



Driving installed costs down towards grid parity

CEEA 2010

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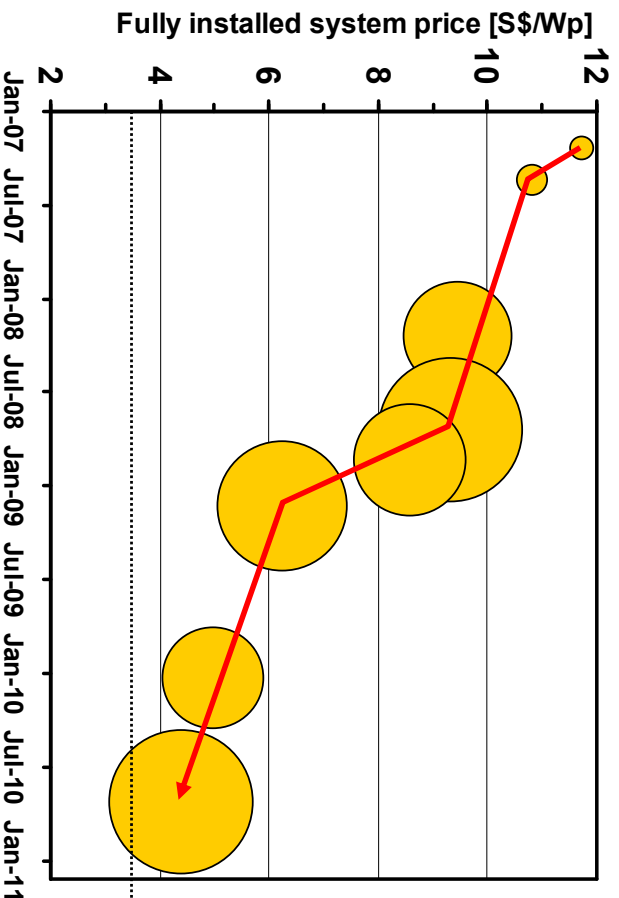
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Towards grid parity - contents

- **PV soon commercially viable in Singapore**
- Cost reduction potential throughout the system
- Conclusions

Installed system prices approaching grid-parity in Sgp

Combined effects of scale, cheaper modules, AND lower installation costs



At installed prices of S\$3.50/Wp we will be in grid parity territory

Source: Phoenix Solar commercial projects and GeBiz tenders. Prices at time of final offer (not at installation)

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PV power plant is viable at price of SGD3.50/Wp PV power plants yield an extremely reliable revenue stream!

- Annual energy per kWp from well-exposed rooftop system is 1'250-1'400kWh
- Installed cost of 500kWp rooftop system approx S\$2.5m today
- “Grid parity” likely by around 2014 in Singapore

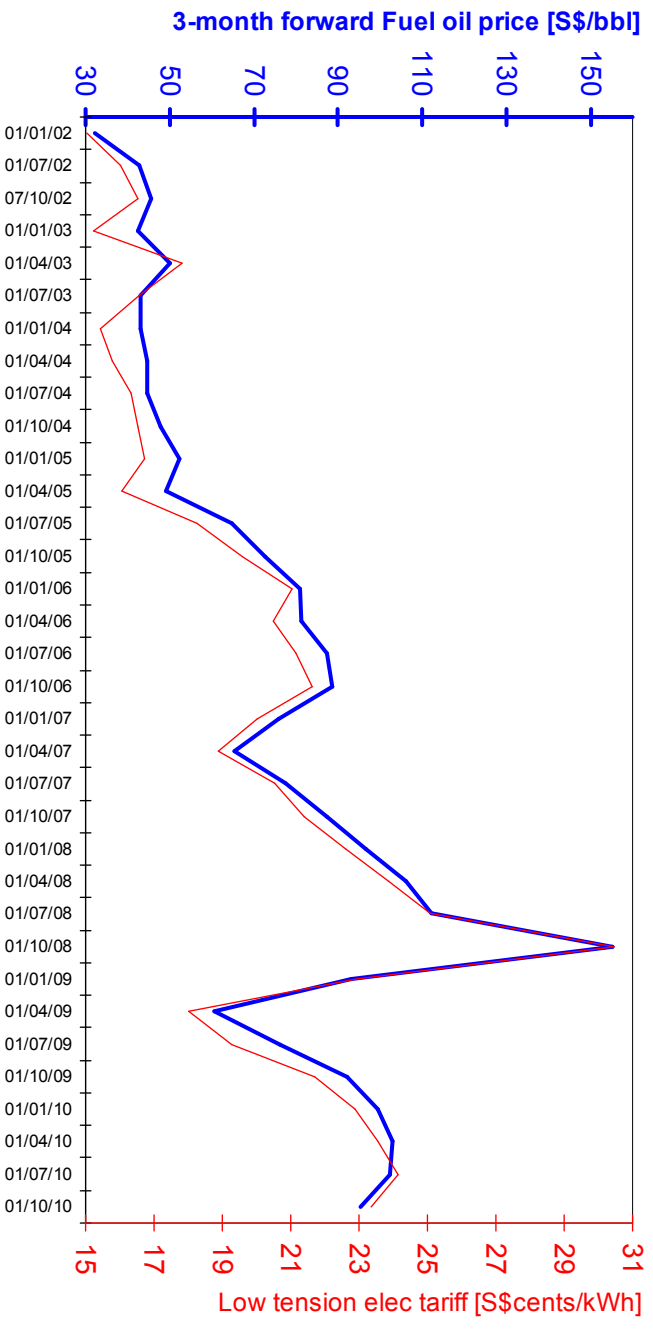
Payback period in years

	1'250kWh/kWp		1'400kWh/kWp	
	S\$5.00/Wp	S\$3.50/Wp	S\$5.00/Wp	S\$3.50/Wp
Retail tariff S\$0.20/kWh	20	14	17	12
Retail tariff S\$0.25/kWh	16	11	14	10
Retail tariff S\$0.30/kWh	13	9	12	8

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Retail tariffs will rise as global economy recovers

Electricity generation costs closely linked to fuel costs



Data: SP Services

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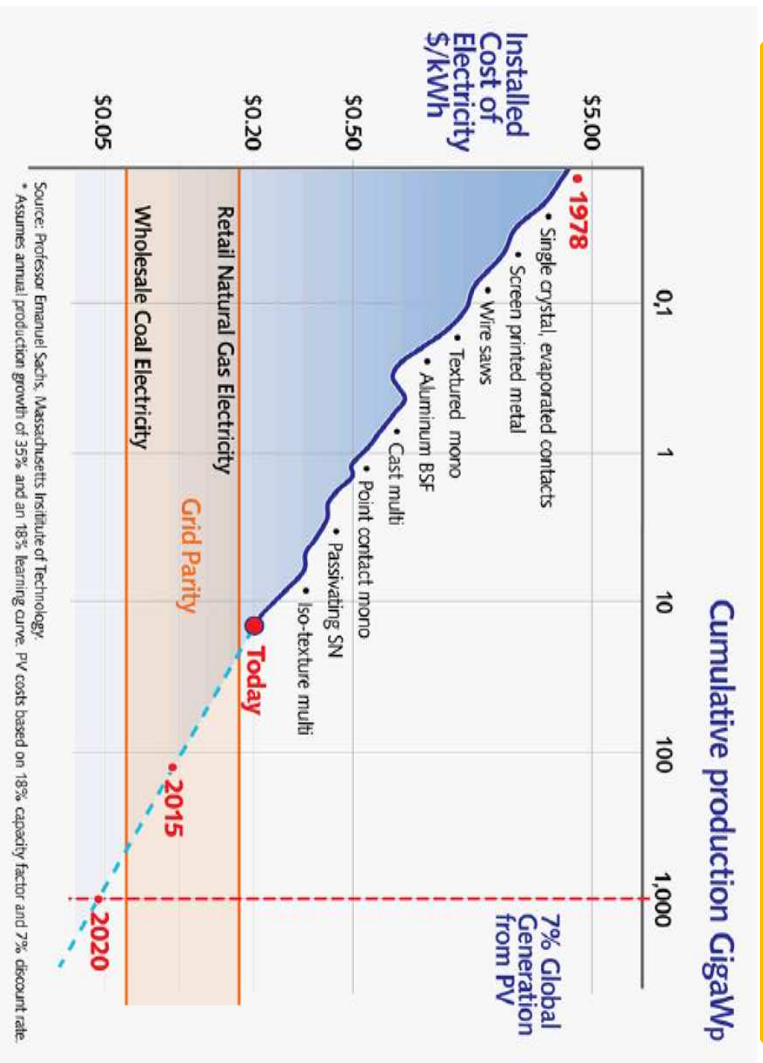
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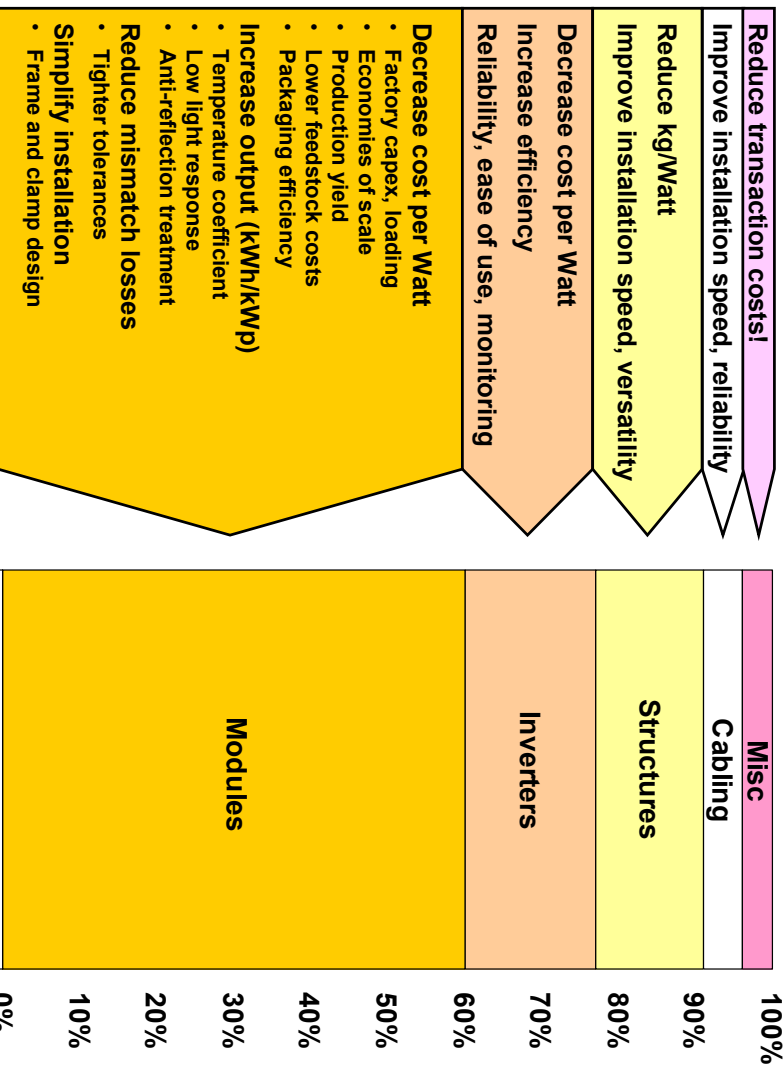
Experience curve is steadily approaching grid parity

No silver bullets in the technology learning curve



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Scope to reduce cost throughout the system



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Scope to save cost of structures

Conventional solar farm uses lots of redundant structural material



Transverse rails to support modules ...

Longitudinal rails x 2

Vertical post



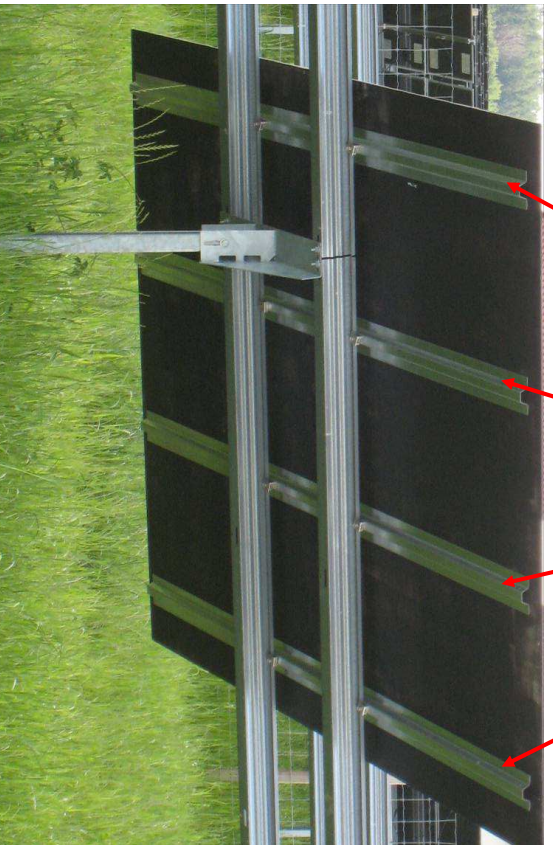
... but modules already have extruded aluminium frames

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Eliminate module frames and reduce rail material costs

4 galvanised steel bonded rails cost less than extruded aluminium frame AND eliminate transverse rails



Support rail spacing saves glass costs and weight (only 8mm thick glass)

Frameless laminates allow better rain runoff for self cleaning

Glass/glass packaging resists humidity better

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USA - Large modules call for special handling



Dimensions:

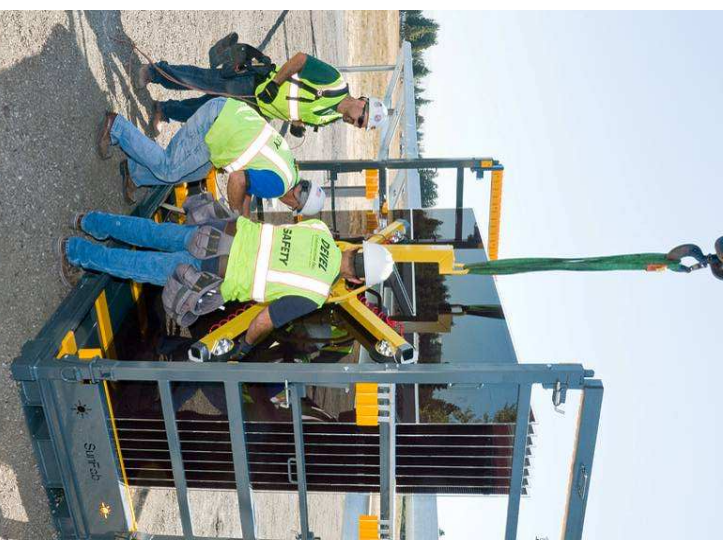
2'200mm

2'600mm

8mm.

Weight ...108kg.

**Resources:
6 (big) men,
1 machine.**



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Narrow gangways leave no room for heavy machines on roof



Applied Materials Singapore Operations Centre

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Asia – Large modules all in a day's work

Resources: 6 (compact) men ... 1 custom-made trolley



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PV will soon be commonplace in Singapore

- Cost reduction opportunities go well beyond modules
 - Learn from other industries (eg motorway construction and glass handling)
 - Manufacturers and system integrators must collaborate
 - Keep working on reducing the transaction costs!
- Whole systems approach works best to reduce costs

**Commercial viability
within a few years**

**Great news for
Singapore!**

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Photovoltaics – powering the future, today.

THANK YOU

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