SOLAR POLICY AND GREEN BUILDING

LESSONS FROM GERMANY

Greenbuild 2012

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Hosted by BSW-Solar, the German Solar Industry Association

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Learning Objectives

- Understand various types of solar photovoltaic (PV) policies in the US and in Germany, and the overall results achieved
- Understand how policies impact the feasibility of rooftop solar
- Understand the potential benefit of smarter solar policies
- Understand how to get involved in advocating for smart solar policies in the US

Agenda

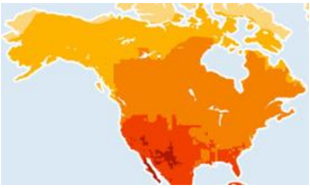
- Learning objectives
- What is Germany like?
- How has solar PV developed in Germany and in the US?
- Why does this matter to the (US) green building community?
- What makes a solar incentive good?
- What types of solar incentives exist, and what are their strengths?
- What should our priorities be for the future?

Disclaimer

Evaluations, results, opinions, conclusions, and any other content in this presentation reflect my own personal views and not those of BSW-Solar (Bundesverband Solarwirtschaft, e.V.) or the Alexander von Humboldt-Stiftung/Foundation.

What is Germany like?

Germany: Similar to California but denser; dark like Canada

	Germany	California	USA
Population (millions)	81	38	315
Size (sq miles)	138,000	164,000	3,794,000
Peak Demand (GW)	80	60	800
Min. Demand (GW)	40	20	400
Residential Electricity	$0.33/kWh	$0.15-0.18/kWh	$0.05-0.37/kWh
Peak Time	Winter evenings and mid-day	Summer days	
Non-Solar Resources	Limited	Lots of nearly everything	
Solar Resource			
2020 Renewables Goal	35%-40%	33%	None

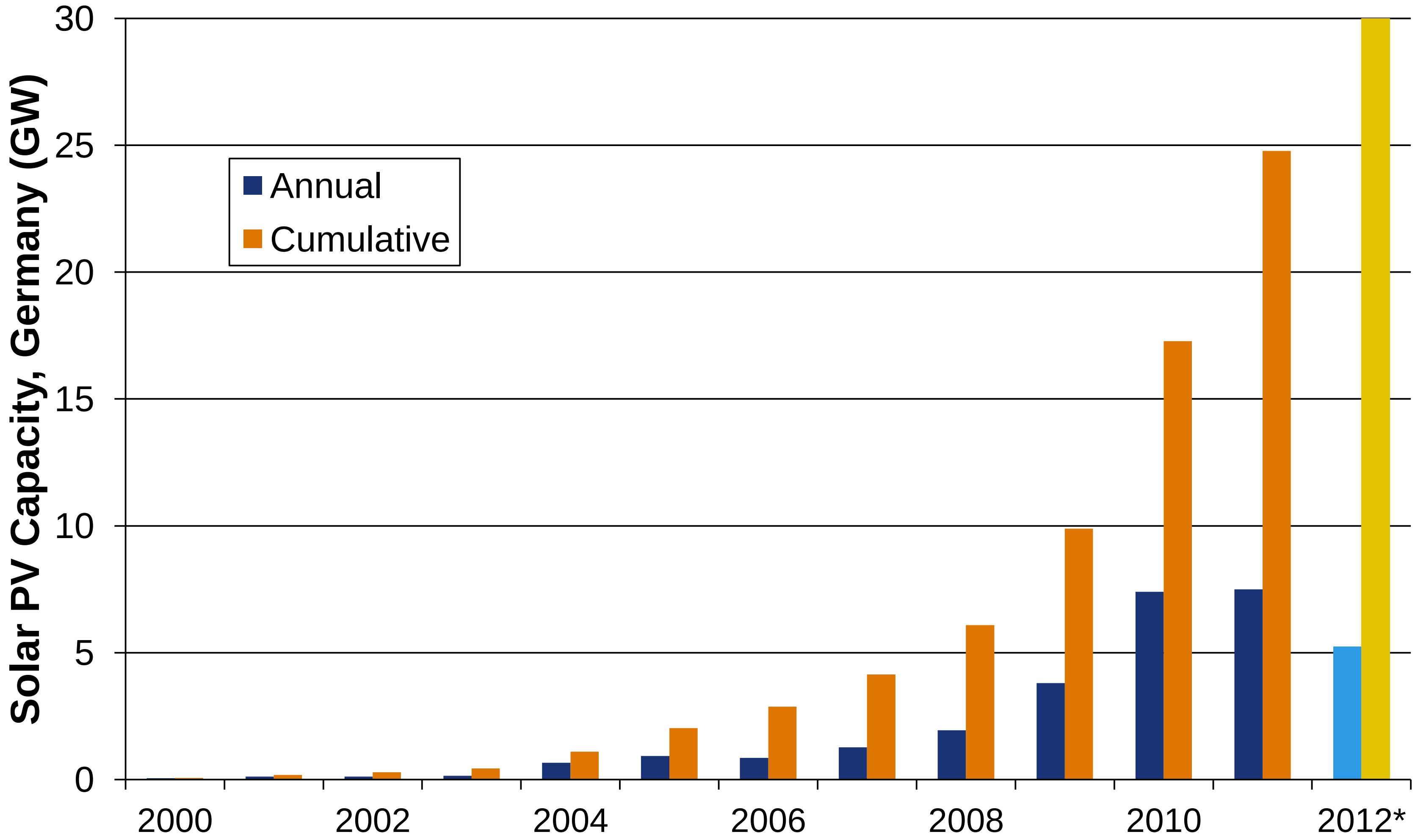
Images source: http://www.creativhandz.co.za/images/solar_radiation.jpg, Meteonorm

Germany: Anti-nuclear, decentralized, limited resources, engineering culture

A few stereotypes…	Germany	USA
Preferred job type	Engineering, industry	Service?
Natural gas situation	Dependent on Russia	Large domestic supply
Stance on nuclear	Passionately opposed due to Chernobyl & Cold War	Abstractly in favor, in practice NIMBY
Innovation culture	Incremental improvement	Big breakthroughs
Regional differences	Founded in 1871/1949; strong regional gov't, self-identification, dialects	High degree of state autonomy, varied politics/culture
Energy independence	Individual/community	National scale
Environmental culture	Conservative, consensus value; connected to nature	Universal connection to the land, but "environment" is liberal

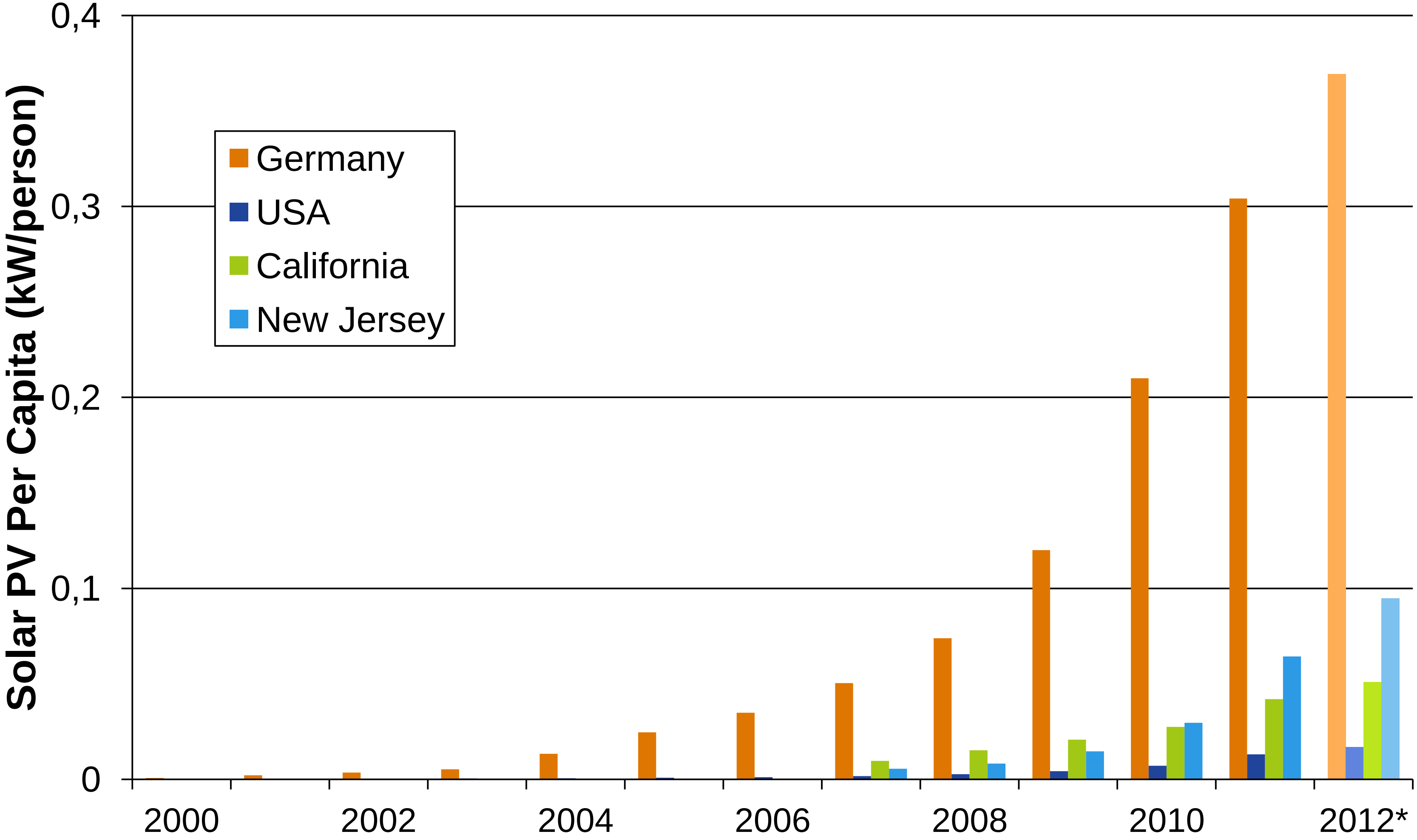
How has solar PV developed in Germany and in the US?

Results: Unprecedented 30 GW capacity, with solar PV now 5% of generation



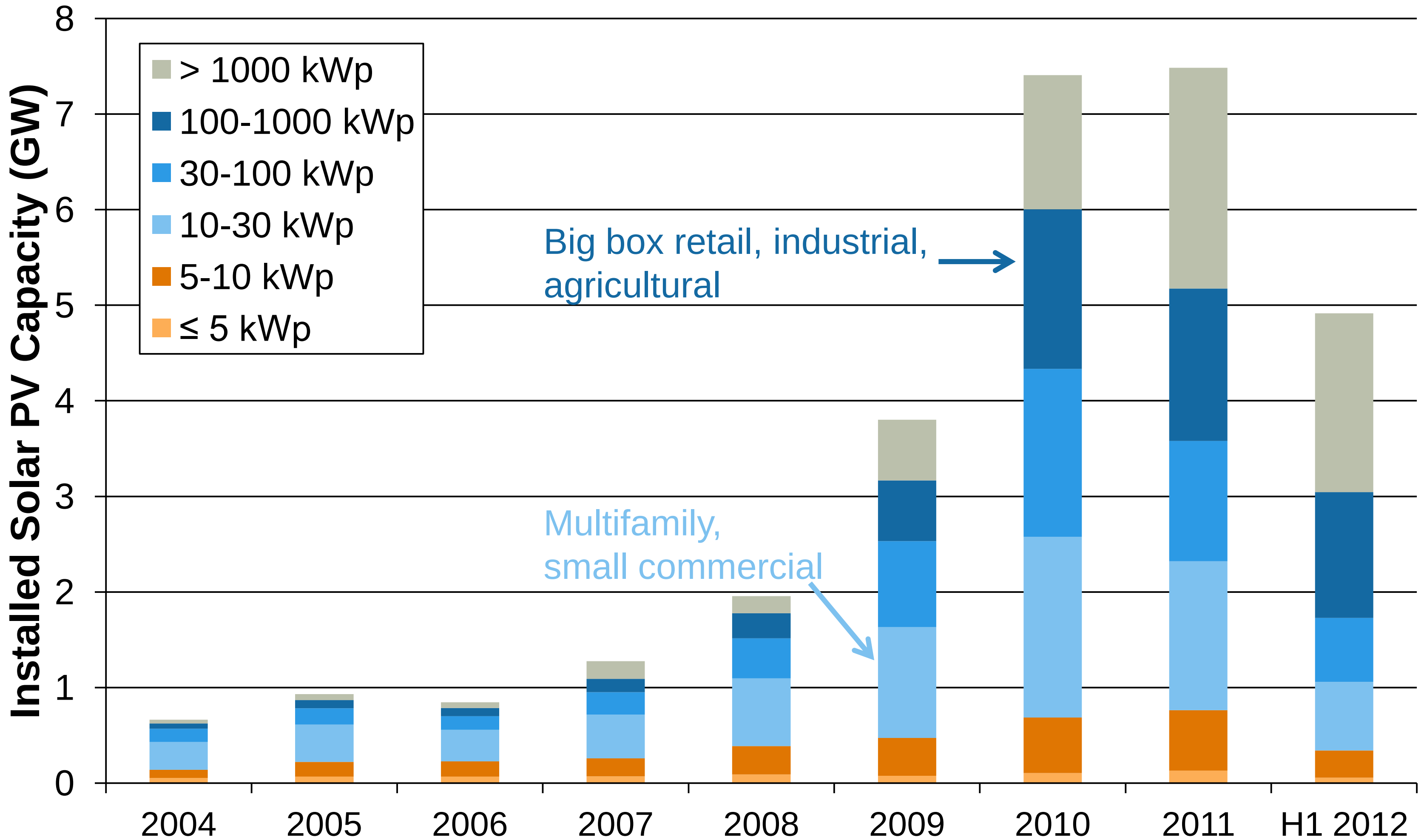
Sources: http://www.solarwirtschaft.de/fileadmin/media/pdf/BNetzA_0107_kurz.pdf 2012 and http://m.photovoltaik.eu/nachrichten/details/beitrag/mehr-als-30-gigawatt-photovoltaik-in-deutschland_100009120/

Results: 22x more PV per capita vs. USA, 7x and 4x more than California and NJ



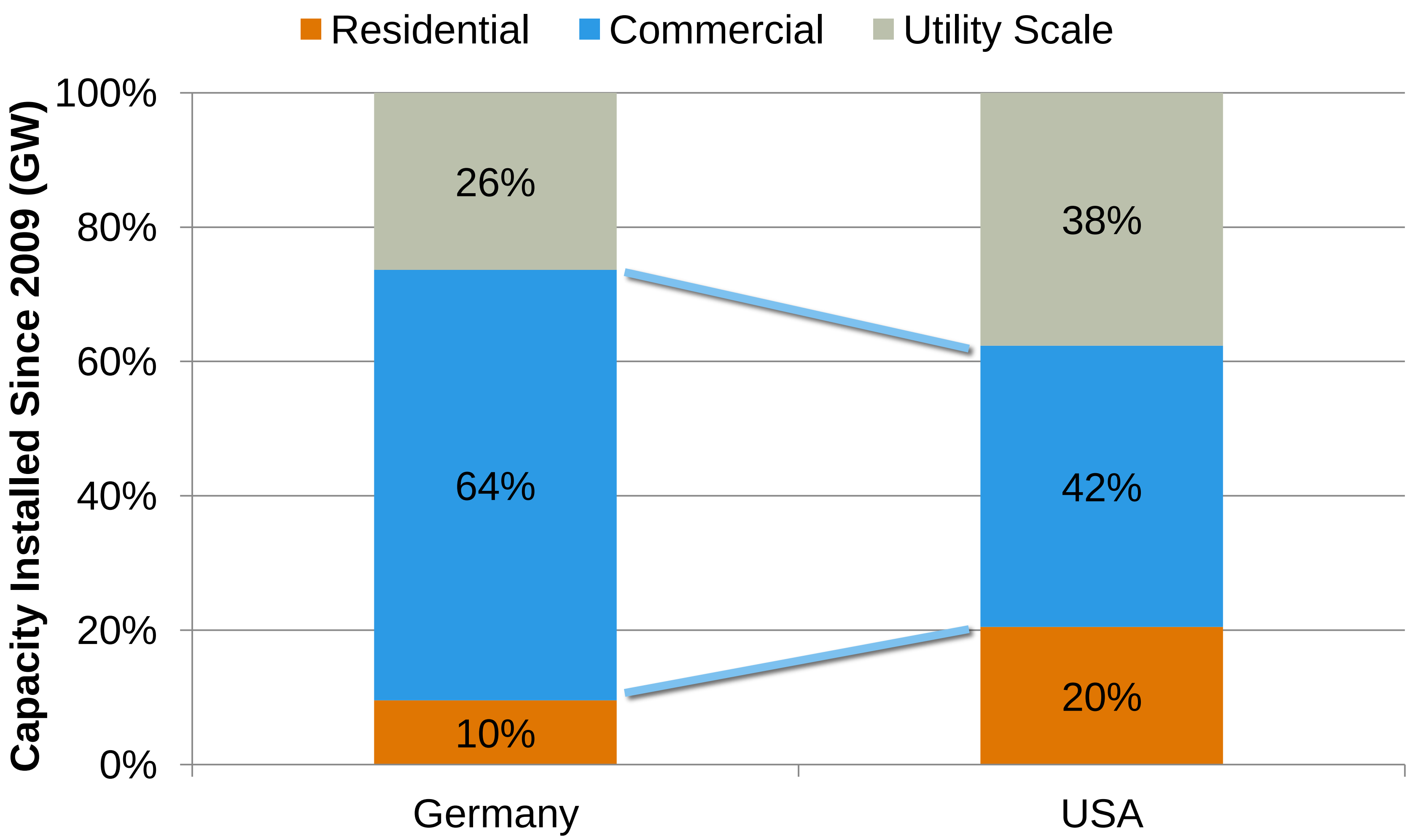
Sources: http://www.solarwirtschaft.de/fileadmin/media/pdf/BNetzA_0107_kurz.pdf 2012 and http://m.photovoltaik.eu/nachrichten/details/beitrag/mehr-als-30-gigawatt-photovoltaik-in-deutschland_100009120/

Results: Two thirds of German solar PV capacity at the commercial rooftop scale!



Source: BSW-Solar

Results: US market more focused on centralized, non-rooftop applications



Sources: BSW-Solar, IREC, SEIA

Why does this matter to the (US) green building community?

Solar electricity has huge potential, and it shouldn't be an economic sacrifice!

- Technical potential: 664 GW rooftop solar PV in the US, or 22% of all electricity (conservative estimate)
  - At $3/W, that's a $2 trillion investment!
- PV **half as expensive** in DE vs. US
- Opportunity to view PV not as a cost but as an investment
- Constraint should be roof size, not affordability
- LEED Points (EBOM 2012)
  - SS: Heat Island Reduction, 1 point
  - EA: Green Energy Production and Utilization, 1–5 points

www.gls.de/fileadmin/media/pdf_beteiligungen/GLS_Klimagenuss_5solar_Infobrosch_s.pdf

Technical potential from NREL, http://www.nrel.gov/docs/fy12osti/51946.pdf. Costs from BSW-Solar and SEIA.

Scaling up:
Portfolio perspective, case study

- 700 million square feet of US office space managed by this company have adopted sustainability standards
  - 6,000 buildings, 6% of total US office space
  - Back of the envelope: 60 million square feet of feasible roof space

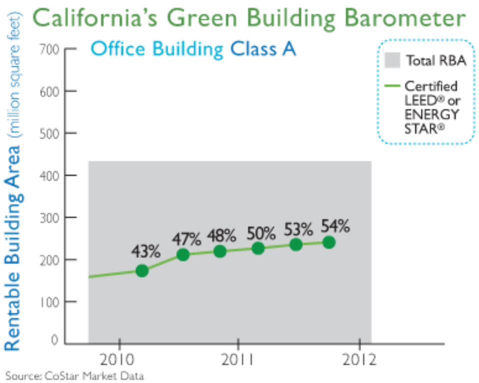
- Over 600 MW potential
  - Reference point: 10% of total US solar installed to date
  - $3 billion investment at current California 30-100 kW prices
  - $1.4 billion investment at current German 0-100 kW prices

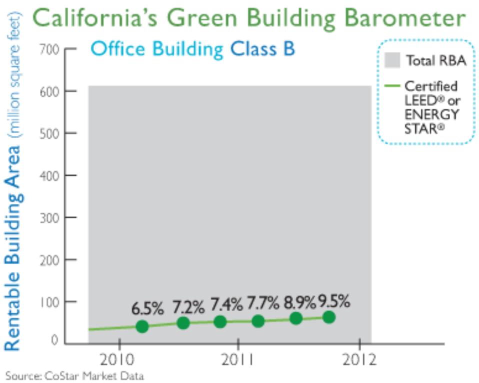
- Large, stable investment opportunity
  - An 8% ROI is common in Germany; 8% of $1.4 billion is $113 million
  - If ROI drops by 1%, potential returns decrease by $14 million

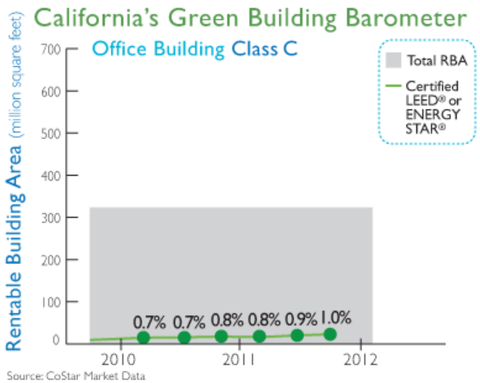
Sources: Company press release, EIA CBECS 2003, Go Solar California, BSW-Solar.

Scaling up: Need bankability – income, not savings

- Banks and investors are more willing to pay for solar if it will yield a guaranteed, stable income over the long term
  - Savings predictions are usually dependent on owner solvency, on-site consumption behavior, and utility rates, which may change over time
- Savings approaches often result in undersized systems
- Mainstream adoption means moving beyond Class A offices, government, big box retail, and niche residential applications







Images source: California Sustainability Alliance, http://sustainca.org/programs/green_buildings/overview

Scaling up:
Need bankability – long term stability

- Banks and investors are more willing to pay for solar if it will yield a guaranteed, stable income over the long term
  - How will changes in consumption behavior impact ROI?
  - How will time-of-use rates impact ROI of existing installations?
  - What happens if utility rate structures shift towards higher per kW demand charges and lower per kWh electricity charges?
  - What happens when market prices change?
    - Solar Renewable Energy Credit market
    - Electricity spot market
  - How does the picture change if we consider on-site storage or EVs?

Scaling up:
Tenant- and neighbor-friendly solar

- Not every electricity consumer owns his or her own roof
  - 30% of dwellings in the United States are rented, not owned
  - Only 60% of commercial floorspace is owner-occupied or government owned
  - Sharing or selling power locally involves many challenging details

- What metering and grid connection requirements are reasonable?

- How does solar interact with lease structures?

- What taxes & grid fees apply?
  - On-site consumption vs. grid feed-in

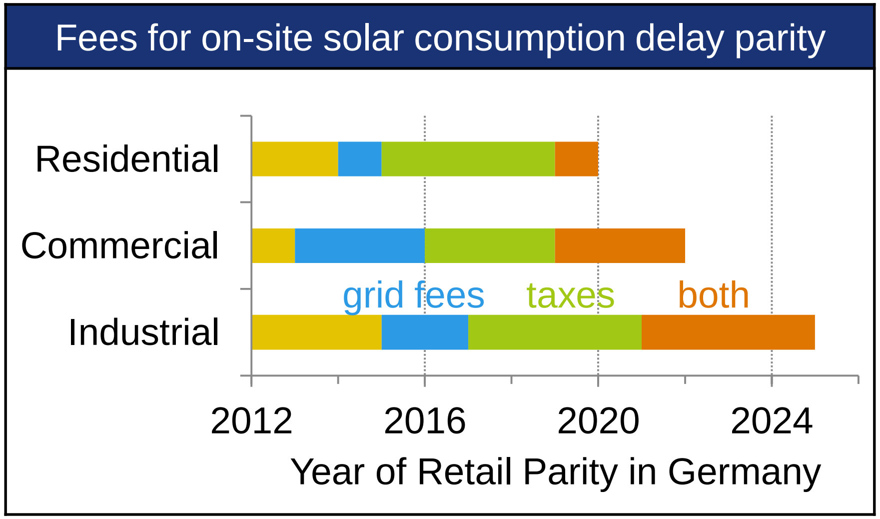
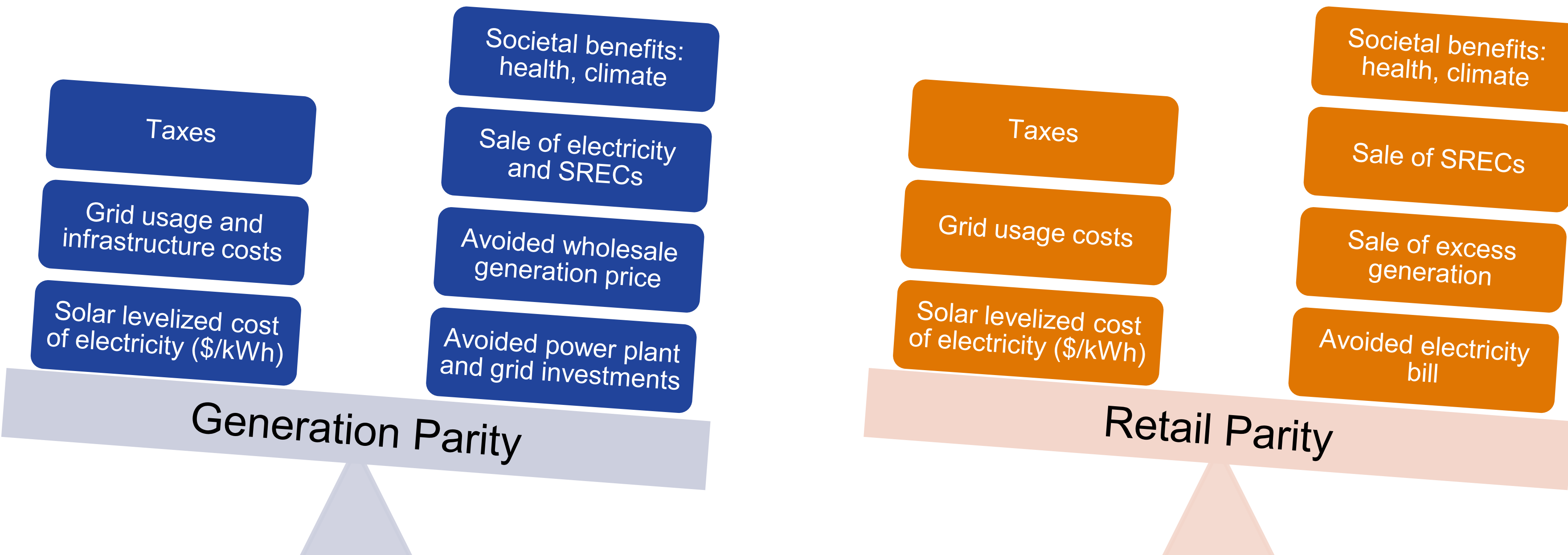


Chart source: EPIA, 2012. http://www.photovoltaic-conference.com/images/stories/27th/5_parallelevents/assigning/WS_2012_T1_Frankfurt_06_Latour.pdf.

A closer look: What is grid parity?

<u>Competitiveness depends on the regulatory structure in place, and is subject to change along with policy, rates, and markets!</u>



- Static parity: Instantaneous
- Dynamic parity: Net present value over the life of the system

What makes a solar incentive good?

Solar support schemes should create conditions that overcome adoption barriers

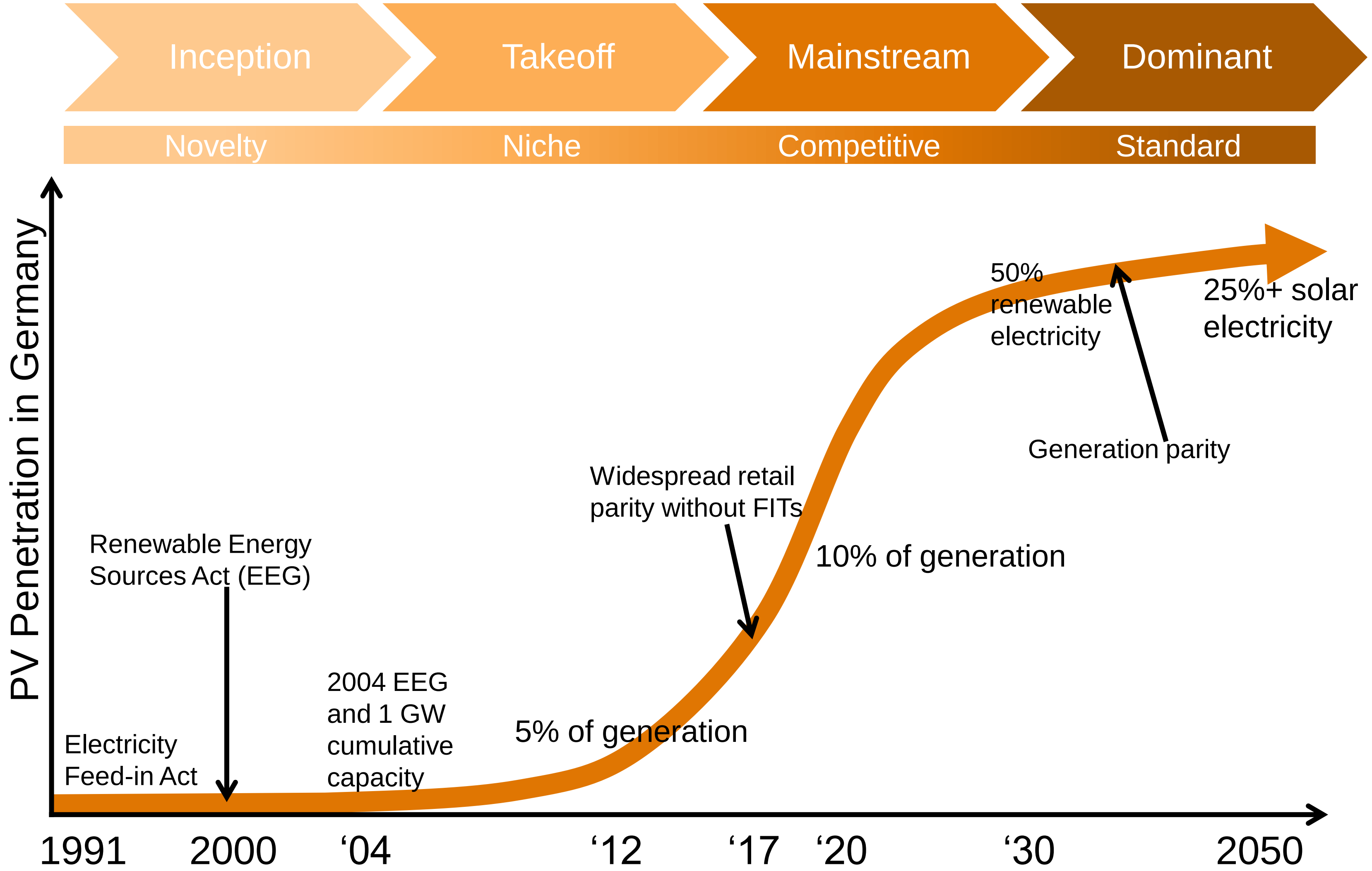
Major Barriers to Adoption

- Up-front cost
- Long-term nature of investment entails risk
- Labor force and supply chain development
- Supporting technologies still emerging (storage, smart grid)
- Entrenched energy interests
- Markets & grid designed for fossil fuels, not renewables

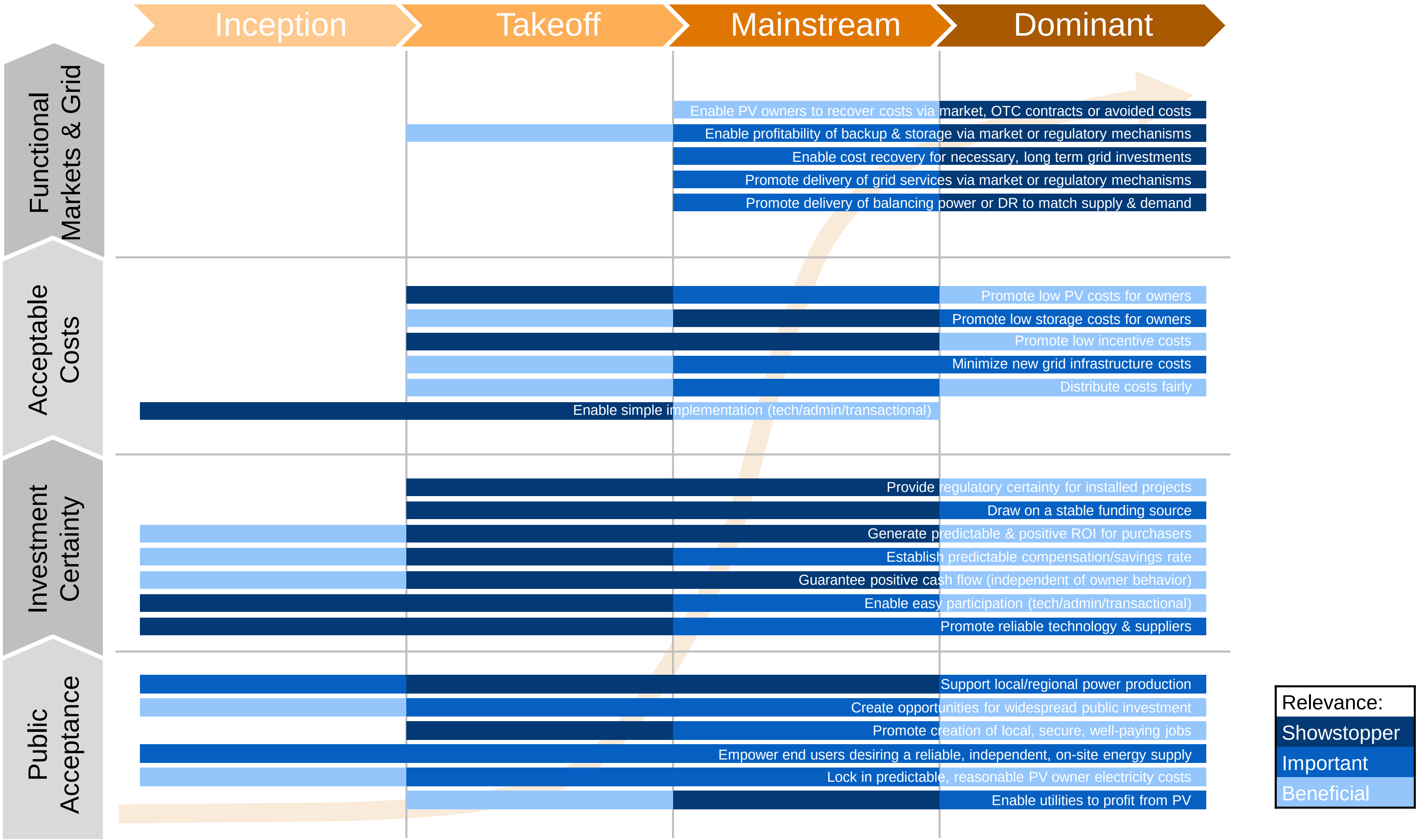
Necessary Conditions for Adoption

- Address stakeholder interests to promote **widespread acceptance**
- Establish **investment certainty**
- Keep costs low in the short term while also **driving down costs** in the long term
- Develop **markets and regulations** designed to function with high levels of renewables

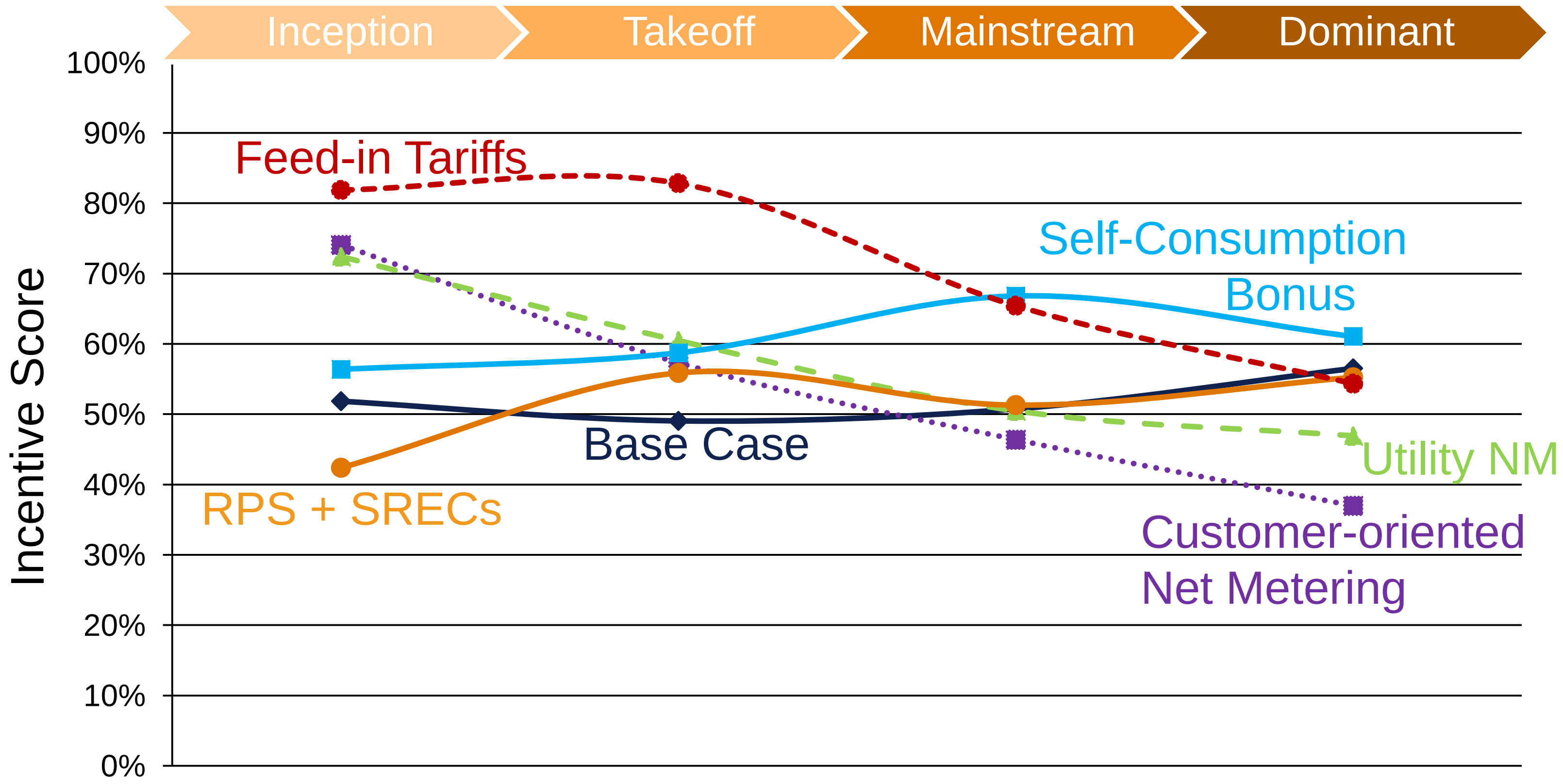
System needs vary by market phase, necessitating different forms of PV support



Fulfillment of key criteria contributes to creation of the necessary conditions



Support mechanisms can be rated by creation of necessary growth conditions



FITs are the best tool for solar takeoff, but they and other existing mechanisms will face challenges in the mainstream phase.

What types of solar incentives exist, and what are their strengths?

Incentive Types: Legend

Electricity

Compensation/Payment

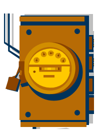
Solar Renewable Energy Credit

Optional Element

Belonging to PV Owner

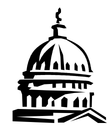

PV System


On-site Electrical Load

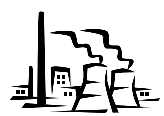

Electricity Meter


Storage

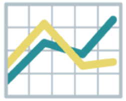

Local Utility


Regulators


The Public
(Energy Consumers)

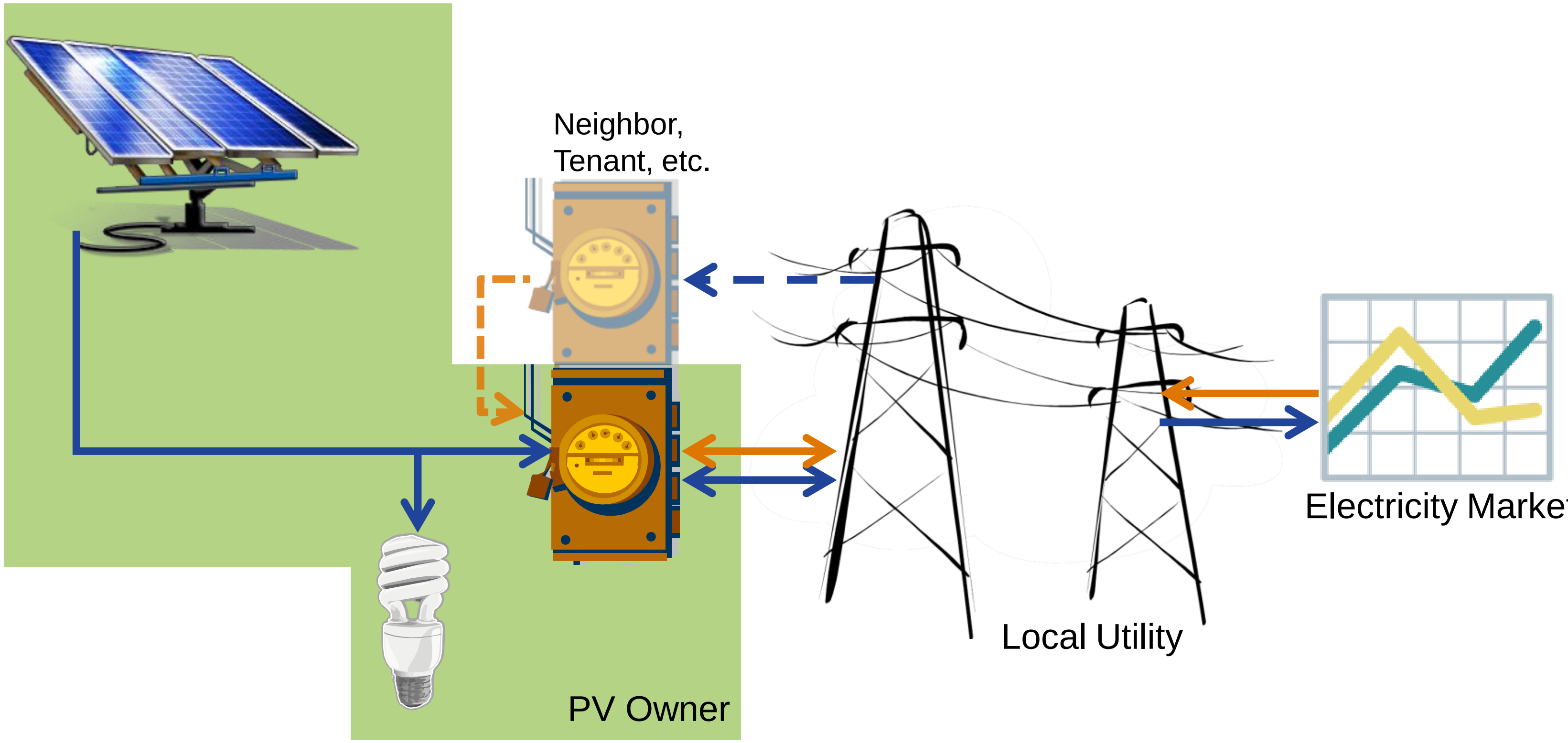

Traditional Generators

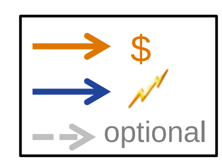

PV Owner


Electricity Market

Incentive Type Definitions: Customer-Oriented Net Metering

"The meter spins backwards"

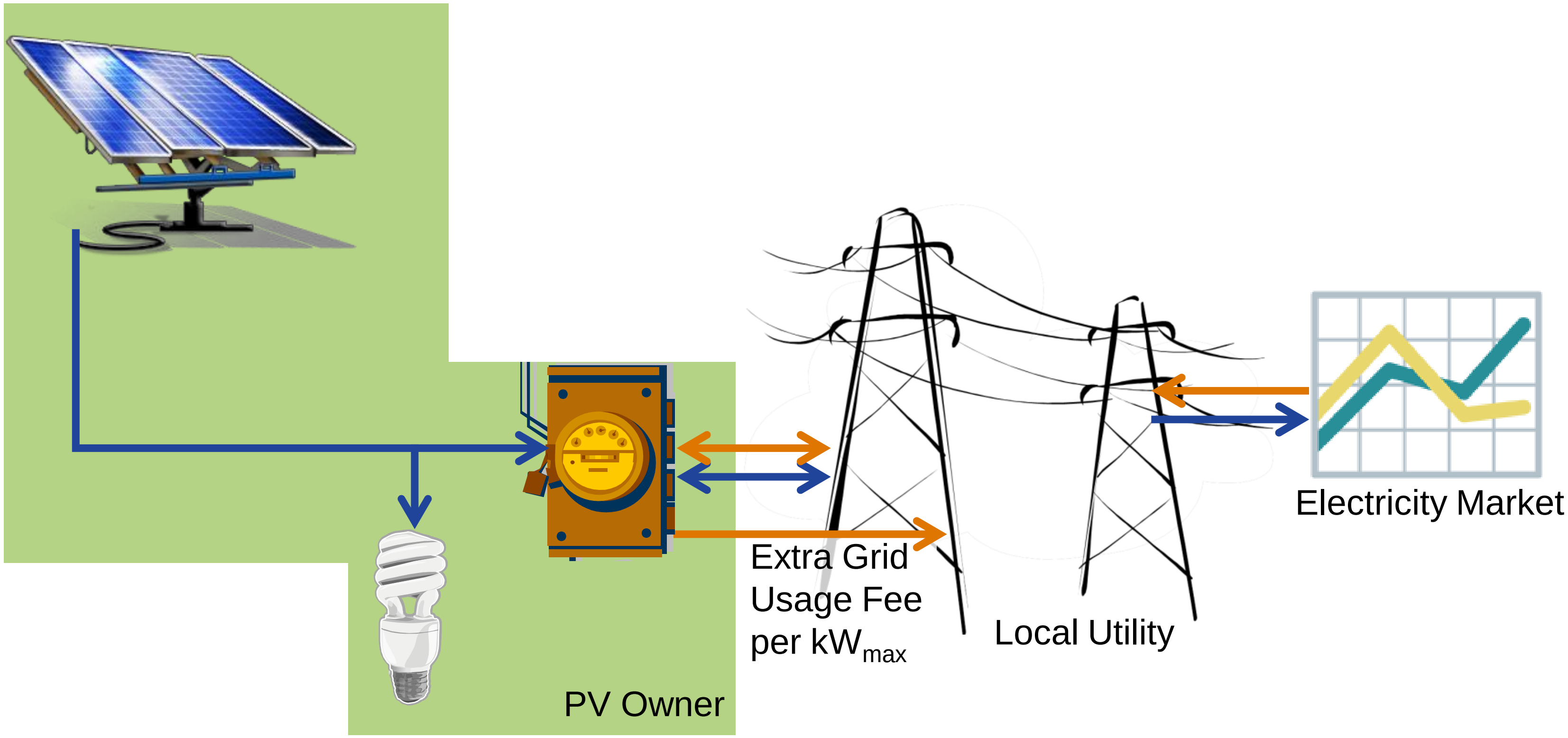




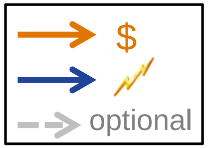
- Excess electricity credited at retail rate & may be carried over for up to one year
- Compensation for expired carryover at that year's peak period avoided cost rate
- Virtual & aggregate net metering allowed (sharing with adjacent/nearby meters)

Incentive Type Definitions: Utility-Oriented Net Metering

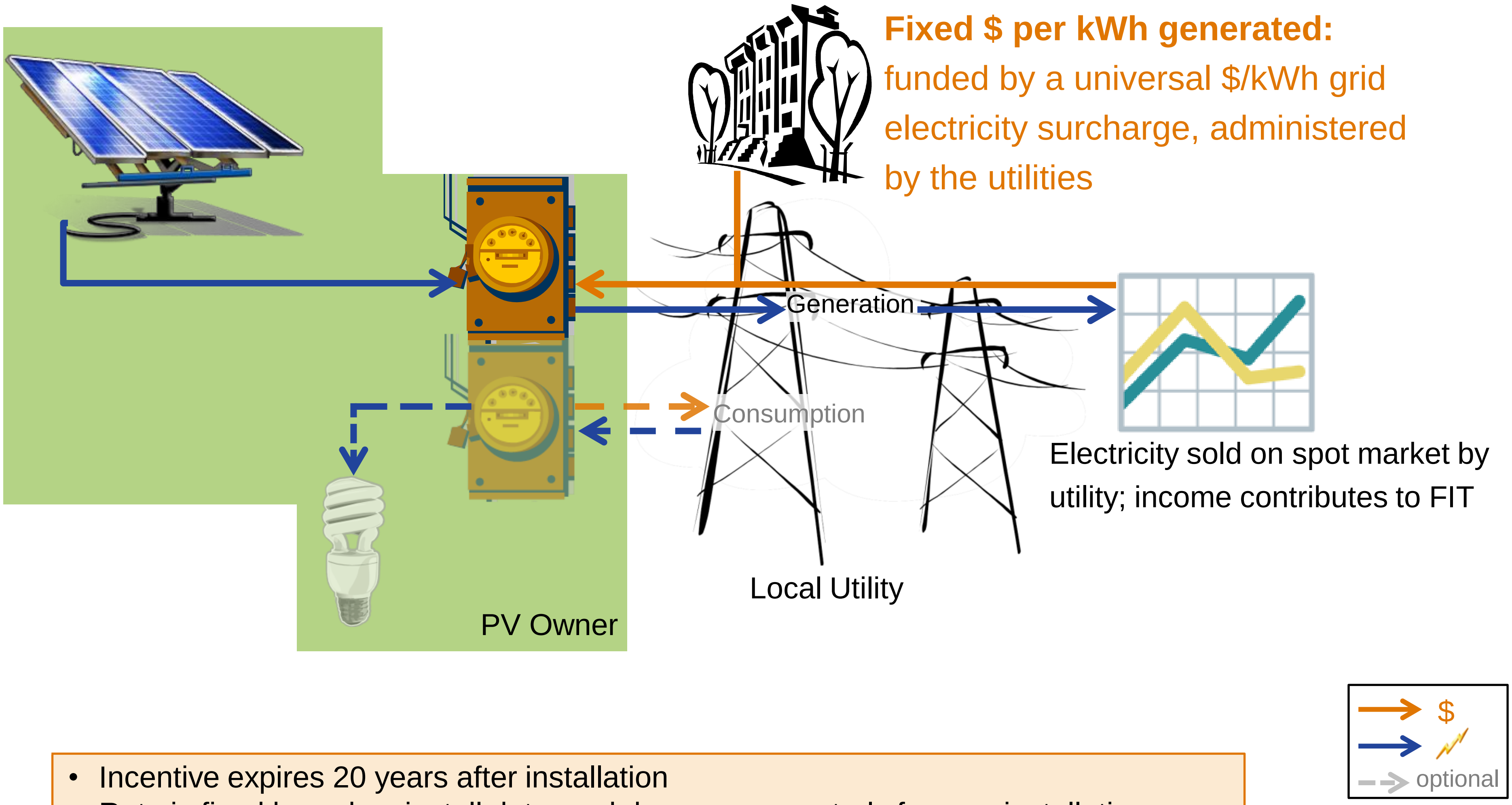
"The meter spins backwards"



- Size limited to the lesser of 100% of consumption or 1 MW
- Carryover allowed for the generation portion of the bill only
- No compensation provided for expired credit (after 1 year)
- No virtual or aggregate net metering



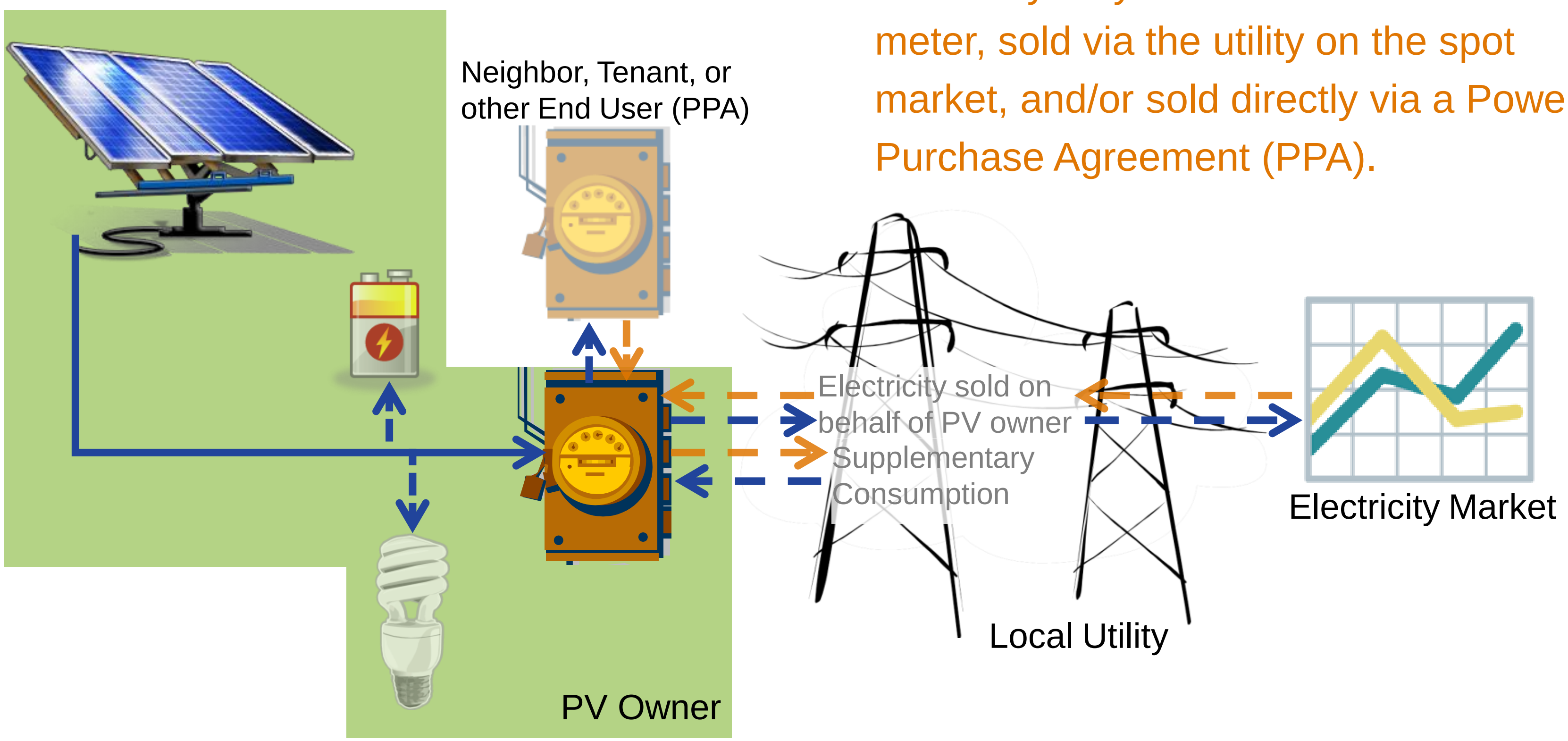
Incentive Type Definitions: Feed-in Tariffs (FITs)

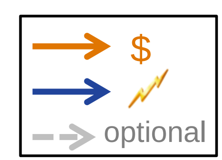


- Incentive expires 20 years after installation
- Rate is fixed based on install date, and decreases quarterly for new installations

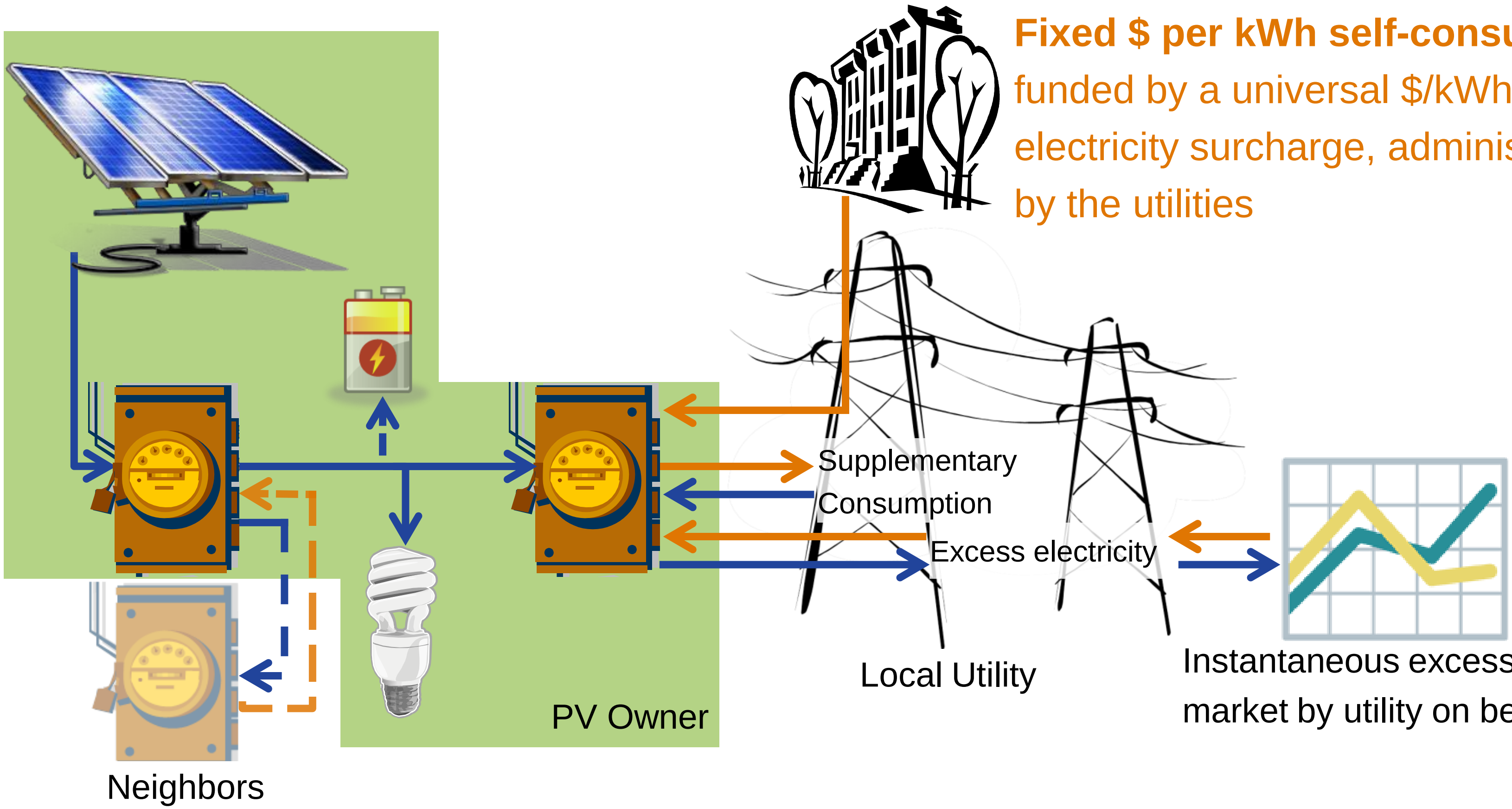
Incentive Type Definitions: Base Case (Behind the Meter/Spot Market/PPAs)

Electricity may be consumed behind the meter, sold via the utility on the spot market, and/or sold directly via a Power Purchase Agreement (PPA).





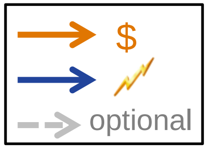
Incentive Type Definitions: Self-Consumption (SC)



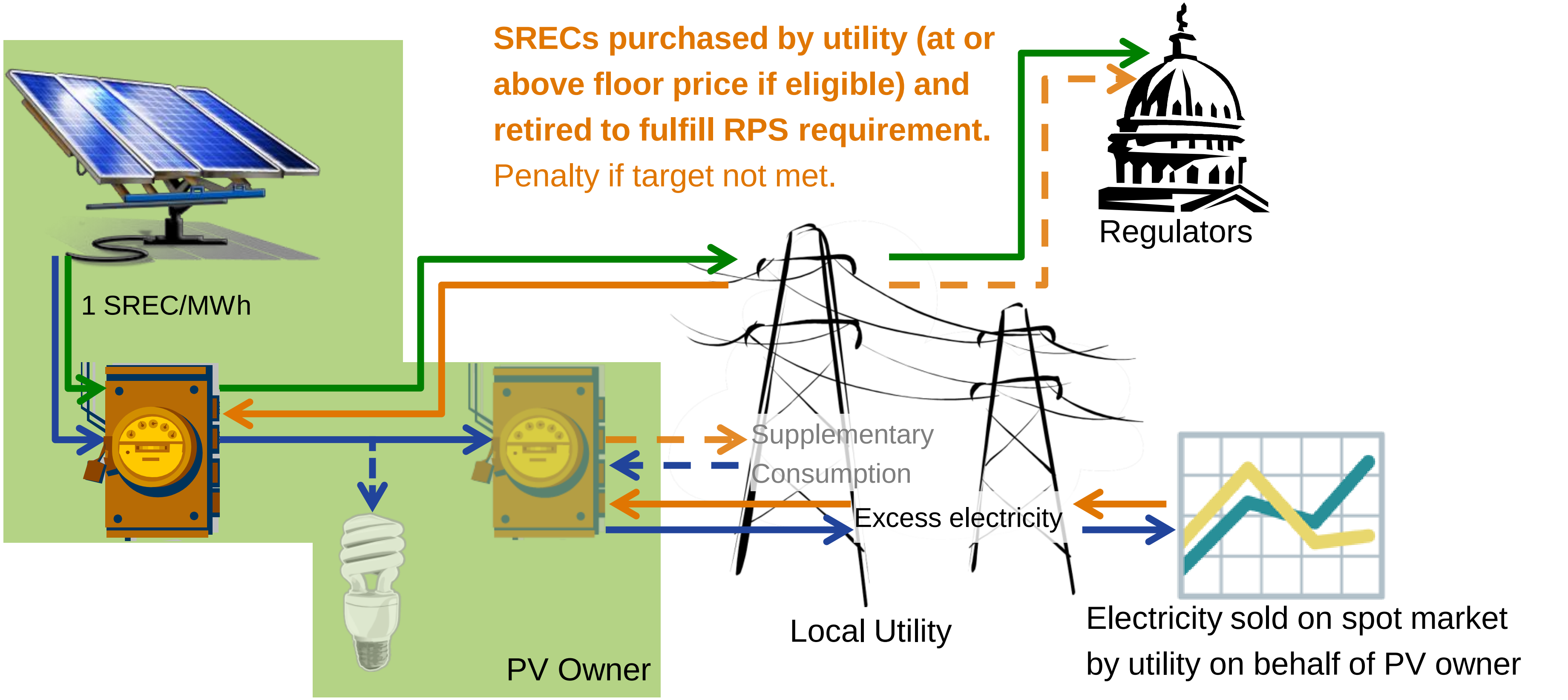
Fixed $ per kWh self-consumed: funded by a universal $/kWh grid electricity surcharge, administered by the utilities

Instantaneous excess sold on spot market by utility on behalf of owner

- Incentive expires 20 years after installation
- Owners may not artificially increase SC share via a large resistor or other waste
- Rate is fixed based on install date, and decreases quarterly for new installations



Incentive Types: Renewable Portfolio Standard (RPS) & Solar Renewable Energy Credits (SRECs)



- RPS requires a minimum amount of solar electricity each year, increasing annually.
- Years of eligibility for floor price (initially 20 yrs) revised annually for new installations, depending on over/under-achievement of RPS targets. Unpurchased SRECs roll over.
- Penalty price per MWh decreases annually.
- Regulators grant SRECs & host a market for trading (OTC contracts also allowed).

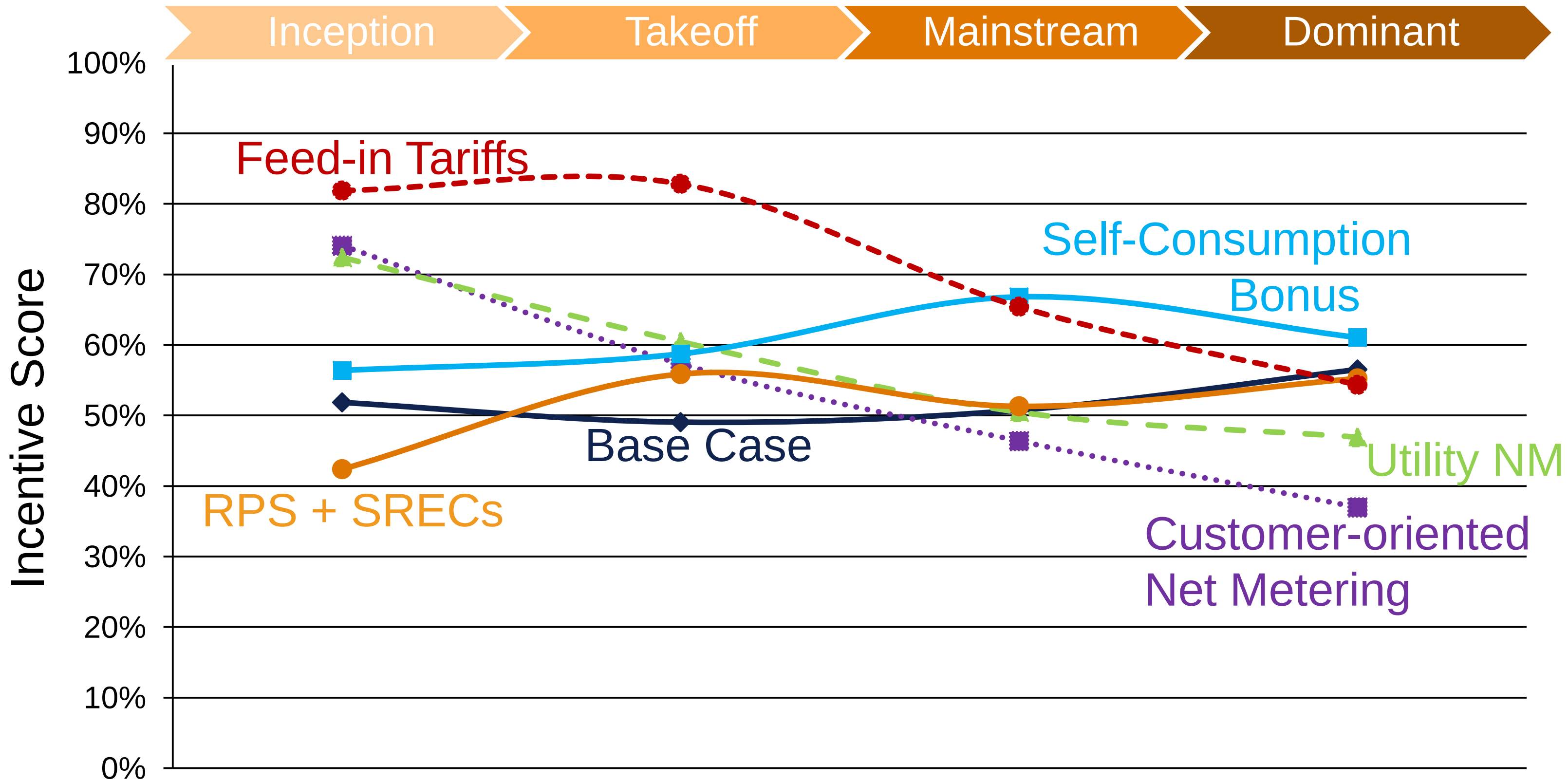
Now it’s your turn: What are some advantages & disadvantages to each system from your perspective(s)?

For high penetration, solar should benefit as many stakeholders as possible

Society	Investors	Energy Industry
The public Energy consumers Communities	PV owners/operators Banks and insurers	Utilities and grid operators Non-PV power generators Demand response and storage providers PV industry

Government	
Regulators	Politicians

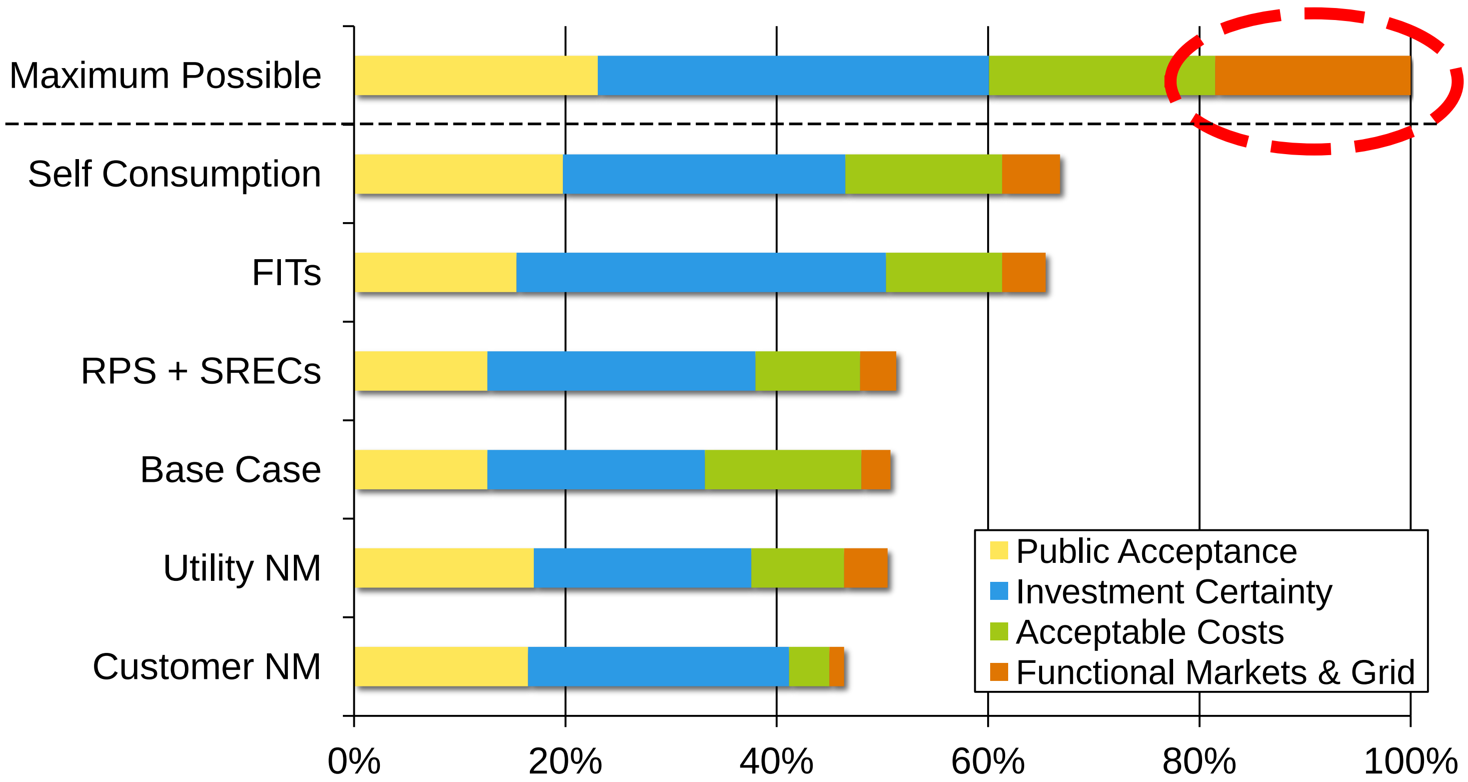
Support mechanisms can be rated by creation of necessary growth conditions



FITs are the best tool for solar takeoff, but they and other existing mechanisms will be problematic in the mainstream phase.

What should our priorities be for the future, when PV is mainstream?

In the future, we will need new types of support for solar electricity



FITs create investment certainty, but no existing incentive effectively addresses market and grid function.

Priorities to support future PV growth

Investment Certainty	• Maintain positive ROI in **diverse market segments** • Create opportunities for **positive cash flow**, not just savings • Simplify participation & implementation
Matching Supply & Demand	• Enable profitability of storage, backup capacity & demand response • Expose PV system operators to **demand signals** • Expose consumers to supply signals
Grid Functionality	• Encourage grid-friendly solar & ensure **recoverability of grid costs** • Promote delivery of grid services from non-fossil-fuel sources • Enable **utilities** to profit from PV

Meanwhile, maintain acceptance by supporting local/regional generation and empowering individual prosumers.

Key design choices, beyond net metering

Behind the Meter (self-consumption)	Grid Feed-In (excess or all generation)
• Constant kWh rates • Time of Use (TOU), per kWh electricity rates • Additional peak demand charges (such as critical peak pricing or peak kW)	• Spot market price • Cost of avoided new generation • Bilateral contracts • "Full value" standardized power purchase agreements (PPAs) • Capacity market

Goal: widespread adoption of solar PV as part of a secure energy system

Needed: Strong market signals, alongside the investment certainty to promote growth

Behind the Meter (self-consumption)	Grid Feed-In (excess or all generation)
☐ Constant kWh rates	☐ Spot market price
☑ Time of Use (TOU), per kWh electricity rates	☐ Cost of avoided new generation
☑ Additional peak demand charges (such as critical peak pricing or peak kW)	☑ Bilateral contracts
	☑ "Full value" standardized power purchase agreements (PPAs)
	☐ Capacity market

Getting these design changes right is going to be hard, so now is the time to start the process!

It's time to actively shape solar policy!

- Solar is not just a technology to adopt as is – it is applied within a policy & regulatory framework that shapes feasibility
- The building/real-estate sector has much to gain from favorable, fair solar policies
- There are many organizations to get involved with

ACORE American Council On Renewable Energy
SEIA
IREC Interstate Renewable Energy Council
BOMA International
Canadian Renewable Energy Alliance
CanSIA
OSEA
MSEIA Mid-Atlantic Solar Energy Industries Association
CALSEIA California Solar Energy Industries Association
The Vote Solar Initiative

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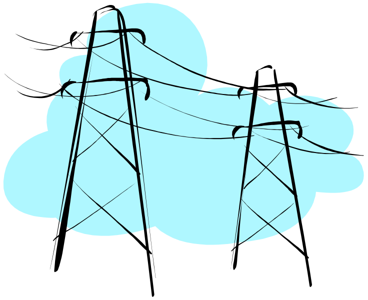
What criteria must a support scheme fulfill in order to promote acceptance?

Create jobs

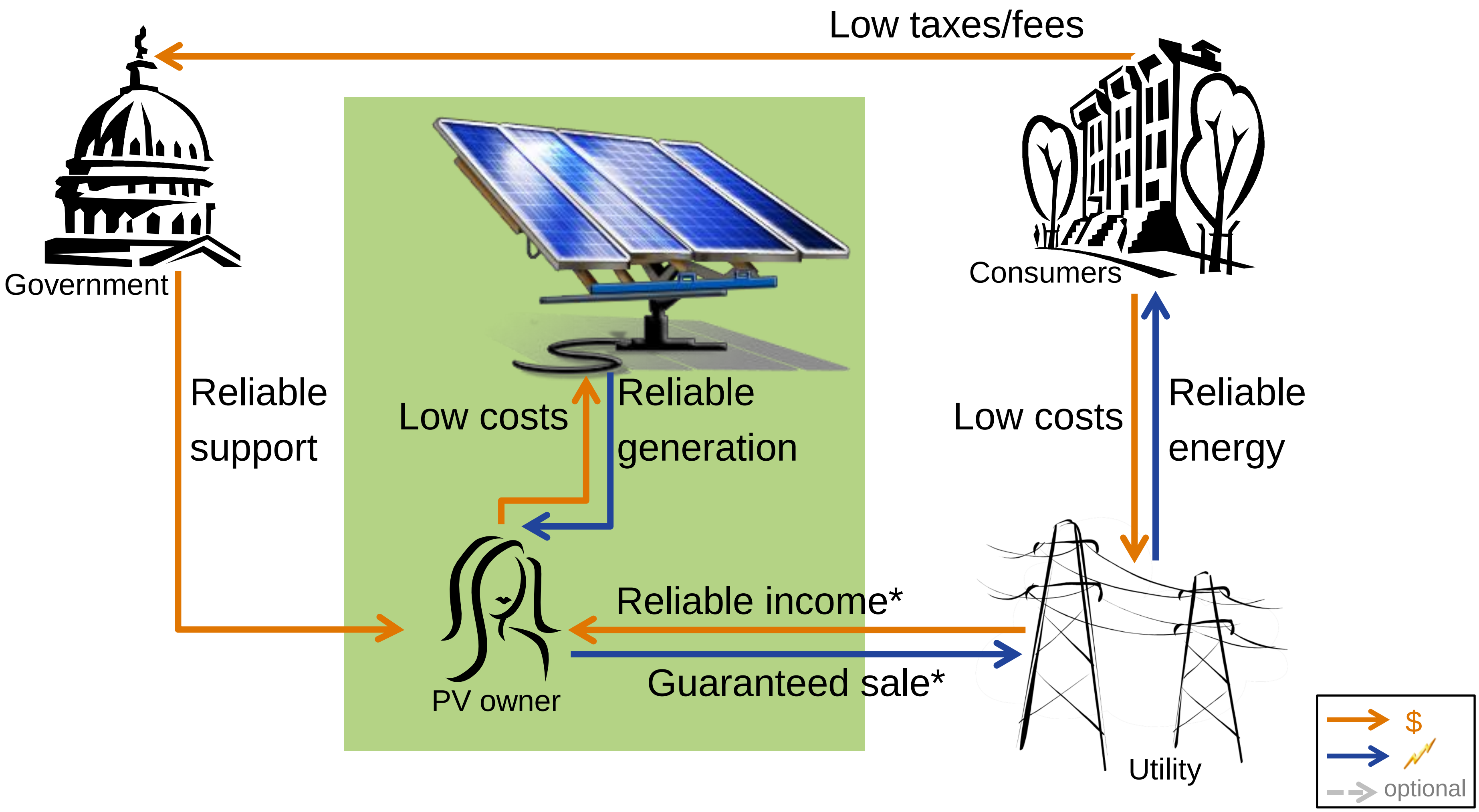
Empower communities and the public



Reduce strain on the grid and dependence on imports

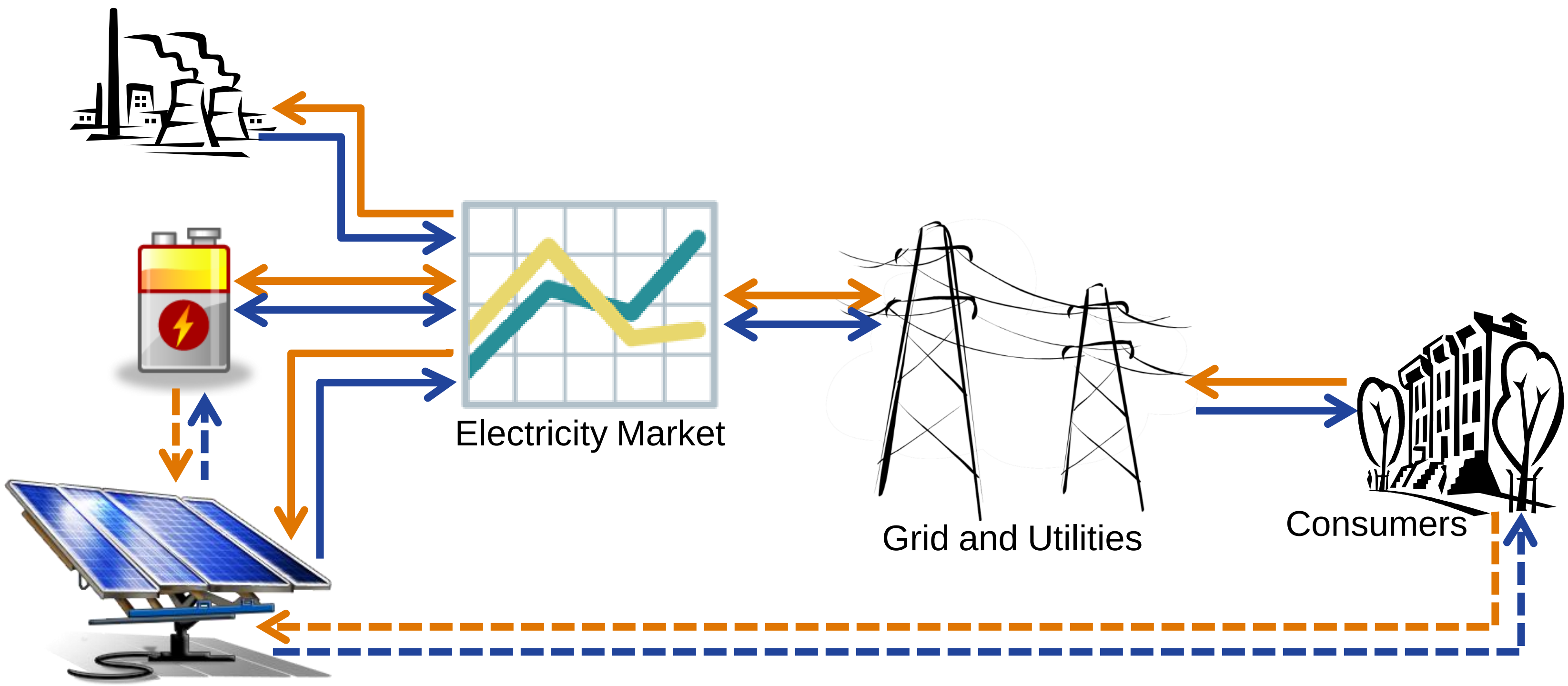
Supply secure, predictable, and reliable energy

What is needed to establish investment certainty and impose acceptable costs?



*If electricity is not consumed onsite

What criteria must be fulfilled to integrate renewables into the energy system?



Stakeholders should be able to recover the costs of investments in PV, storage, grid infrastructure, and backup generation via the open market, over the counter contracts, or regulatory structures.