Betrieb von Solarkraftanlagen aus Sicht eines EVU

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Inhalt

- E.ON‘s Renewables Business
- Ausgangslage - Helioenergy
- Technische Zielsetzung
- Betriebswirtschaftliche Betrachtungsweise

Overview E.ON Climate & Renewables

What is E.ON?

- A multi-national utility
- With ~65 GW of power plants under operation
- ~1,700 b kWh of gas sales
- EUR 113 b of revenues
- ~ 78.000 employees
- Germany was original core market
- Now active in ~50 countries; Brazil and Turkey new growth markets

What is E.ON Climate & Renewables?

In short

- EC&R is E.ON‘s global unit responsible for all industrial-scale renewables world-wide

The recent past

- Founded in 2007
- > EUR 9 b invested so far

The present

- > 4.6 GW of power plants under operation
  - Global #3 in wind offshore, #8 in wind onshore
  - Market participant in biomass, PV and CSP
- > 850 employees from ~35 nationalities
- Present in 11 countries

The future

- Significant budget for investments going forward
- Increasing focus on O&M optimization

Helioenergy 1 & 2 – Joint Venture of Abengoa and EON

Key facts

Capacity	50 MW
E.ON share	50%
Production	106 Mio kWh/y
enough for	26.000 homes

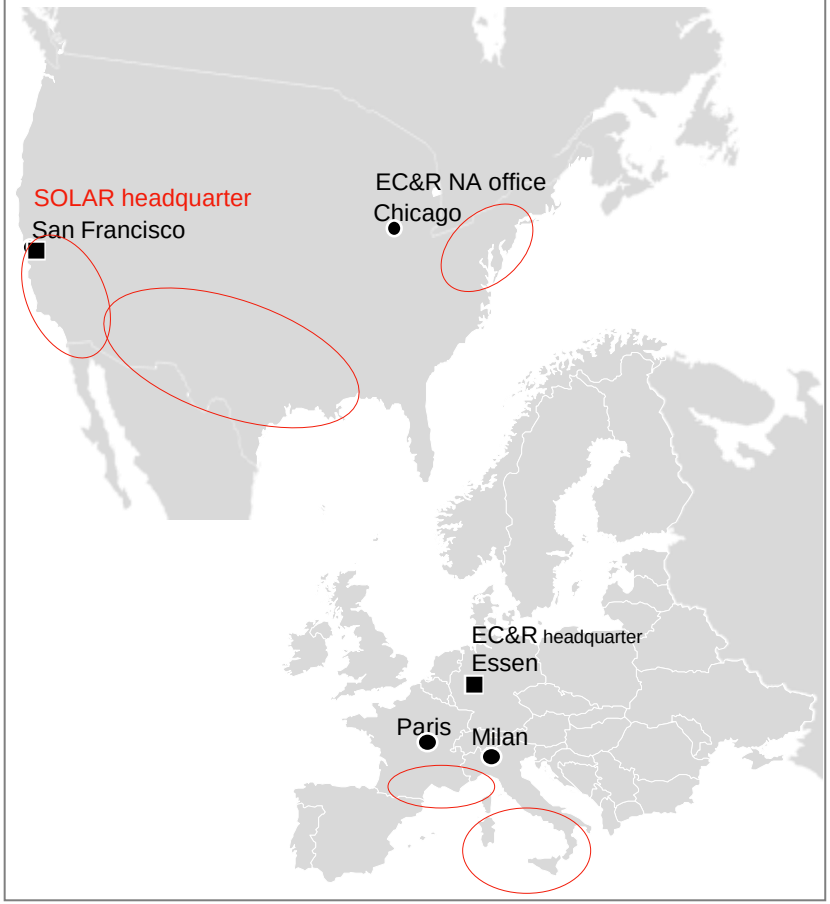
Status	Operational
Construction from	02/2010
COD	09/2011
Investments	285 Mio €

Good to know

- Availability is close 98 %
- Production is above expectation
- Provides dispatchable power
- Uses gas to stabilize generation

PV Projects and Operations at a Glance

Solar locations and focus areas



Key facts

SOUTHERN EUROPE

- 57 MW capacity installed in France and Italy, operated with average 99.2% availability
- Largest plants (18 + 11.2 MW) at the E.ON power plant site Fiumesanto (Sardinia)
- 87 GWh electricity produced in 2012
- Demonstrated CAPEX reduction: 50% wrt 2010
- Application of the EC&R HSSE framework

USA

- PV HQ since 1/09
- First project online, second in construction (20 MW total)
- 350 MW pipeline
- Ambition to significantly grow capacity

Note Project portfolio MW as of 30 October 2012, rounded

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Ausgangslage - Helioenergy

Input variables in Operations

- Increase Production from 91 GWh to 105 GWh
- Decrease O&M Costs from 80€/MWh to 30€/MWh
- Optimize production in a changing regulatory regime

-> KPI‘s to control EBITDA

HSSE	Production & Maintenance	Economics
LTI	Gross Production	Revenues
W&T cards	Net Production	O&M cost
HSSE program	Parasitics On-line	GNL cost
CO2 emisions	Parasitics Off-line	EBITDA
Environmental incident Cat. 1,2 y 3	GNL consumption	MWhe cost produced (Ebitda level)
Amount in tons of hazard wastes generated	Water Consumption	
PH (Output Efluent)	Raw water consumption (specific)	
SOLID SUSPENSION H1	Demi water consumption (specific)	
D.Q.O.		
FREE RESIDUAL CHLORINE		
A. O. X.	HCE breakage	
PH (Output Refrigeration System Purging)	Mirrors breakage	
TEMPERTURE	Reflectivity	
CONDUCTIVITY	Repaired fault notifications	
CONDUCTIVITY. (Upstream)	Corrective / Preventive	
CONDUCTIVITY. (Downstream)		

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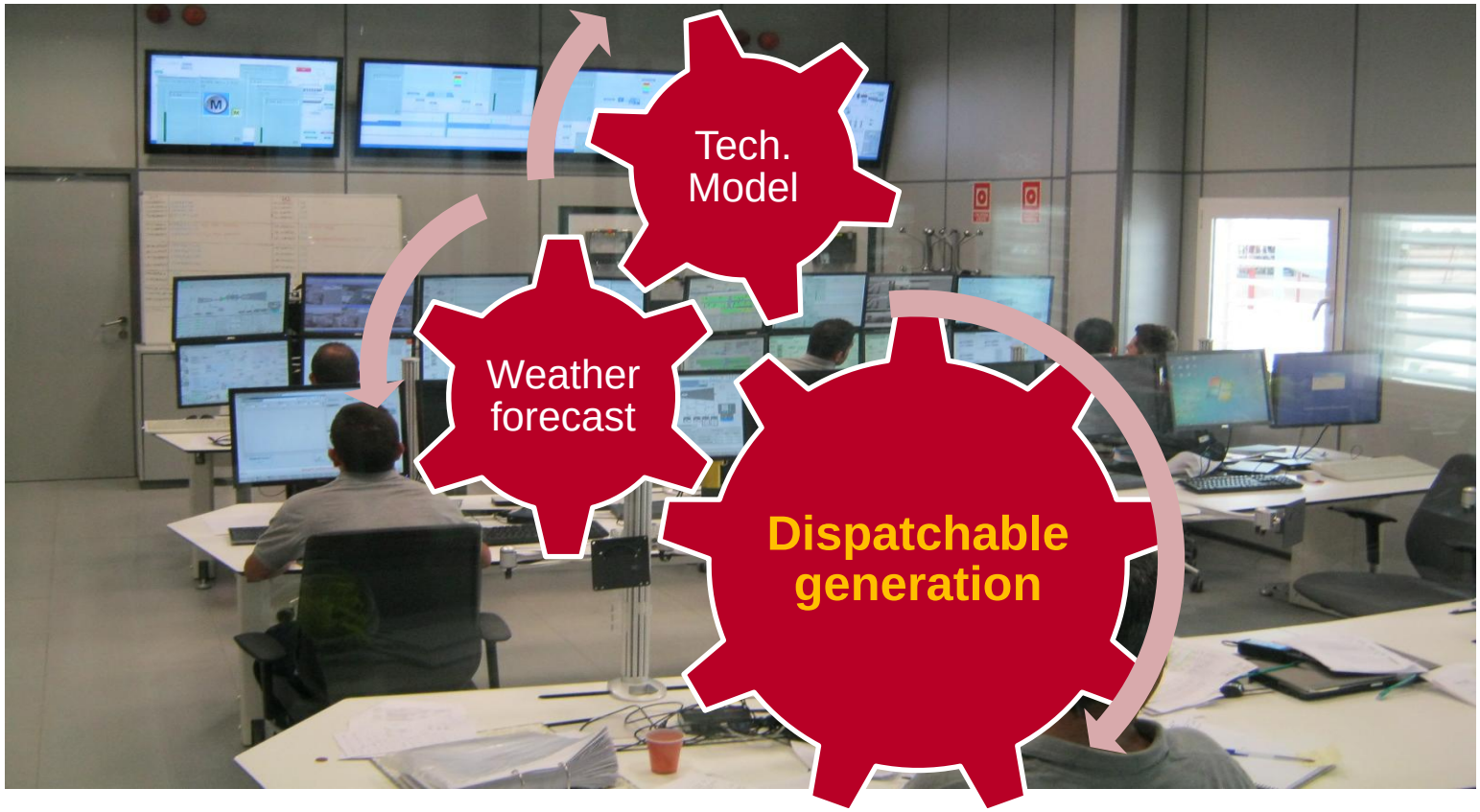
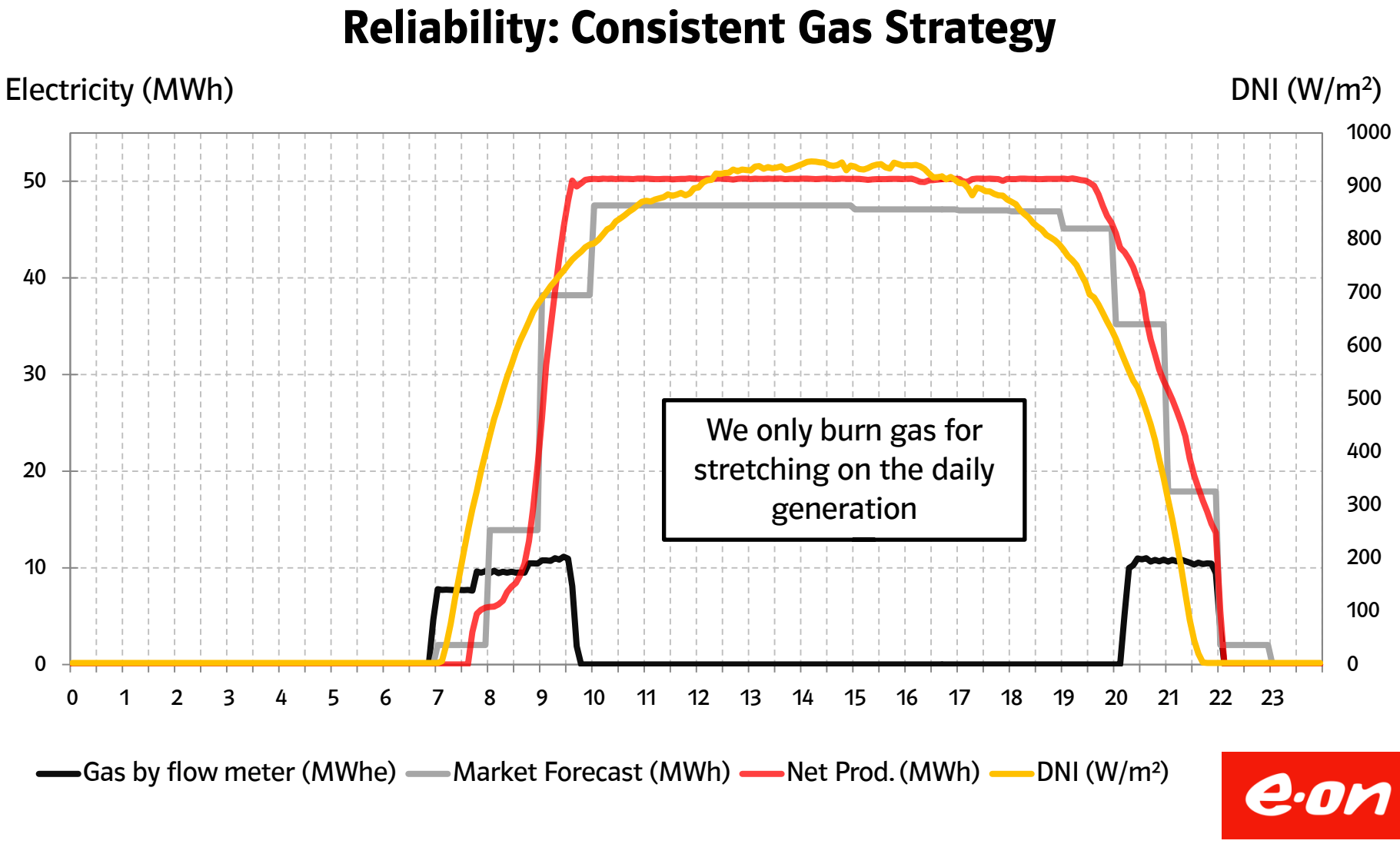
Technische Zielsetzung

Reliable Operation

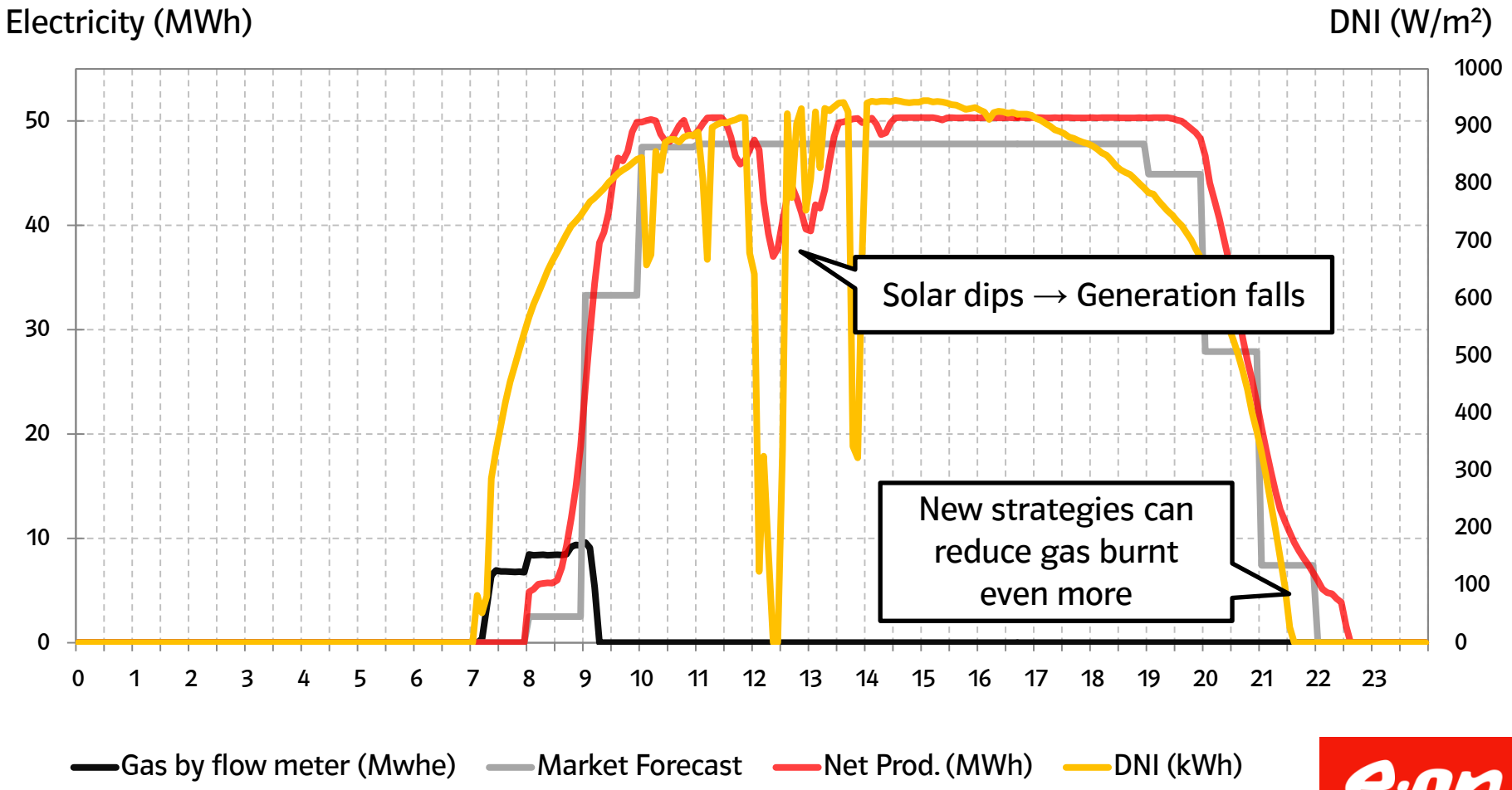


Technische Zielsetzung - Vorhersage der Erzeugung



Technische Zielsetzung –
Vermeidung von Erzeugungsschwankungen

Reliability: Consistent Gas Strategy



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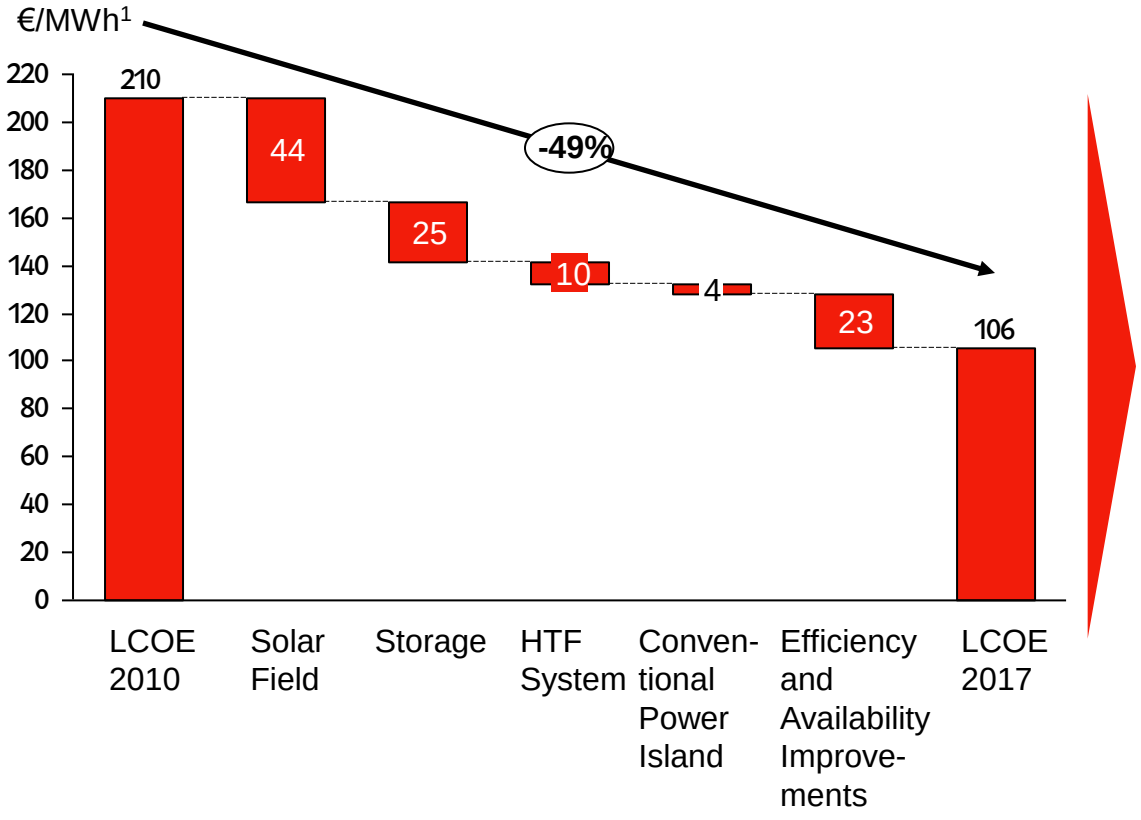
NREL expects significant cost reduction in the mid term by making use of scale, innovation and margin reduction

Major CSP cost reduction drivers[1]



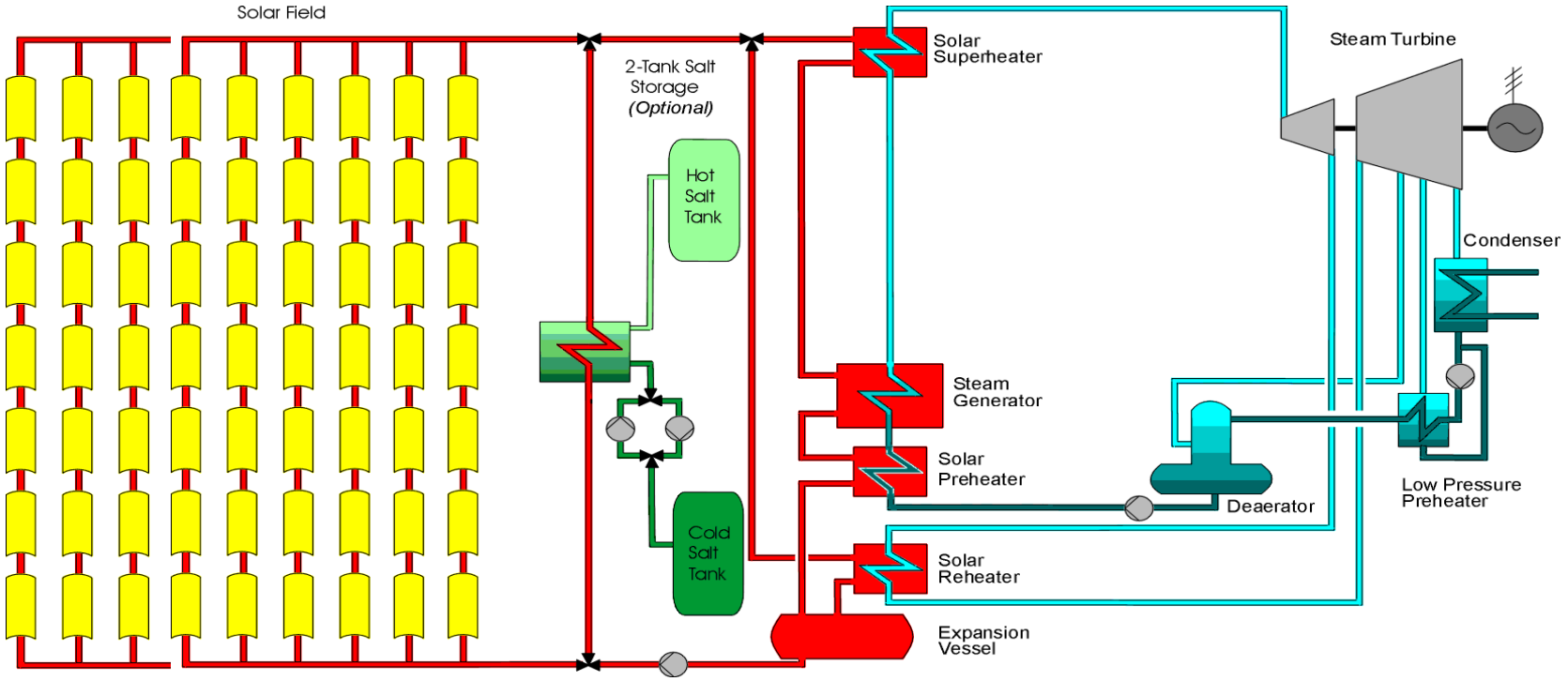
Examples for identified levers

- Solar Field:
  - Larger plants → scale savings
  - Larger aperture troughs
  - Improved collector and foundations design
  - Thin glass/reflective film mirrors
- Storage:
  - Improved and lower cost fluids (molten salt)
  - Switch to single tank system (instead two tanks)
- An additional upside is to be expected in developing countries due to lower labour costs
- ~1000 FTE needed for construction of 50MW plant, >70% of these locals

1 Based on NREL Cost Reduction Plan 2010 (Trough Technology)

CSP Plant Lay-Out with Storage

50MW and 7h Storage costs 290mio € (SF+TES 240mio, PB 50mio)



Solar Field or 25 year gas contract

Power Block CSP = Gas

The Gas Price Influences Competitiveness of CSP

			Capex PB 2009	50.000.000	50.000.000	50.000.000
			Capex SF 2009	190.000.000		50.000.000
			Capacity im MW	50	50	50
			Capex improvement per year	4,5%	0,0%	0,0%
			annual power volume in MWhe by sun	175.000		100.000
			annual power volume in MWhe by gas		175.000	75.000
			corresponding annual gas volume in MWhgas		336.538	187.500
			corresponding CO2 at 6 €/t		630.000	270.000
		Year	**Gas Price €/MWh**	**Capex CSP (SF&STE)**	**Value Gas Contract + CO2 for 25y**	**Value PV + Gas + CO2**
		2009	20	240.000.000	234.019.231	200.500.000
		2010	21	229.200.000	242.432.692	205.187.500
		2011	22	218.886.000	250.846.154	209.875.000
		2012	23	209.036.130	259.259.615	214.562.500
		2013	24	199.629.504	267.673.077	219.250.000
		2014	25	190.646.176	276.086.538	223.937.500
		2015	26	182.067.099	284.500.000	228.625.000
		2016	27	173.874.079	292.913.462	233.312.500
		2017	28	166.049.746	301.326.923	238.000.000
		2018	29	158.577.507	309.740.385	242.687.500
		2019	30	151.441.519	318.153.846	247.375.000
	60%	2020	31	144.626.651	326.567.308	252.062.500

Capex reduction of CSP makes it competive to gas plants

The Gas Price Influences Competitiveness of CSP

		Opex	90	10	10
		Improvemer	10,00%		
CSP Opex	**Year**	**Gas Price €/MWh**	**CSP + Opex**	**Gas only + Opex**	**PV + Gas + Opex**
81,00	2009	20	135,86	63,49	55,83
72,90	2010	21	125,29	65,41	56,90
65,61	2011	22	115,64	67,34	57,97
59,05	2012	23	106,83	69,26	59,04
53,14	2013	24	98,77	71,18	60,11
47,83	2014	25	91,41	73,11	61,19
43,05	2015	26	84,66	75,03	62,26
38,74	2016	27	78,48	76,95	63,33
34,87	2017	28	72,82	78,87	64,40
31,38	2018	29	67,63	80,80	65,47
28,24	2019	30	62,86	82,72	66,54
25,42	2020	31	58,48	84,64	67,61

However, Opex of CSP is still too high to replace gas to power.
Pari would be reached at 40€/MWh Opex and 31€/MWh for gas

Zusammenfassung

- Zielsetzung der EVU‘s ist zu minimalen Kosten Strom zu erzeugen
- EVU‘s vermeiden finanzielle und technische Risiken
- Optimierung wird durch Verbesserung der Arbeitsprozesse erreicht
- Kostenoptimierung bei bestehenden CSP Anlagen ist begrenzt
- Ertragsaussichten für CSP Analgen wird als schwierig eingestuft