

Enapter Finance Workshop

Solar Hydrogen

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LCOE Levelized cost of Electricity

Source Wikipedia

The levelized cost of electricity (LCOE), also known as Levelized Energy Cost (LEC), is the **net present value of the unit-cost of electrical energy over the lifetime of a generating asset.**

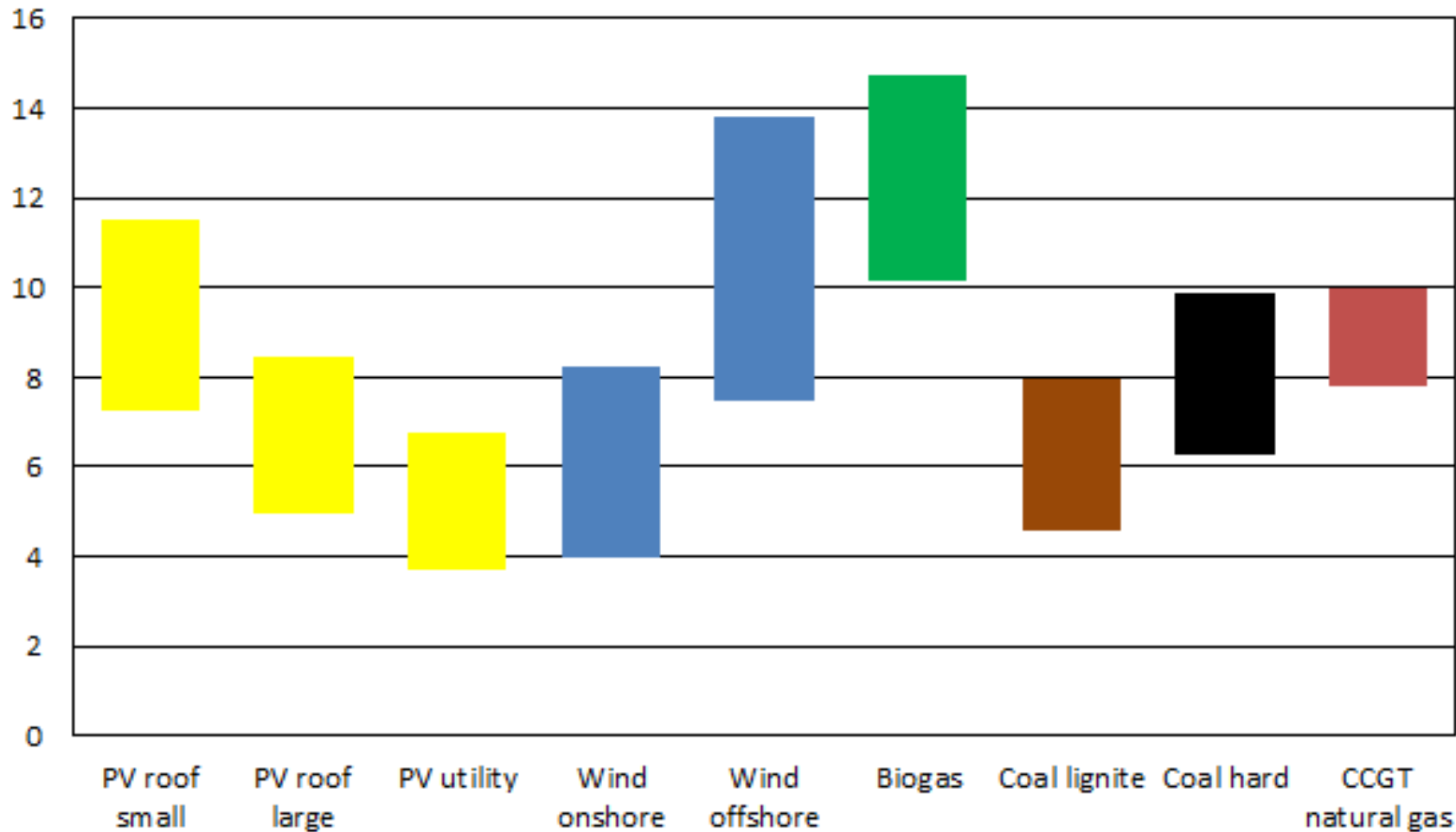
It is a first-order **economic assessment of the cost competitiveness of an electricity-generating system** that incorporates all costs over its lifetime: initial investment, operations and maintenance, cost of fuel, cost of capital.

The levelized cost is that value for which an equal-valued fixed revenue delivered over the life of the asset's generating profile would cause the project to break even.

Typically the LCOE is calculated over the design lifetime of a plant, which is usually 20 to 40 years, and given in the units of currency per [kilowatt-hour](#)

Levelized cost of electricity for Germany

in EuroCent/kWh, source: Fraunhofer ISE; March 2018

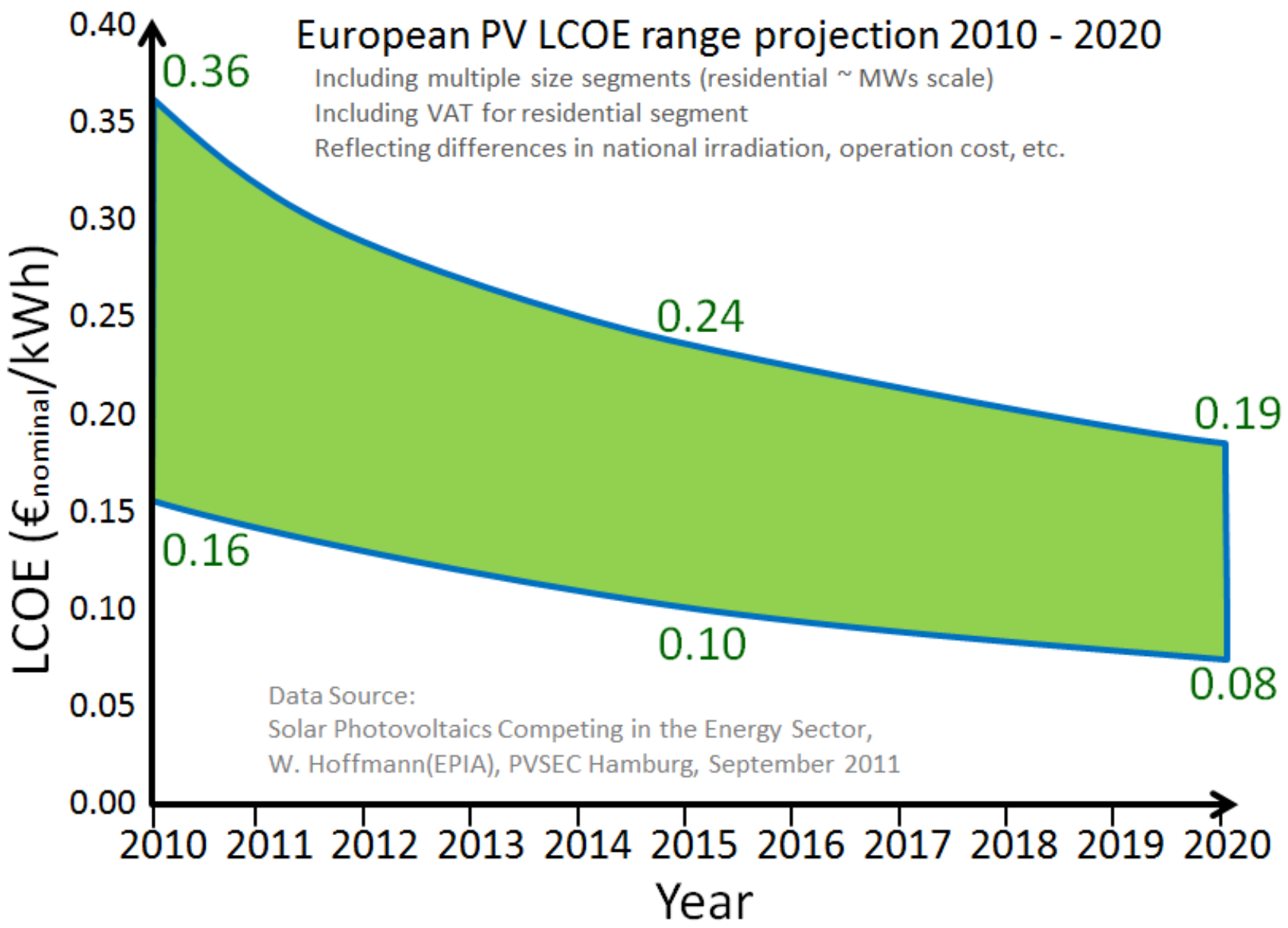


German LCOE in €/MWh

Technology		ISE (2013)		ISE (2018)	
		Low cost	High cost	Low cost	High cost
Coal-fired power plants	brown coal	38	53	46	80
	hard coal	63	80	63	99
CCGT power plants		75	98	78	100
Wind Power	Onshore wind farms	45	107	40	82
	Offshore wind farms	119	194	75	138
Solar	PV systems	78	142	37	115
Biogas power plant		135	250	101	147

Source: Fraunhofer ISE (2013) – Levelized cost of electricity renewable energy technologies^[51]

Source: Fraunhofer ISE (2018) – Stromgestehungskosten erneuerbare Energien^[50]



Solar Grid Parity 2019 – even in China

While previous studies of nations [such as Germany](#) and the US have concluded that solar could achieve grid parity by 2020 in most developed countries, some have suggested China would have to [wait decades](#).

However, the [new paper](#) published in [Nature Energy](#) concludes a combination of technological advances, cost declines and government support has helped make grid parity a reality in Chinese today.

In their paper, [Prof Jinyue Yan](#) of Sweden's [Royal Institute of Technology](#) and his colleagues explain that this “stunning” performance has been accelerated by government subsidies, but has also seen China overinvesting in “redundant construction and overcapacity”.

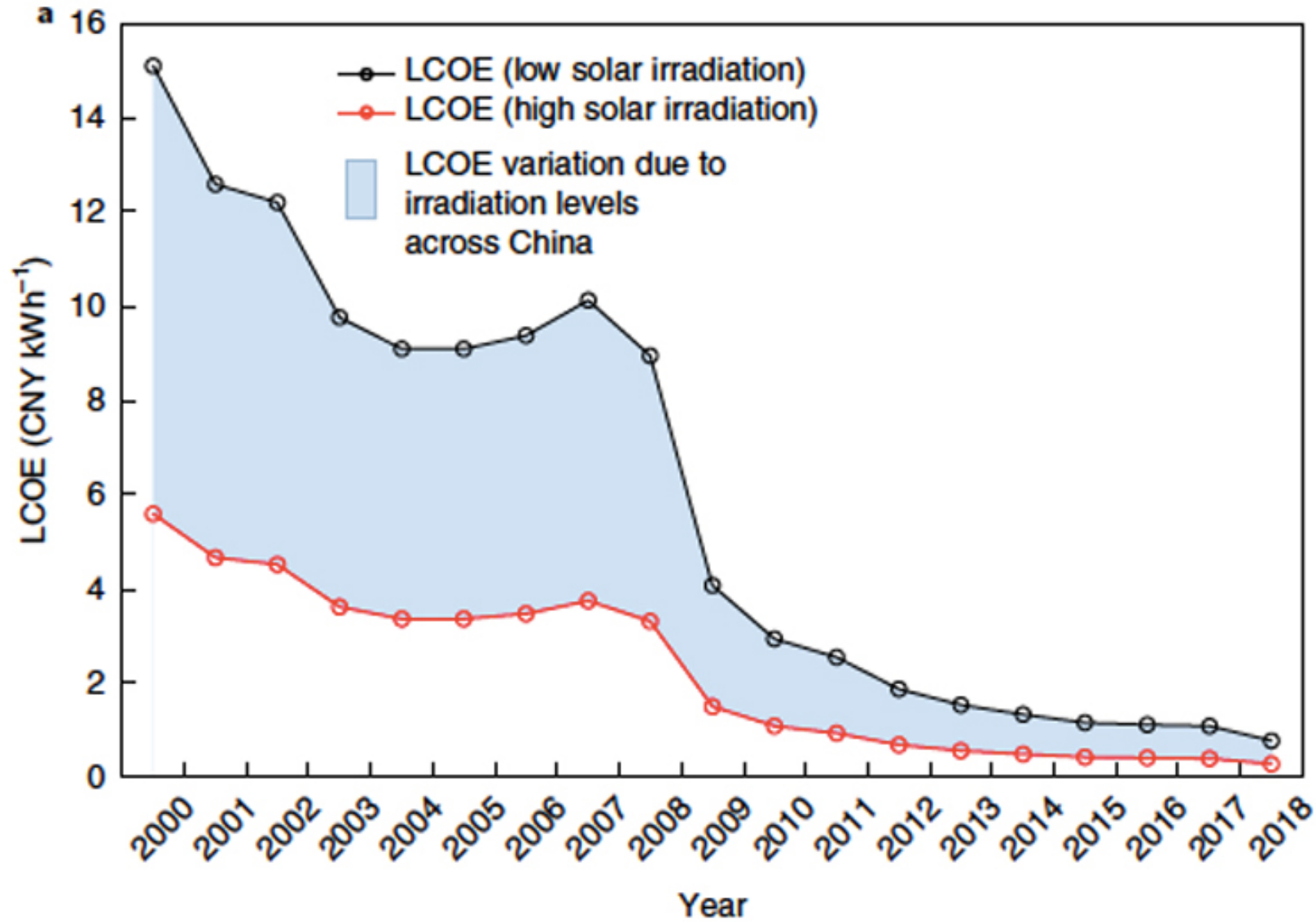
Solar Grid Parity – even in China

Abstract

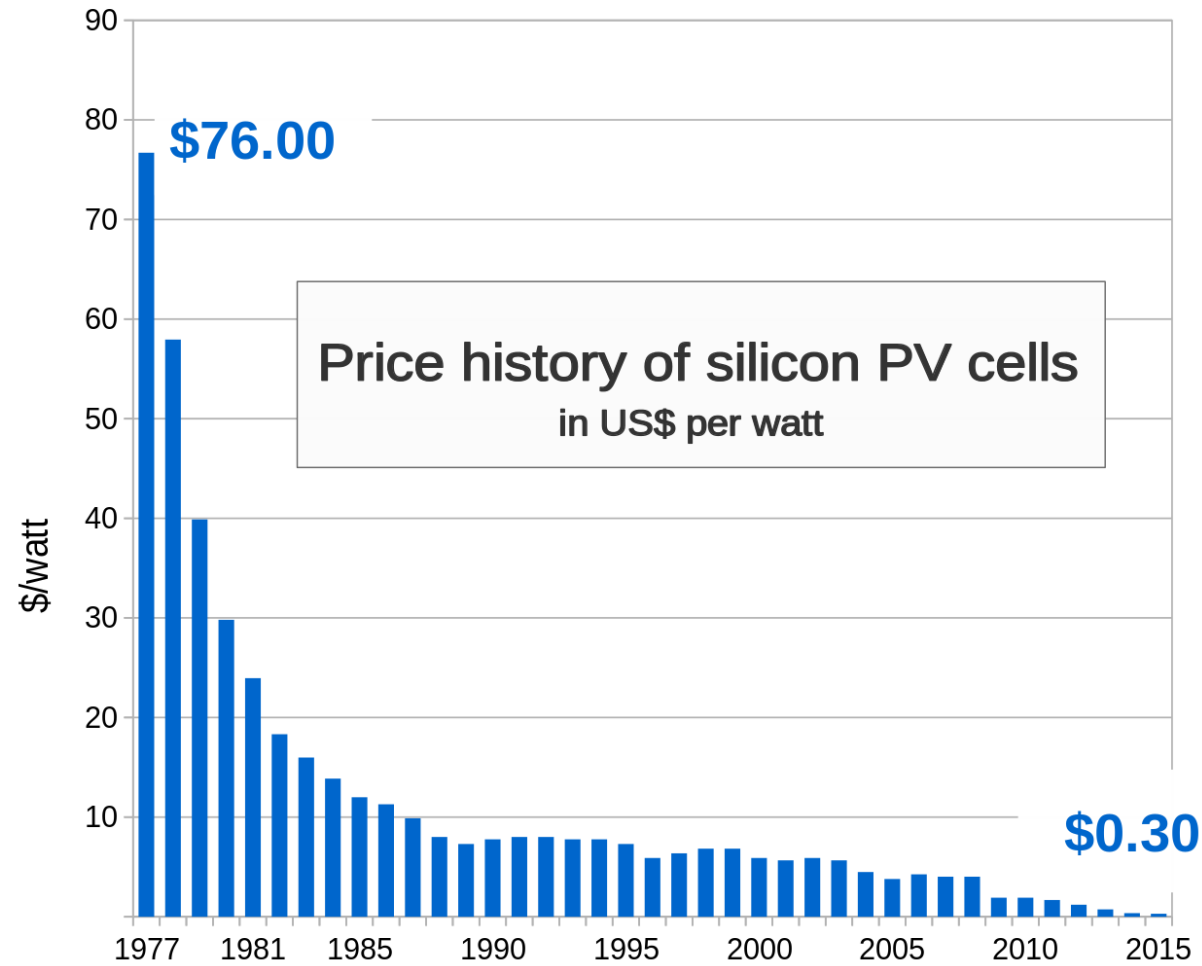
In recent years, China has become not just a large producer but a major market for solar photovoltaics (PV), increasing interest in solar electricity prices in China. The cost of solar PV electricity generation is affected by many local factors, making it a challenge to understand whether China has reached the threshold at which a grid-connected solar PV system supplies electricity to the end user at the same price as grid-supplied power or the price of desulfurized coal electricity, or even lower.

Here, we analyse the net costs and net profits associated with building and operating a distributed solar PV project over its lifetime, taking into consideration total project investments, electricity outputs and trading prices in 344 prefecture-level Chinese cities.

We reveal that all of these cities can achieve—without subsidies—solar PV electricity prices lower than grid-supplied prices, and around 22% of the cities' solar generation electricity prices can compete with desulfurized coal benchmark electricity prices.



PV Cell Price 1977 - 2019



Source: Bloomberg New Energy Finance & pv.energytrend.com

Solar kWh 2019

Cambodia tender secures lowest solar power price in Southeast Asia

- The Asian Development Bank-backed procurement round attracted 26 bidders for the 60 MW project, according to the development lender.
- Cambodia's first solar auction has set an electricity price the [Asian Development Bank](#) (ADB) says is a record low for [Southeast Asia](#) of

\$0.03877/kWh

Solar kWh 2019

Uzbekistan tender secures world's lowest solar

- International Financial Corp (IFC), which is advising the Uzbek government on the tender process,
- The project is being financially supported by the **Austrian** Ministry of Finance, **Switzerland's** State Secretariat for Economic Affairs and the government of the **Netherlands**.
- The energy utility accepted submissions from 23 companies from Europe, Asia and the Middle East, the IFC said in March last year.
- Masdar wins Uzbekistan's 100 MW PV tender with lowest bid of

\$0.027/kWh

Solar Hydrogen System 2019

Enapter System Total Production				
kWh	122,100			
Lifetime	20	years		
Total load kWh	891330			
Euro/kWh	€ 0,37	฿ 14,15		\$0,41

Solar Hydrogen System 2024

Enapter System Total Production				
kWh	122,100			
Lifetime	20	years		
Total load kWh	891330			
Euro/kWh	€ 0,13	฿ 5,11		\$0,15

Solar Hydrogen System 2019 - 2024

Year		2019	2021	2024	2026		
Hydrogen Cost ex Ops	Enapter Hydrogen	EL 2.0	EL 4.0	EL 4.0 mass	EL 4.1 mass		
	CAPEX Electrolyzer	10.000	8.000	5.000	2.000	Euro	
	estimated life-cycle in hours	35.000	35.000	35.000	38.000	Hours	
	Capacity Nm3/hr	0,5	0,5	0,5	0,5	Nm3	
	Unit in kg	1	1	1	1	kg	
	1kg Hydrogen in Nm3	11,1	11,1	11,1	11,1	Nm3	
	Cost per kg	6,34	5,07	3,17	1,17	Euro	ex Rate E/USD
	Cost per kg	6,98	5,58	3,49	1,29	USD	1,1
Total Hydrogen System	Total System in EUR	0,37			0,13	kWh	
	Total System in USD	0,41			0,15	kWh	
Solar System	Price of Solar kWh	0,038				kWh	
		0,027					
Total Cost for Solar Hydrogen					0,15	kWh	



Together

We will revolutionize the way
people produce, store and use
energy.