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Renewable energy application in o&g fields

Fuel gas substitution in production site

San Donato Milanese, 18.10.2017

The Basis

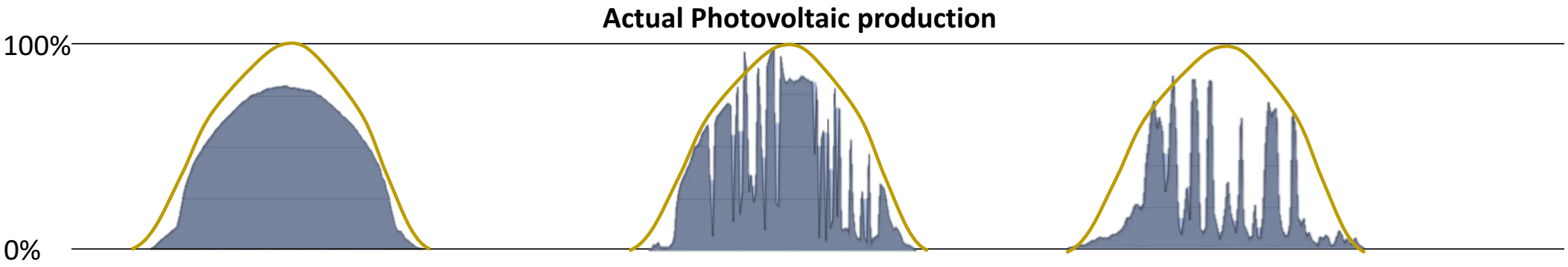
Project framework

- *Oil & Gas production site (North Africa)*
- *53 GWh: yearly power consumption of site*
- *Self-standing site:*
  - *2 x 100% genset*
  - *Feed with plant produced gas*
  - *Required availability for power generation: 98%*
- *Oil&Gas production ruled by PSA (cost recovery mechanism)*
- *Profitable sale gas tariff*
- *Performance*
  - *eHR:* *13,274 kJ/kWh$_e$*
  - *FG consumption:* *0,352 Sm3/kWh$_e$ (18,7 MMSCM/year)*
  - *CO2 production:* *0,749 kg/kWh$_e$ (39,7 ktonn/year)*

Renewable Source Selection

- *Availability of land area for PV field installation*
- *Good productivity for PV tecnology*
- *Good fit with power requirement*

PV Application: the Challenge



- *Sudden variation of solar source could generate unpredictable loss of power leading to plant shutdown and associated loss of production*
- *New generation concept is to be capable to manage the unpredictability of renewable source and ensure the availability requirement to support site production*

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Screened Scenarios

100%

Power requirement fully generated by PV plant, conventional generation totally removed

- *System composed by PV plant and storage*
- *Storage system sized to cover sudden variation and long-term solar source unavailability ("no-sun" day, night shift, etc.)*
- *PV plant sized to provide power to users and to ensure refill of storage system*

Minimal

Power mainly by conventional source, renewable limited by flexibility requirement

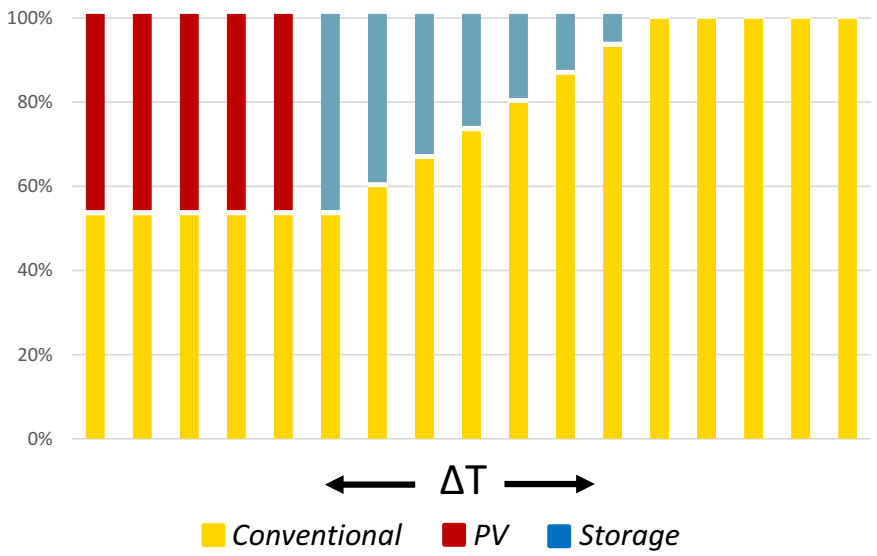
- *Conventional generation run in parallel with PV*
- *PV sized in order to not overcome conventional generation capability to handle sudden variation (typically, 5÷15% of total load)*
- *No storage required*

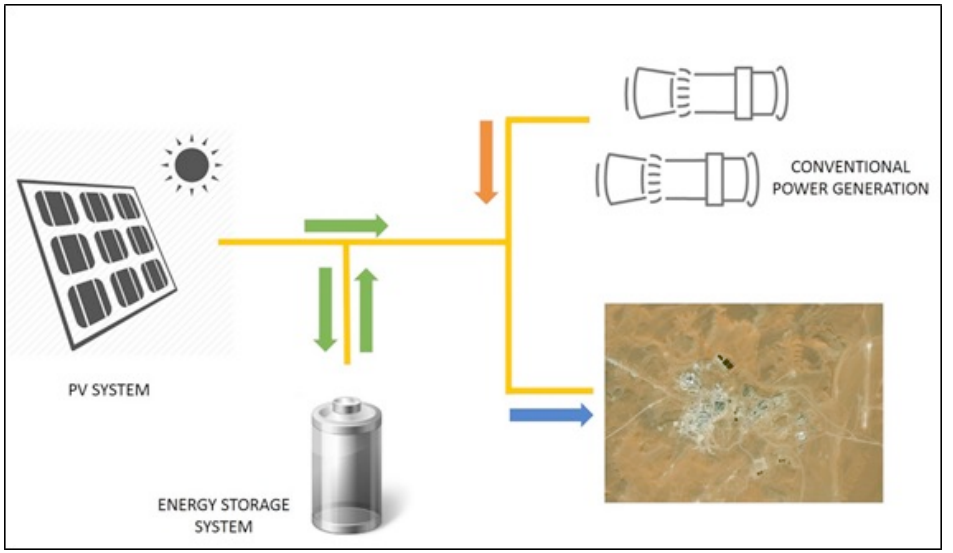
Hybrid

Conventional generation run at minimum, storage to cover sudden variation

- *Conventional generation run in parallel with PV*
- *Conventional generation run at minimum turndown to be ready for night shift and to cover daily sudden solar source unavailability*
- *PV sized to fill the gap with total load requirement*
- *Optimized storage provided to handle transient when renewable run off and conventional generation ramp up to cover full load demand*

The Solution





- *Network stability analysis determine the optimized storage sizing according with considered power system specific dynamic behavior*
- *Availability of hybrid generation system relies on EMS (Electrical Management System) to be designed in order to withstand the transient scenarios and manage the three power sources (conventional, PV, storage)*

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Case Study Findings

DATA	• 53 GWh/year • 98% availability				
	EXISTING plant		*HYBRID Solution*		
FACILITIES *(additional for Hybrid)*	• *2x100% x 8,0 MW GenSet*		• *5,0 MW_p PV Plant* • *0,5 MWh Storage* • *Enhanced EMS*		
PERFORMANCE	• eHR:	13 274 kJ/kWh_e	• eHR:	11 119 kJ/kWh_e	
	• FG consumption:	0,352 Sm^3/kWh_e (18,7 MMSCM/y)	• FG consumption:	0,295 Sm^3/kWh_e (15,6 MMSCM/y)	(Δ=16,2%)
	• CO_2 Production:	0,749 kg/kWh_e (39,7 ktonn/year)	• CO_2 Production:	0,627 kg/kWh_e (33,3 ktonn/year)	
COST	-		8÷10 M€		

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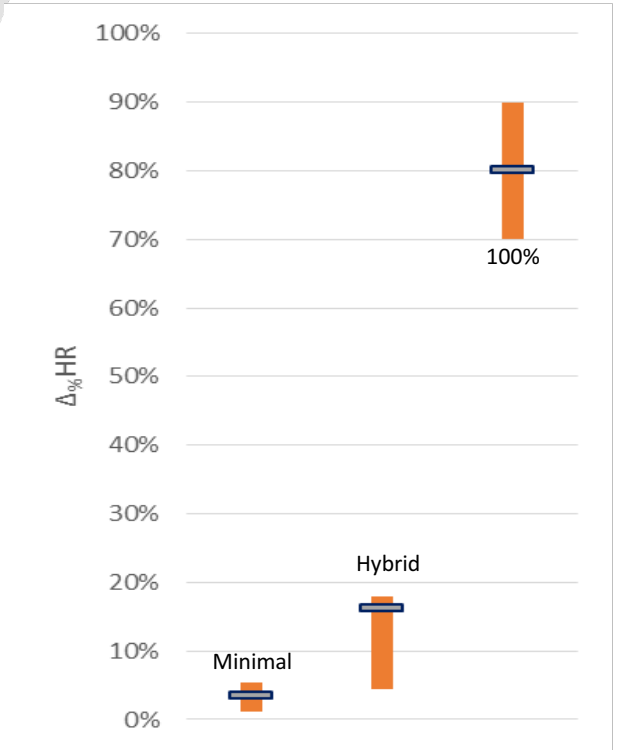
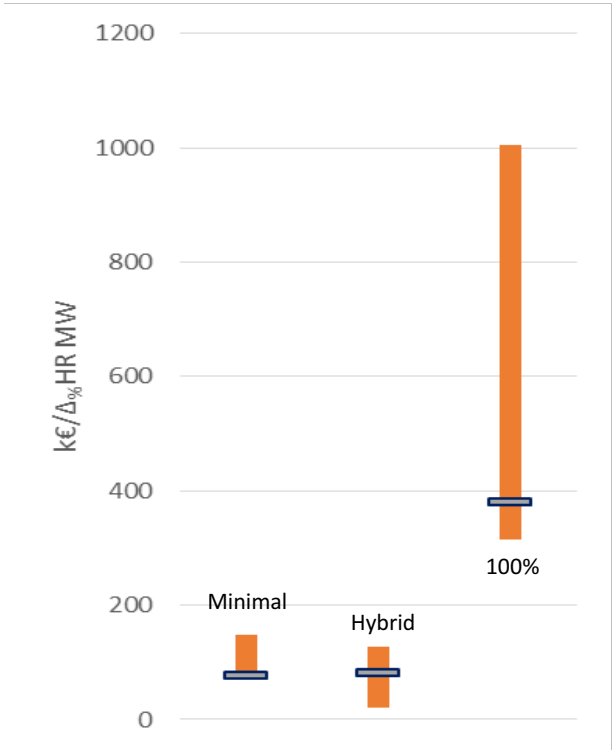
Overview on other scenarios



Δ%HR	Minimal	Hybrid	100 %
Range	1,1÷5,4%	4,4÷17,9%	70÷90%
Study	3,5%	16,2%	80%



K€/ Δ%HR MW	Minimal	Hybrid	100 %
Range	72÷148	21÷127	314÷1006
Study	77	82	379

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