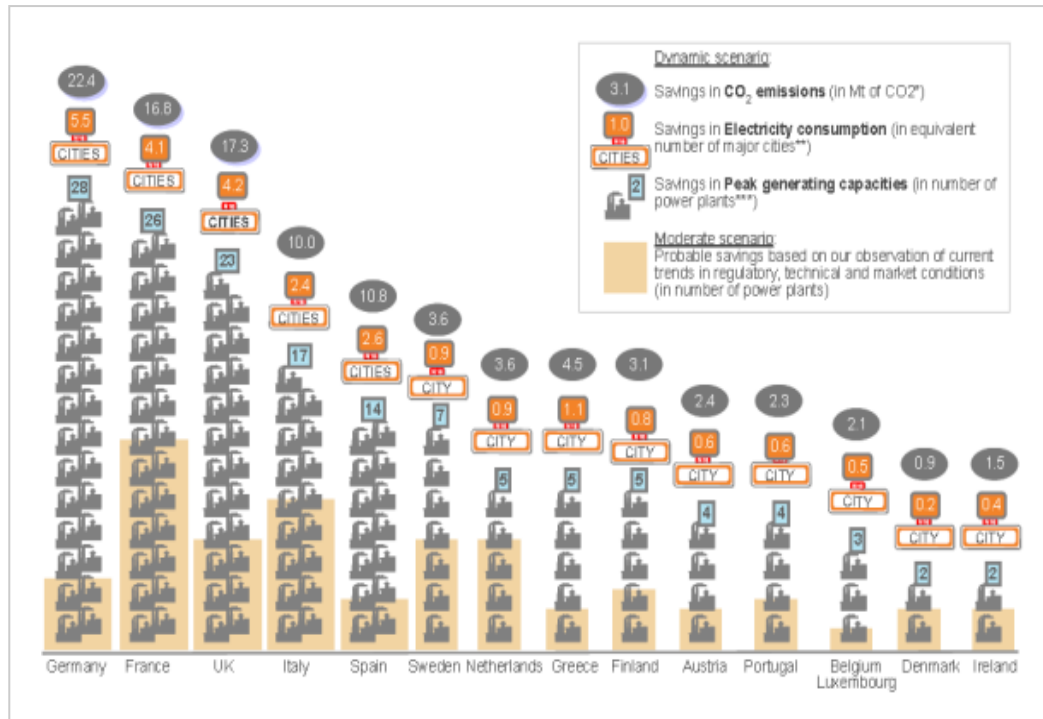


Abbildung 4-4: Dauerlinie der 100 Stunden mit der höchsten Verbraucherlast in Deutschland 2008 /eigene Darstellung nach ENTSOE-01 09/

Demand Response to curb peak load is the proactive and most constructive solution. The graph displays illustrative savings in the EU-15 countries in 2020.

European Market Opportunity



Demand Response is the catchall term for giving energy customers the ability to lower their electricity demand in response to energy curtailment requests (and/or dynamic energy prices)

- DR alone can achieve 25-50% of EU's 2020 targets concerning energy savings and CO₂ emissions ¹⁾
- DR services will provide utilities with *virtual peak power* ³⁾ → no need to build new power plants
- DR lowers the need to invest in peak capacity, thus will take off (CO₂ intense) power plants by actively managing the demand side
- DR Annual energy savings potential of >200 TWh, equivalent to the residential consumption of Germany and Spain ²⁾
- DR will attract customers, as these energy adjustments/reductions will increasingly be conducted in precise, non-intrusive ways.

1)Capgemini "European Energy Markets Observatory" 9ed, Nov 08 and Enerdata 2009 (www.enerdata.fr).

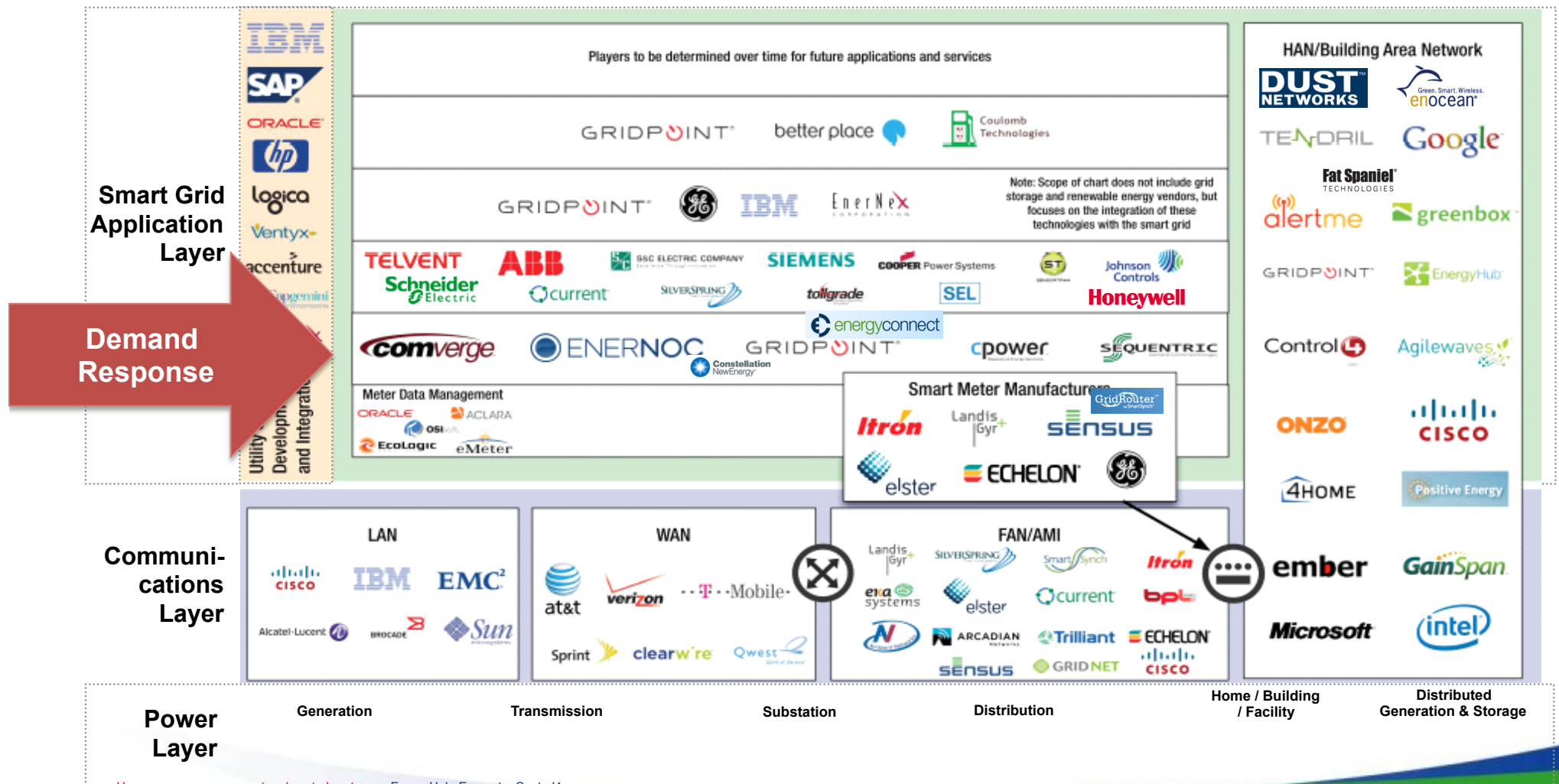
2)Capgemini Study "Demand Response: a decisive breakthrough for Europe", 2008.

3)Serving as a "fifth fuel" to the four traditional fuels: coal, natural gas, nuclear and renewables.



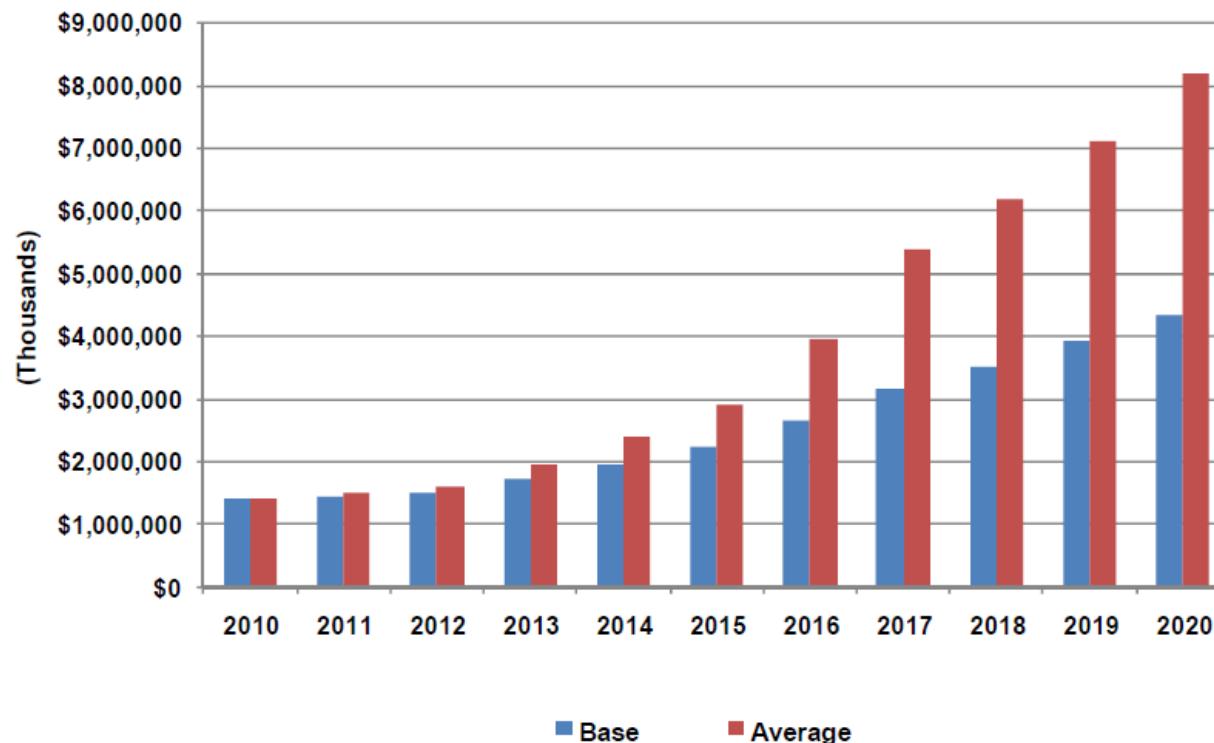
There is already a diverse set of market players, foremost U.S. companies. The demand response market in Europe is substantial and untapped.

Competitive Landscape



Demand Response is predicted to become a US \$2–3 bn market in 2015 in United States only.

Total Demand Response Market Revenue Forecast, Base and Average Scenarios, United States: 2010-2020



(Source: Pike Research)

Demand Response is part of the Vontobel S-BOX Smart Grid Performance-Index

Unternehmen	ISIN	Anfängliche % Gewichtung
Cisco Systems INC	US17275R1023	10,00
Quanta Services INC	US74762E1029	10,00
ITRON INC	US4657411066	10,00
General Cable Corp	US3693001089	10,00
American Superconductor Corp	US0301111086	10,00
ESCO Technologies INC	US2963151046	6,67
ITC Holdings Corp	US4656851056	6,67
SMA Solar Technology AG	DE000A0DJ6J9	6,67
Wasion Group Holdings Ltd	KYG9463P1081	6,67
ENERNOC INC	US2927641074	6,67
Telvent GIT SA	ES0178495034	3,33
ECHELON Corp	US27874N1054	3,33
Pike Electric Corp	US7212831090	3,33
Comverge INC	US2058591015	3,33
Jinpan International Ltd	VGG5138L1004	3,33



Demand
Response



Demand
Response

Demand Response is an established market in the U.S., now expected to reach Europe. 2,000 power plants in the U.S. are redundant; a \$60 billion worldwide market.

Long-Term Market Potential

- "...demand response will generate \$8 billion a year in revenue by 2014, compared with \$1.8 billion in 2008." (U.S.)

Cleantech Group

- Demand Response can reduce U.S. peak demand by 20% (150,000 MW) by 2019
- Thus, eliminate the need for roughly 2,000 peaking power plants

U.S. Federal Energy Regulatory Commission (06/2009)

Projects Savings in Europe through DR by 2020

- 100 TWh (moderate) to 200 TWh (optimistic) scenario
- Peak shaving 5%-9% ("realistic achievable potential") to 15-20% ("maximum achievable potential")

Capgemini Report, 2008

- "...electric power infrastructure expenditures in North America are expected to exceed \$2.65 trillion between 2007 and 2030...
- ...over 10% of the U.S. electric power infrastructure has been constructed in order to meet peaks that occur less than 1% of the time, or approximately 88 hours per year.
- ...the market in North America for reducing demand during these critical peak hours, in place of building supply infrastructure, is \$11.5 billion per year, if the need to build-out infrastructure occurs on an equal annual basis.
- ...the market for eliminating the top 1% of peak demand for electricity worldwide during this same period could be over \$59.2 billion per year."

EnerNOC, 2008
Annual Report

Demand Response is a major step in the energy evolution: sustainable, fast, and capital efficient.

***“Smart Grid will be 10 to 100 times
bigger than the Internet”***

— John Chambers, CEO, Cisco



***“Demand Response is clearly the
‘killer application’ for the Smart Grid”***

— Jon Wellinghoff, Chairman,
U.S. Federal Energy Regulatory Commission

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Entelios AG – A Short History

Transfer and adapt a U.S. business model to Germany

Entelios AG History

2008–09: Inspired by U.S. market: EnerNOC and Comverge

Q4 2009: 3 founders met; inception; team building started

July 2010: Incorporation Entelios AG

Q3 2010: Two angel financing rounds

Q4 2010: Started pilot project with a top 10 German utility

January 2011: Series A financing round

- Yellow&Blue, Netherlands
- Hightech Gruenderfonds

March 2011: Status:

- Stage: in revenue; building out technology platform; winning customer base
- Offices: Munich and Berlin; small team in India

Transfer and adapt a U.S. business model to Germany

Success Factor: Barrier of Entry, Localization

Entelios exploits a high barrier of entry to its home market

- German (European) markets are very different from the U.S.
- European grid infrastructure has been stable
- Regulations are complex; not adapted yet for demand-side technologies
- Entelios investing heavily into building the right business model for Germany
- Entelios builds a solution with a proprietary core software platform and Network Operations Center

Transfer and adapt a U.S. business model to Germany

Success Factor: Timing

Timing

- Germany plans to feed in more and more intermittent renewable energy sources
- Higher demand for reserve power, peak shaving
- E-mobility needs demand-side management
- Symbiosis of the power grid with telecommunications, software and Internet technologies
- Demand-side technologies emerge as the cleanest, cheapest and fastest solutions

Entelios stands for an experienced and successful team of entrepreneurs and engineers

Management Team (Overview)

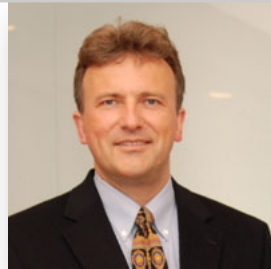
Supervisory Board and Advisory Board

6 experienced managers from the energy industry (Dr. J. Neubarth et al.)

Oliver Stahl (41)
CEO, Sales & Strategy



Tom Schulz (48)
COO, Marketing



Stephan Lindner (45)
CTO, Technology & NOC



Alois Wichtlhuber (50)
Business Development



Thorsten Nicklass (44)
Business Development



Michael Scholvien (36)
Controlling & Processes



Software Development Team, HR- and process support
6+ team members

Entelios:

- Competence in energy
- IT competence
- Telco competence
- Entrepreneurial competence
- Start-ups and exits
- Experts covering wide range of specialty areas
- International experience
- Seniority of founding team
- Excellent network into corporate Germany
- Best sales network

Transfer and adapt a U.S. business model to Germany

Success Factor: People

People, Market Environment, Networking

- Team is experienced in building large-scale software systems, starting and exiting companies
- Important advisory group includes industry and academic experts
- Senior supervisory board
- Relationship building with incumbent market players: Regulatory body (BNetzA), Transmission System Operators (ÜNB), utilities

Demand Response is:

- **Faster**
- **Capital efficient**
- **Green**

Entelios is Demand Response

Contact Details



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