

The German solar rooftop experience – Applicability in the Indian context

Indo-German Development Cooperation

June 7th, 2016



german
cooperation

DEUTSCHE ZUSAMMENARBEIT

»» Energy transition in Germany and India

A natural partnership arising from different challenges yet similar goals

A mutual goal to...

- Significantly **increase the share of renewables** in their energy generation portfolio, focusing on solar (rooftop) and wind
- Improve **energy efficiency**
- Reduce **climate gas emissions**



... all while ensuring a **sustainable energy supply** which does not undermine **economic growth** or **international competitiveness**

India is moving towards its own Energiewende
– and Germany is a crucial partner on this way

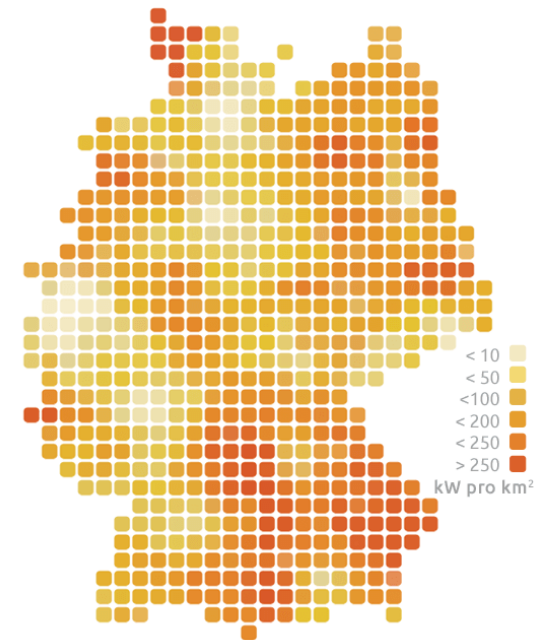
»» Status quo of PV in Germany

Solar energy and wind as drivers of the German Energiewende

Current situation

- Total generation of PV in 2015 – **36.6 TWh**
(\cong **7.7%** of net energy consumption in Germany)
- Installed capacity – ca. **40 GW** (#1 worldwide), about 74% of that mounted on rooftops
- Number of PV plants – **1.5 million**
- 70% of rooftop systems are < 10 kW and mounted on one-or two-family houses
- Yearly planned expansion corridor of 2.4 – 2.6 GW until 52 GW are reached

Installed capacity per km²



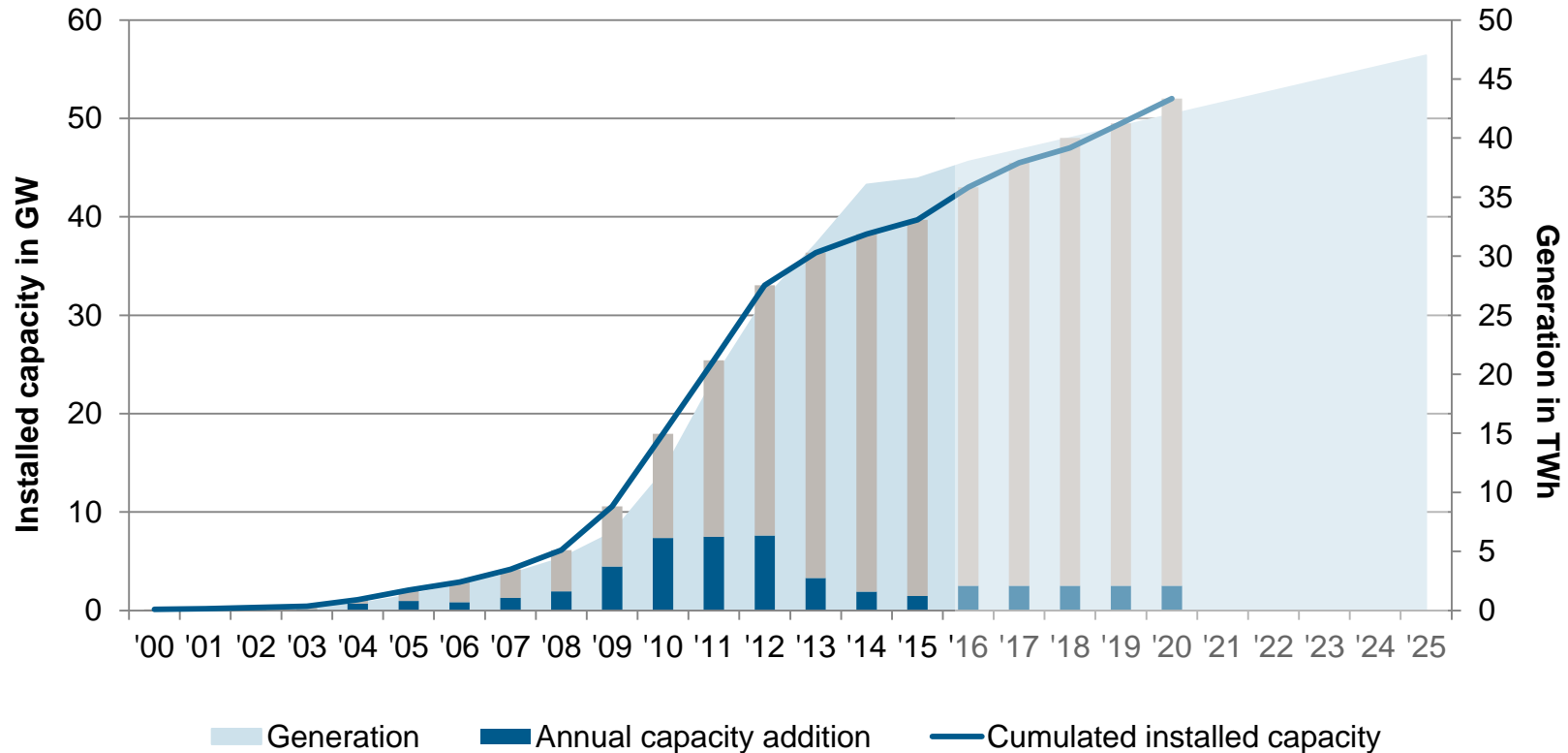
Source: www.strom-report.de

The German Energiewende is largely driven by the residential sector

»» Development of the German PV market

Fastest growth from 2009 to 2012

PV energy generation and installed capacity, Germany 2000 - 2025



Changes in expansion rate were determined by market
but even more so by regulatory factors

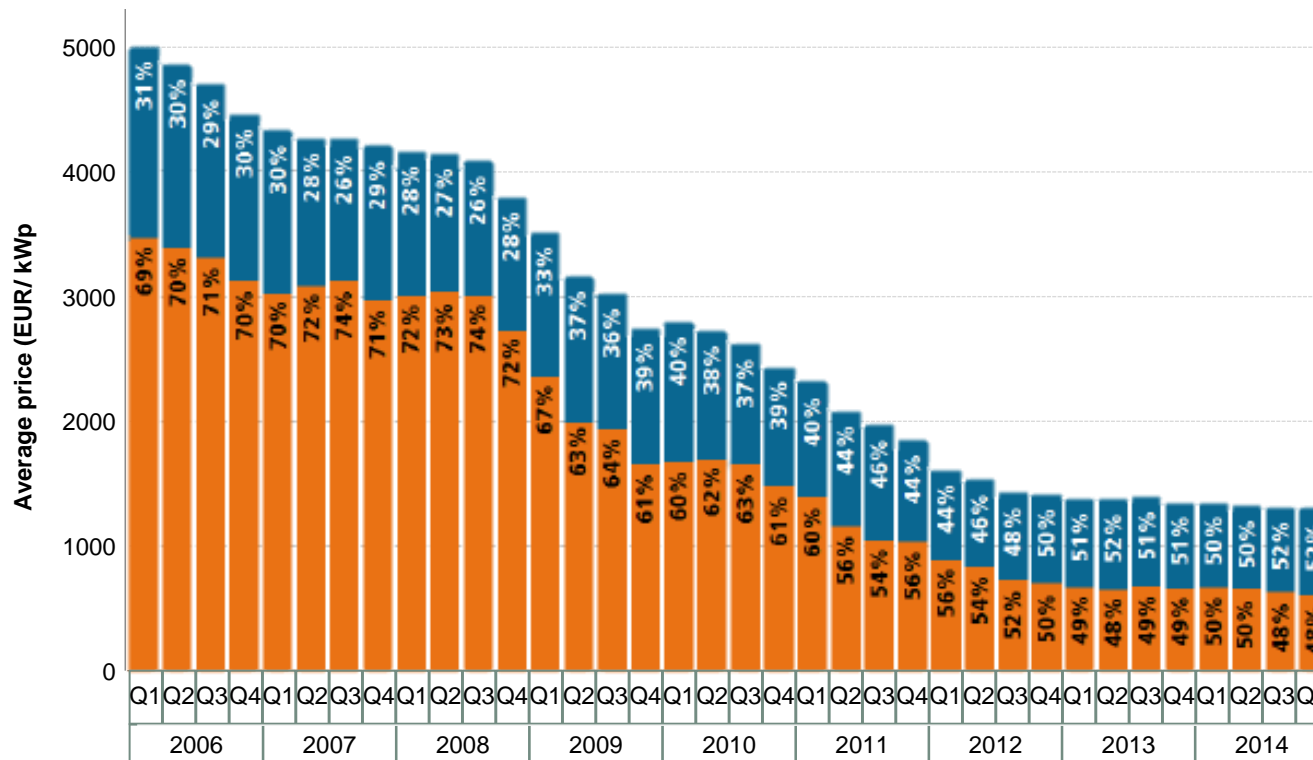
Source: www.energy-charts.de, 2016

»» Market driver: The price erosion of PV systems

Decrease of investment costs by 75% since 2006

Average net end customer price for turnkey solar PV rooftop systems of 10 – 100 kWp

Orange: Module cost as % of total cost



- Average annual decrease of system costs by 14% since 2006
- On average, prices of PV modules reduced by 20% for every doubling in installed capacity
- Minimum price regulation for Chinese modules in 2013 slowed down further price erosion

Source: BMWi, 2014



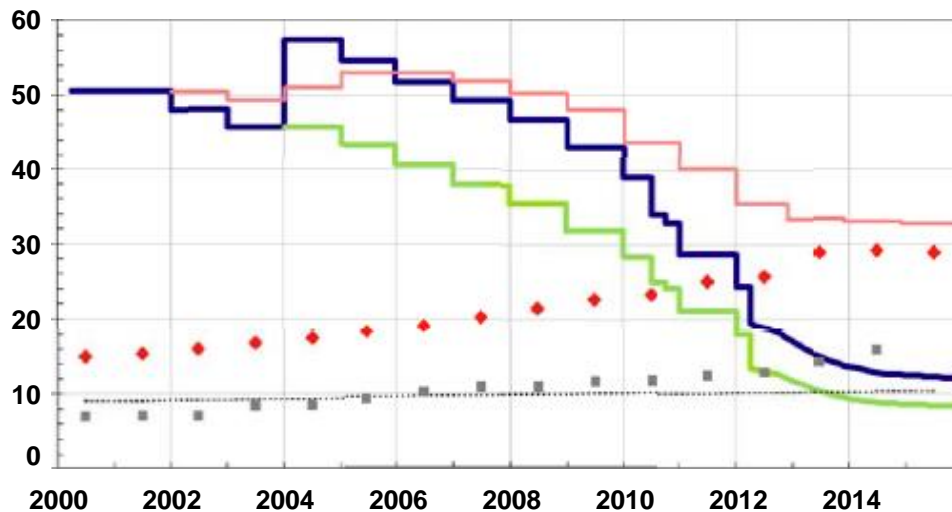
The German solar rooftop experience – June 7th 2016

»» Regulatory driver (1/2): Favourable conditions for RE feed-in

Feed-in tariffs that drove initial expansion are now replaced by market mechanisms

EEG 2000

- **Fixed feed-in tariffs** to be paid over a period of 20 years
- **Purchase guarantees**
- **Priority feed-in** of renewable electricity into the grid



Development of feed-in tariffs (ct/ kWh)

- ♦ Electricity price households, gross
- Electricity price industry, net
- PV new, average tariff
- PV new, small buildings
- PV new, free field/ large buildings

EEG 2014

- **Expansion corridors** for annual capacity increase (2.4 to 2.6 GW for solar)
- Feed-in tariff gradually replaced by direct marketing under the **market premium model**
- **Switch to auctions** (starting in 2017); pilot auctions for solar parks in 2015

The German Energiewende is policy, not technology driven – over time a more market-based approach is required

Source: Greentech Media, 2014

»» Regulatory driver (2/2): Funding programs

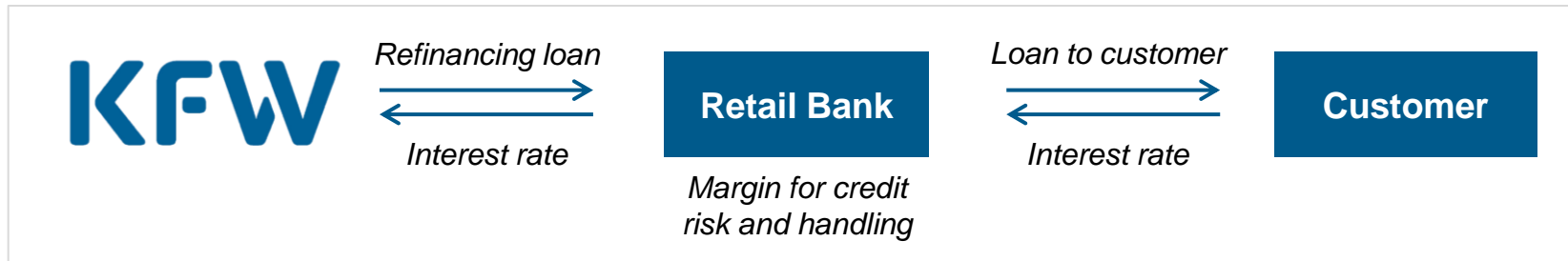
KfW is the most important financier of the German Energiewende

Current loan conditions

- Reduced interest loans for solar PV installations of up to EUR 25 million per project
- Long term financing up to 20 years, up to 3 years repayment-free start-up period
- Combination with storage funding programs possible
- Targets individuals, NGOs, private and public enterprises, self-employed professionals and farmers



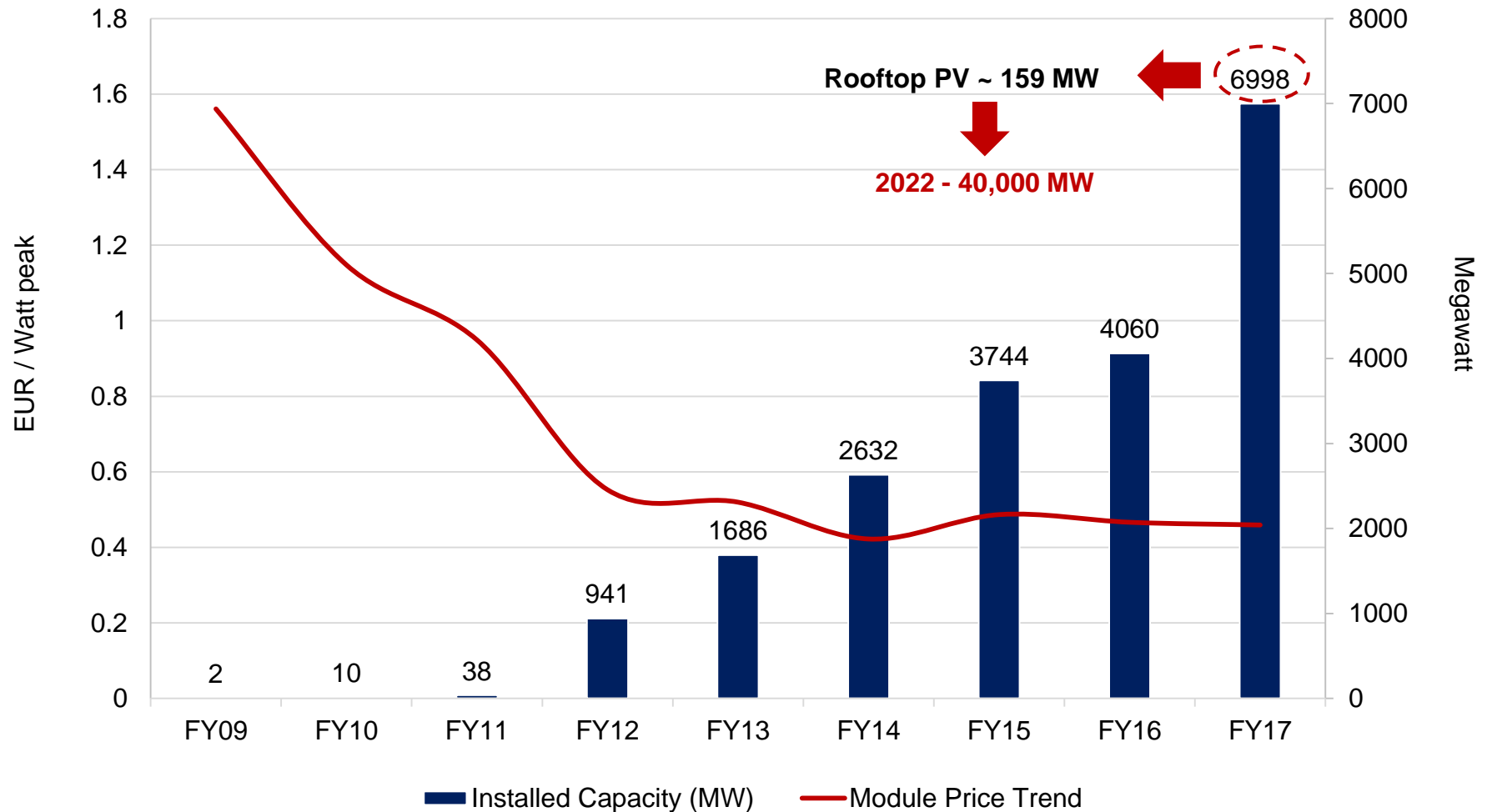
“Energiewende. We promote that.”



More than 50% of new capacities for electricity production from renewables in Germany are (re)financed by KfW

»» Solar power generation capacity growth in India

Declining trend of module price has paved way for adoption of rooftop solar



»» Case analysis: RESI(dential) RTPV

Economic calculation for RTPV in residential sector of Delhi

Payback computation

- Incentive for RTPV: 30% no cap
- **Discounted payback – 4.35 years**
- Internal Rate of Return – 23%
- Saving per annum – INR 134000
- Net present value – INR 2.3 million

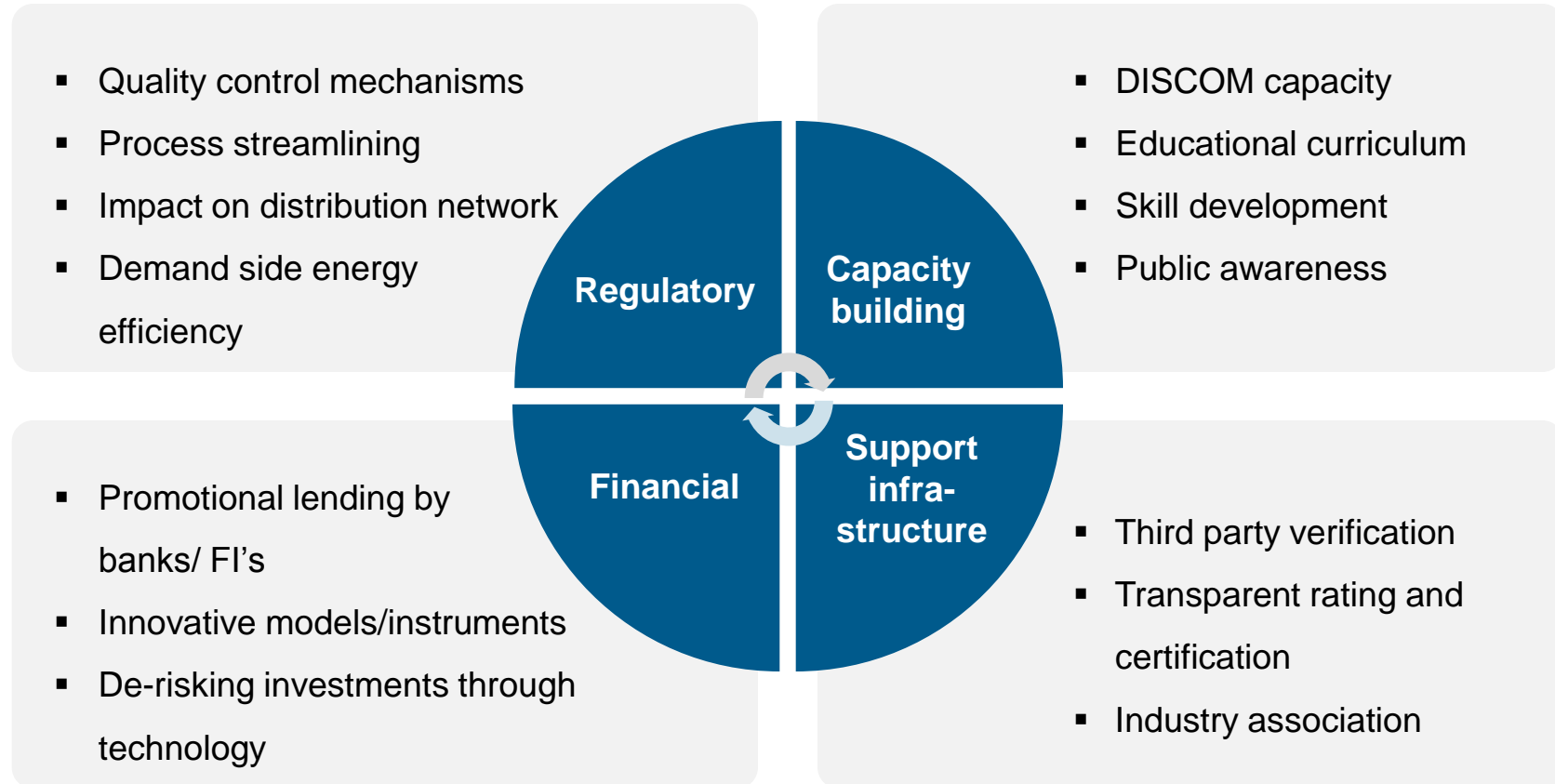


Assumptions

- Size of the system – 15 kW
- Building size – 2000 ft² using 40% area
- Energy inflation – 6% per annum
- Inflation – 4% per annum
- Electricity generation – 23,330 kWh/year
- Average cost/ kWh – Rs 5.74
- O&M – 3% of upfront investment cost
- Upfront investment cost – Rs 70,000/ kW




»» Overcoming barriers

Benefits should reach the last mile consumer



»» Indo-German Solar Energy Partnership

Broad range of partners and activities with special focus on rooftop solar

	1	2	3
	<p>Cooperation in the field of solar rooftops</p> 	<p>Development of solar parks/ zones</p> 	<p>Solar off-grid applications</p> 
Focus	<ul style="list-style-type: none">▪ Rooftops in commercial, industrial & residential segment▪ Captive use (feed in for long term)	<ul style="list-style-type: none">▪ Solar park infrastructure financing▪ Land neutral solar: irrigation, floating, ...	<ul style="list-style-type: none">▪ Solar powered mini-grids▪ Solar Home Systems▪ Agricultural water pumps

KfW

India to receive **concessional loans** in the range of **EUR 1 billion** over the next 5 years through **KfW**

giz

GIZ to provide technical assistance, policy advisory services, pilot project promotion, capacity building and training

PTB

PTB to support skill development curriculum as well as the quality control framework for solar power components