



**coalition for green capital**

# **Decarbonizing the U.S. Power Sector – Clean Energy Finance**

*Jeffrey Schub, Executive Director  
Coalition for Green Capital*

*October 20, 2015*

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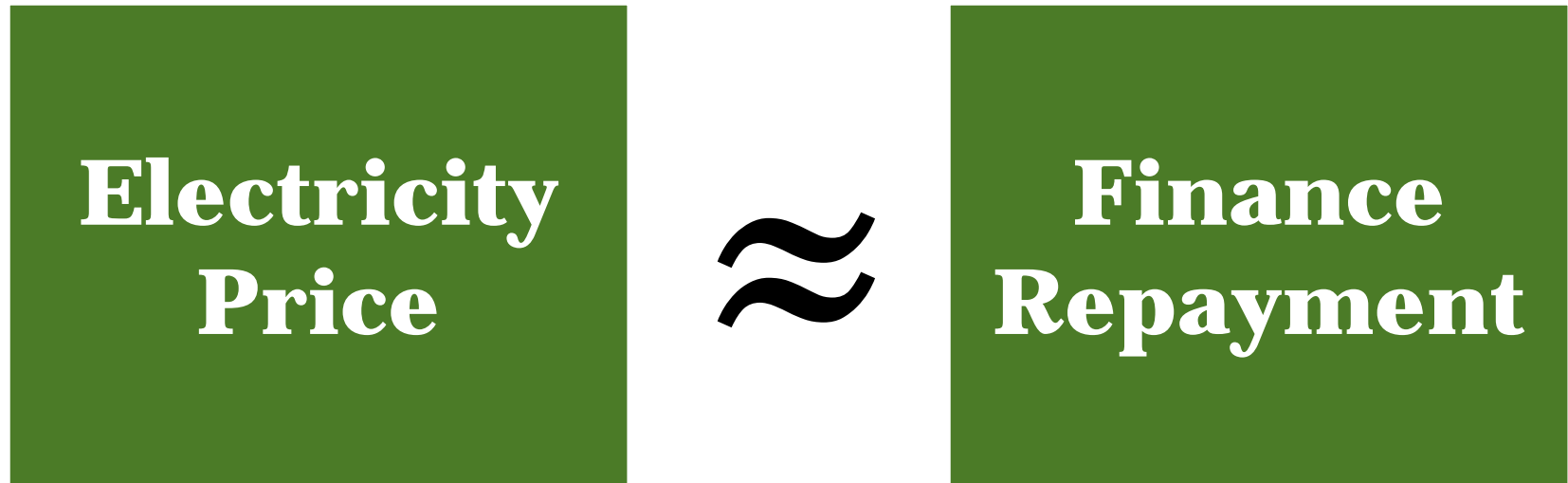
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- **CPP & The Role of Finance**
- **Current State of Clean Energy Finance Markets**
- **Energy Finance 101**
- **Clean Energy Finance Mechanisms**
- **Barriers to Clean Energy Investment**
- **Innovative Policy Solutions**
- **Clean Energy Finance In SIPs**

# Why care about energy finance?

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- Power plants (big or small) are expensive
- All electricity generation is financed - upfront cost is borrowed



- Owners must payback borrowed money with interest *and* earn their own return
- Owner needs steady cash flow to payback financing and get sufficient return

# If CPP involves construction of new generation or efficiency, then capital must be available for financing

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- State's relying on new clean energy sources for CPP compliance must consider who will finance construction
  - Who traditionally finances big, fossil-fuel power plants?
  - Will it be the same investors? Or are other investors better suited?
  - What will the cost of financing be?
  - What happens if not enough capital is available?
  - How will financing impact the state's electricity price?
- Does CPP automatically mean money will flow?
  - How does a mandate translate to clean energy investment?
  - Or a carbon tax? Or a cap-and-trade system?

# Existing RPS are good example of what happens when clean energy policy doesn't consider finance

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According to RPS,  
**Maryland Needs \$3B**  
in Solar Investment  
in 5 years

According to RPS,  
**DC Needs \$690M**  
in Solar Investment  
in 8 years

- Both states offer direct grants & high-priced SRECs, making solar electricity cheaper than grid power, but both states are behind targets
  - ***So why are they behind target?***
  - ***Where will all the investment capital come from?***

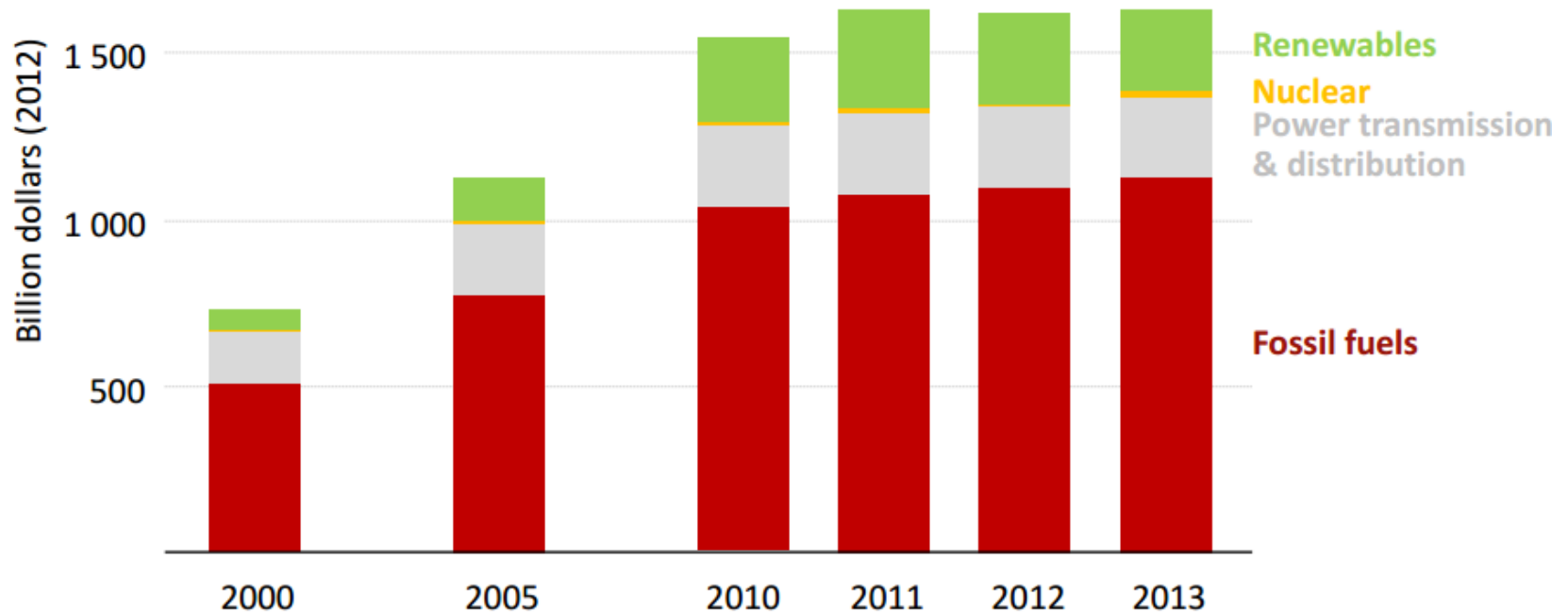
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# Global energy investment dominated by upstream fossil fuel extraction, renewables are tiny

Annual energy supply investment



*Investment in renewables rose from \$60 billion in 2000 to a high point approaching \$300 billion in 2011, stabilising at around that level since*

# U.S. renewable energy markets now attract large institutional investors & private equity

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**\$8.3 B**

2014 U.S. Wind  
Investment

**\$17.8 B**

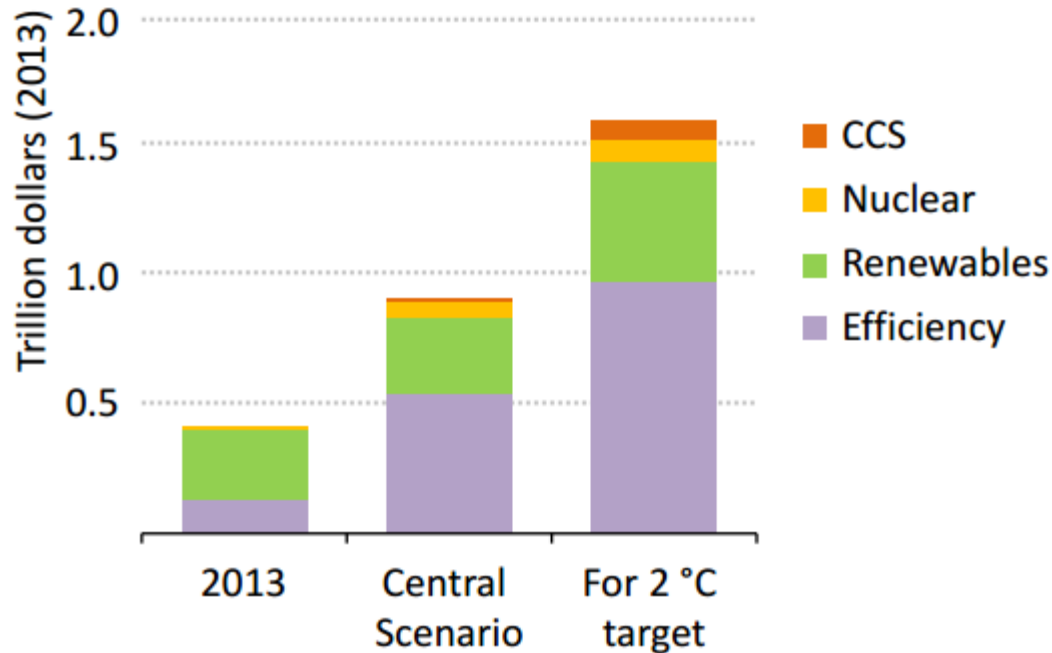
2014 U.S. Solar  
Investment



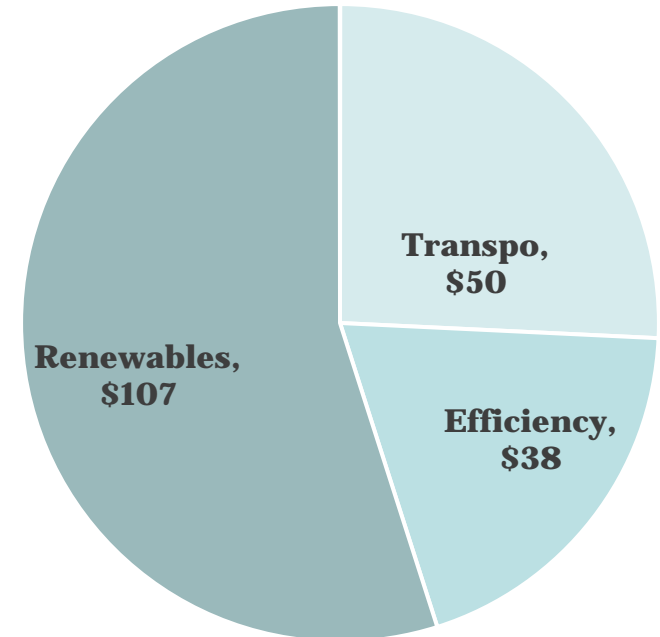
# ...but annual investment must increase massively, and stay at high levels for decades!

## Global Need – \$1.6T p.a.

Average annual low-carbon investment, 2014-2040



## U.S. Need – \$200B p.a.

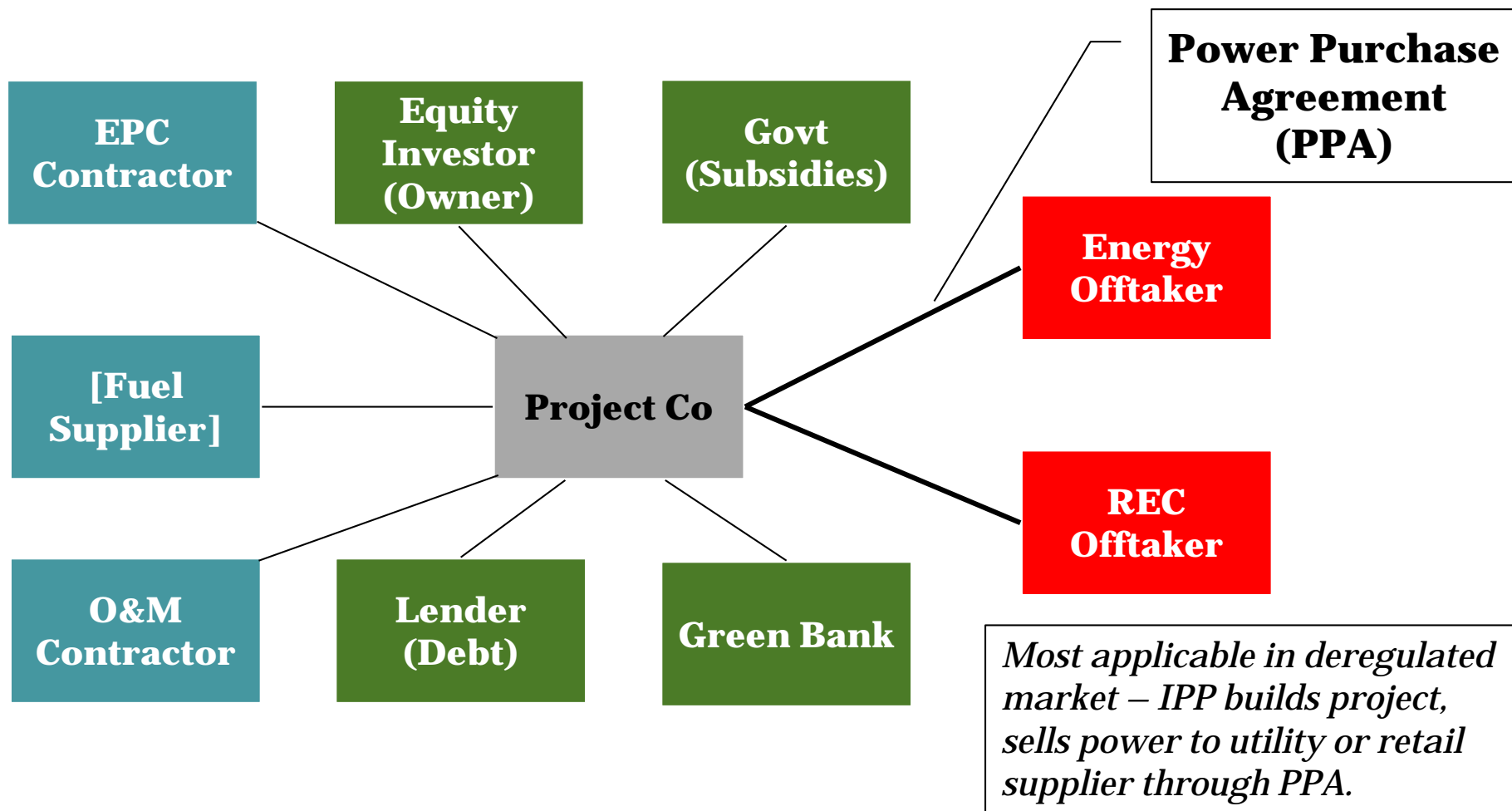


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# Energy projects financed through complex structure of investors, contracts and power purchasers

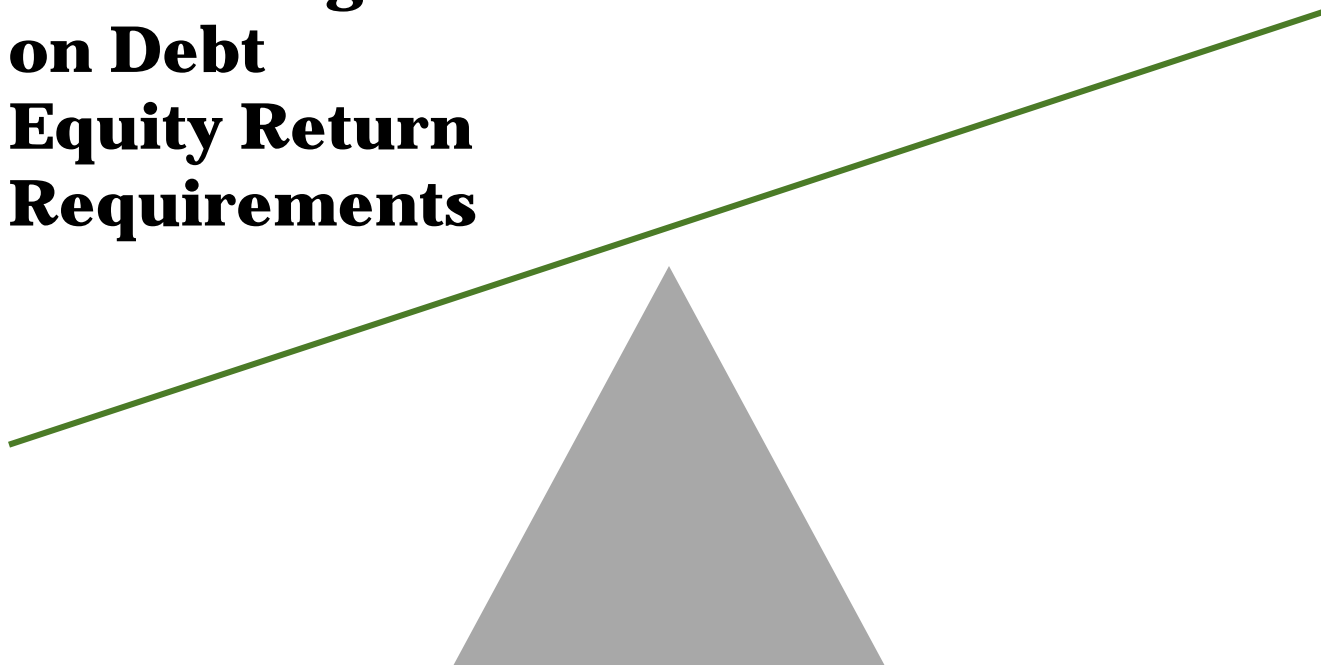


# High input costs will increase requisite electricity price that needs to be charged to meet those costs

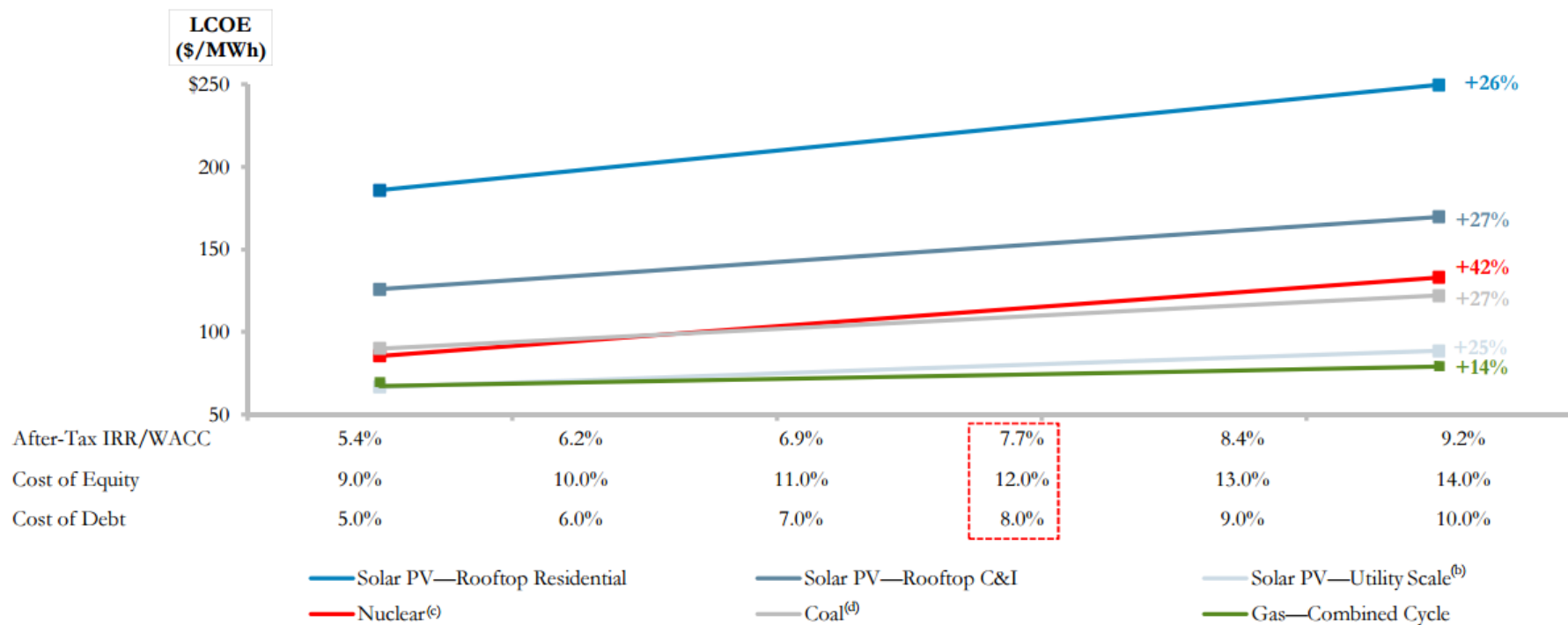
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- **Technology Cost**
- **Fuel Cost**
- **Borrowing Rate on Debt**
- **Equity Return Requirements**

**Price of Electricity (LCOE) from a Project**



# Cost of capital impact on LCOE means states should *really* care about availability & cost of financing

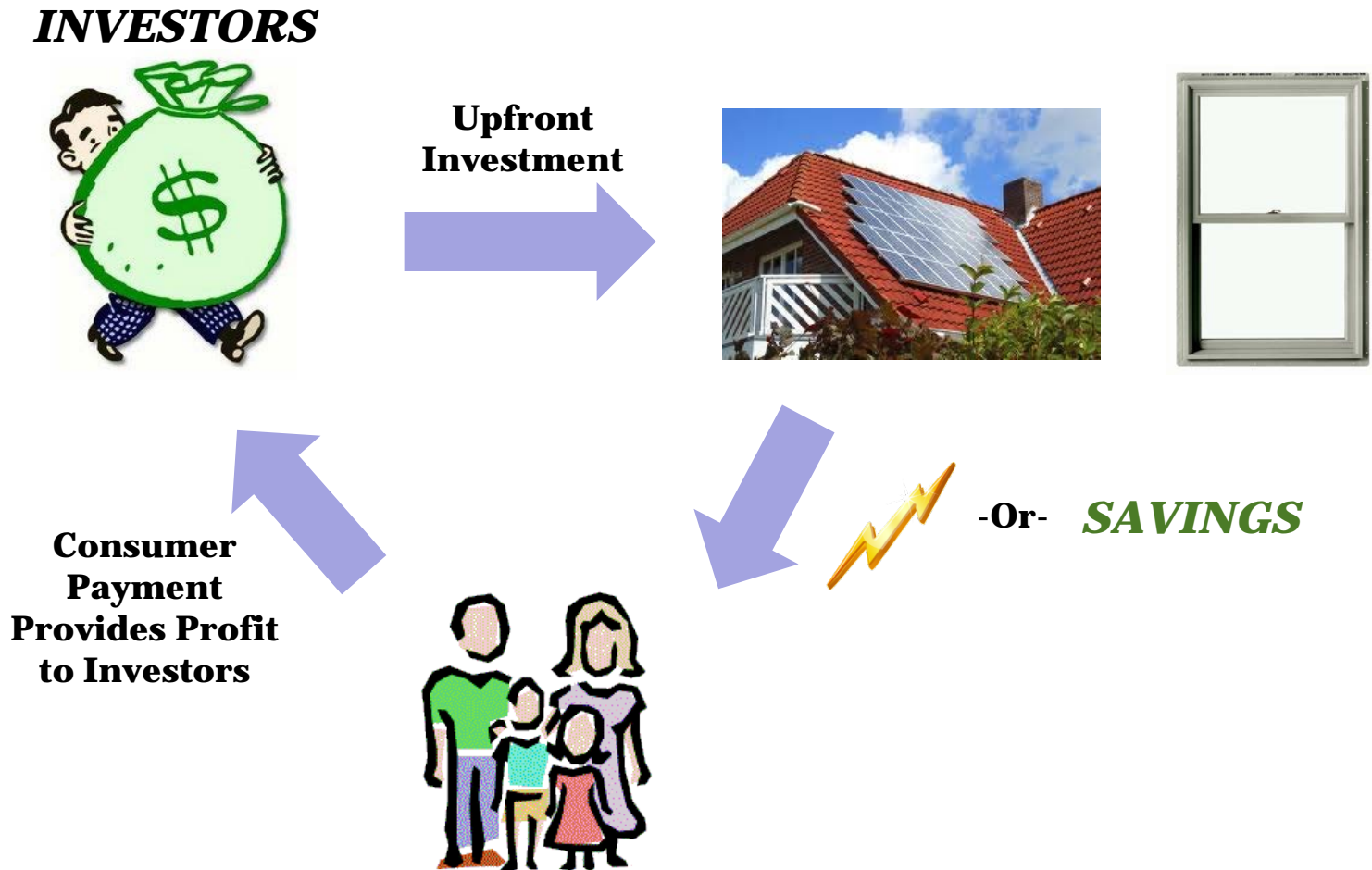


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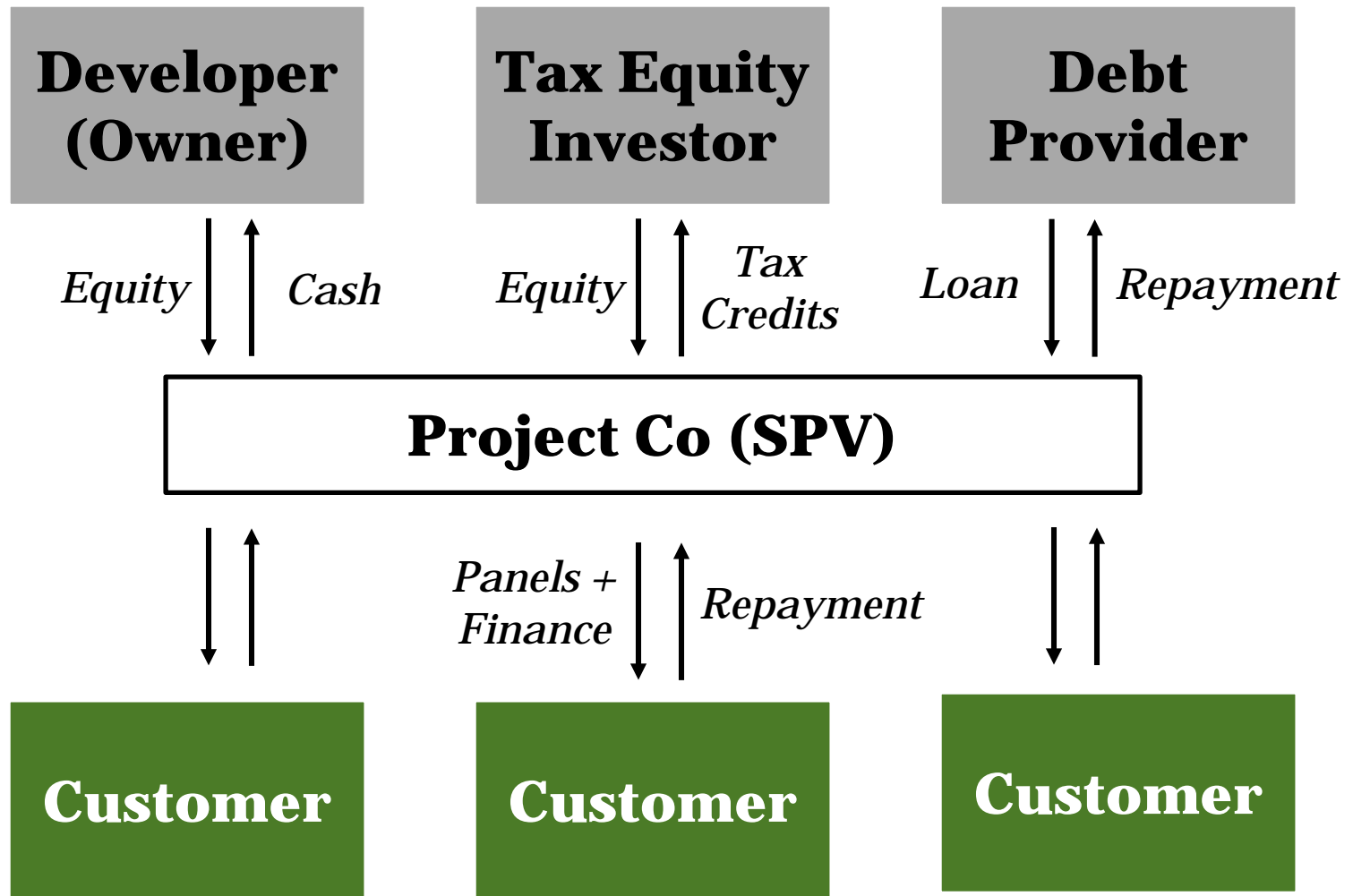
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# Efficiency & DG not that different from other consumer financing



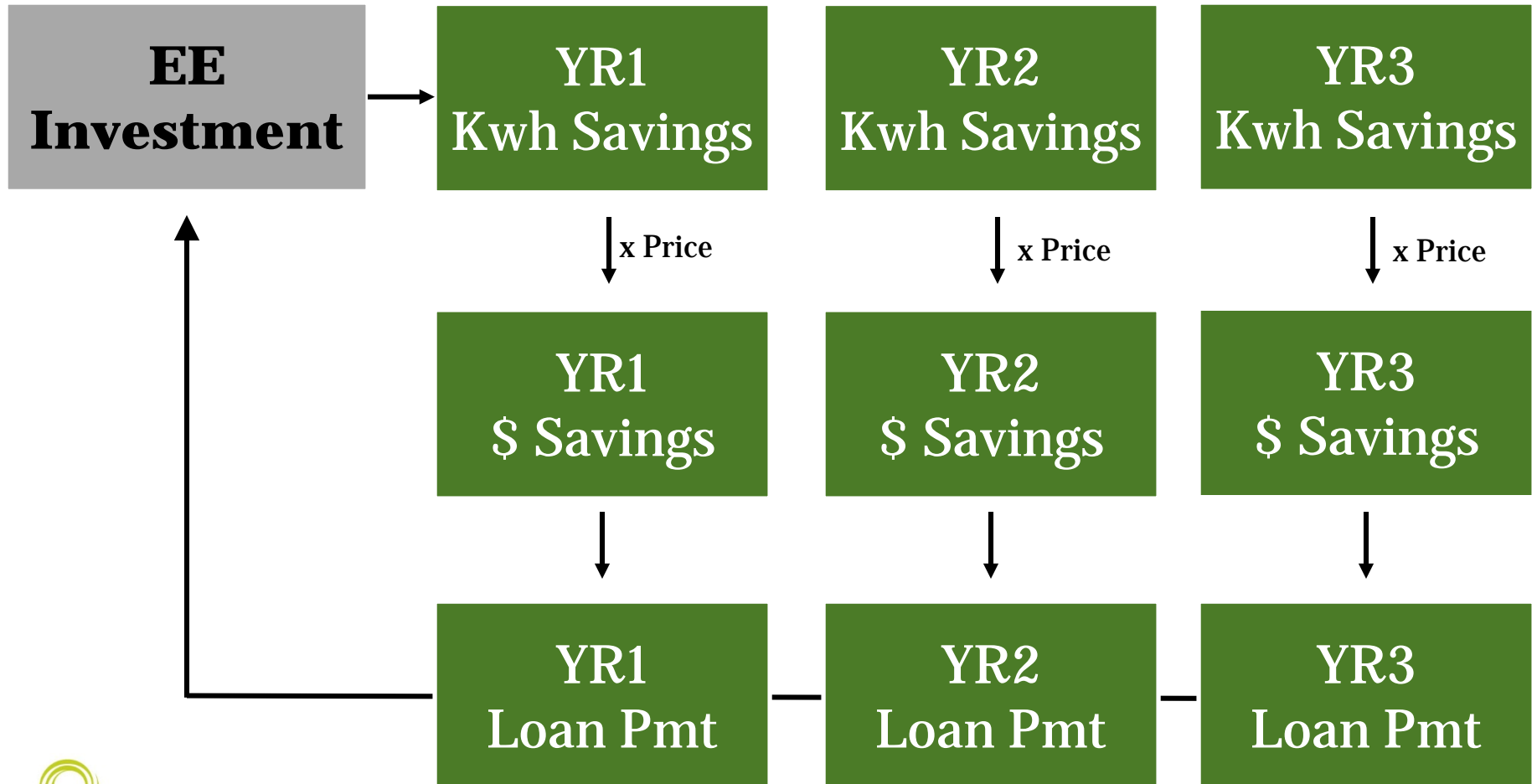
# Most common financing model for distributed solar is the solar lease aka solar PPA – “third-party owned”

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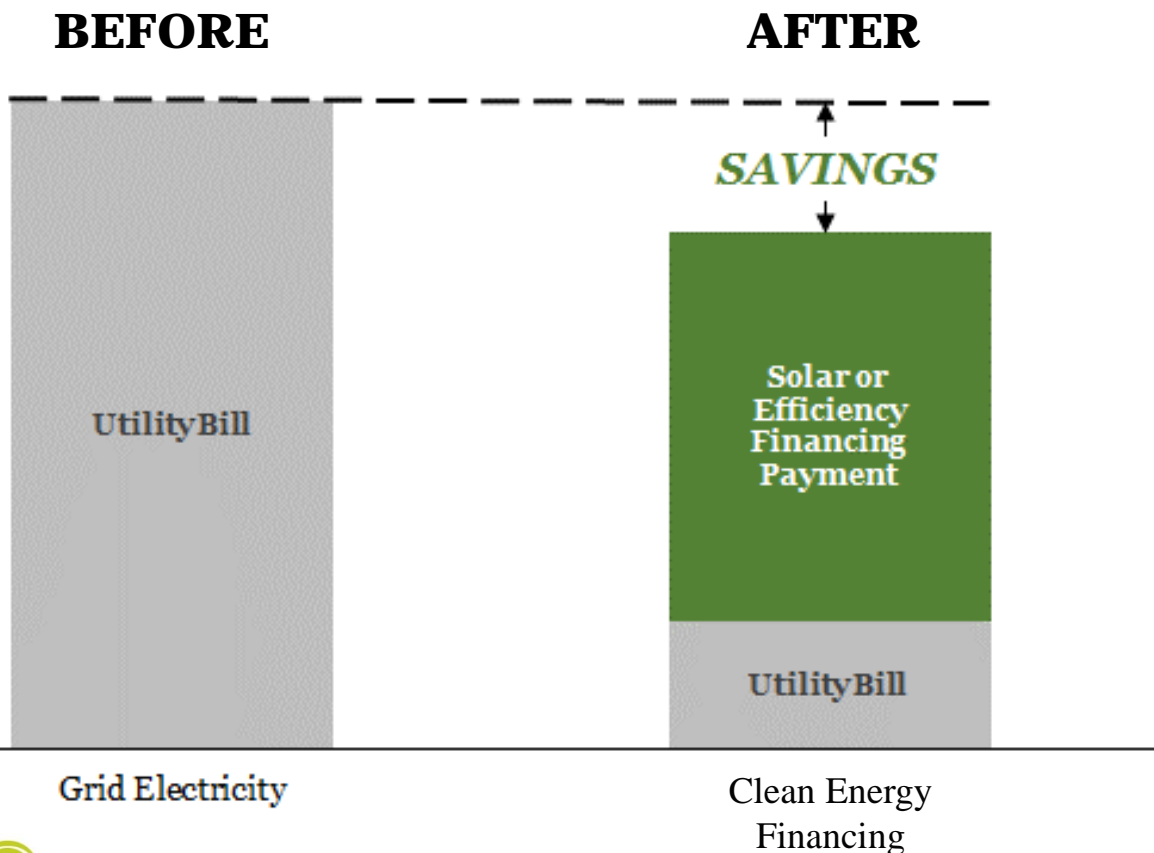


# Energy efficiency financing typically a direct loan, where lifetime savings exceed upfront investment



# Financing ideally structured so that repayment plus remaining utility bill are less than prior utility bill

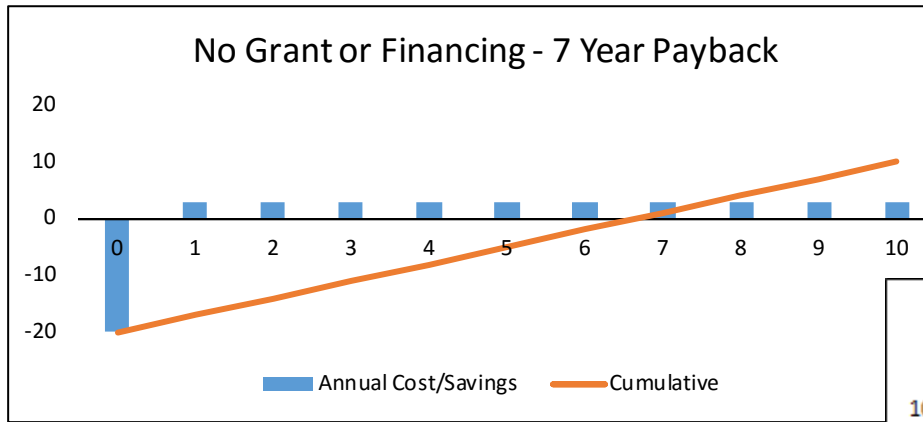
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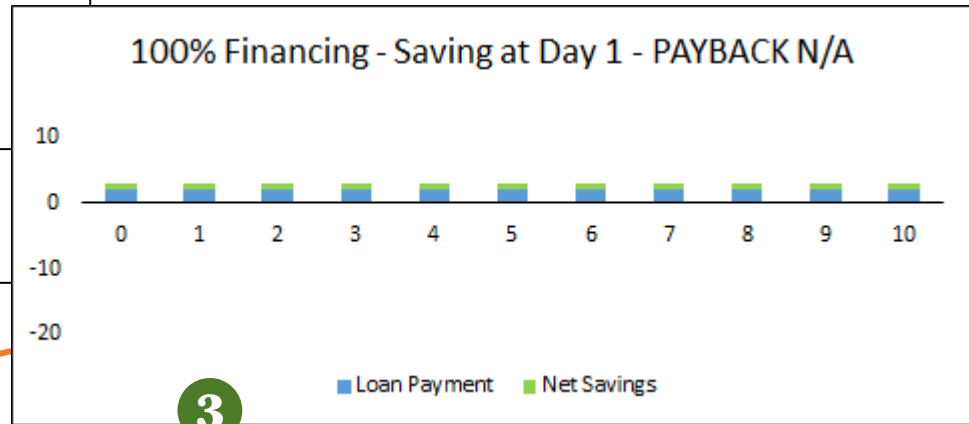
## Key Variables

- **Grid price**
- **Cost of technology**
- **Interest rate**
- **Financing term**

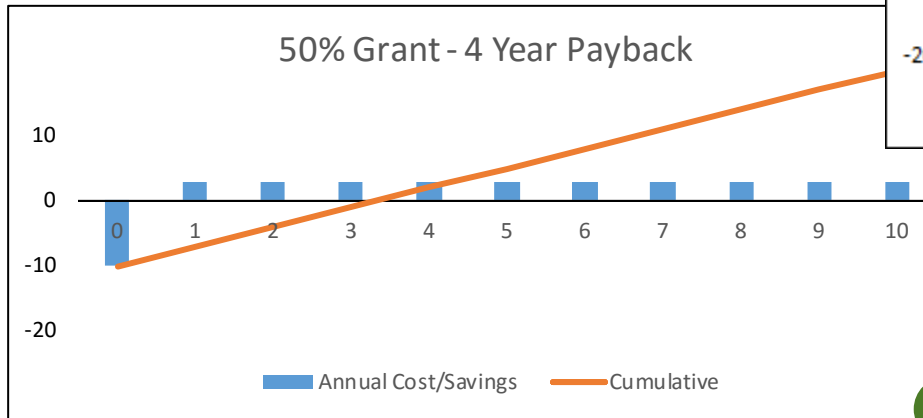
# Financing at appropriate term and rate means payback period no longer matters, all about cash flow



**1** A deep efficiency project has high upfront cost and long payback –barriers to adoption



**3** 100% financing eliminates these barriers – **NO UPFRONT COST, IMMEDIATE SAVINGS, NO PAYBACK PERIOD**



**2** Even a large grant covering 50% of the cost only reduces those barriers – doesn't eliminate them

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# Utility-scale projects look familiar to investors – but distributed projects are different

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## Centralized Projects

- Utility-scale
- Power directly to grid
- Strong credit
- Traditional project finance
- Relatively easy to finance

## Distributed Projects

- Smaller scale
- Scattered locations
- On-site energy use
- Varying credits
- Range of structures and approaches to finance

# Long list of reasons that a state cannot assume private capital will flow freely at good terms

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- **Barriers to supply of financing**
  - Don't trust savings/technology
  - We don't do unsecured loans
  - Underwriting is too complex & expensive
  - Can't figure out "who is the credit"
  - We don't lend longer than 8 years
  - We don't see any demand for this
- **Customer Barriers**
  - Don't trust savings/technology
  - Doesn't work for renters
  - Purchase process is too complicated
  - Will make it harder to sell my house
  - Won't live in this house very long
  - Don't think it will increase my property value
  - I don't want more debt on my balance sheet

# As a result, most distributed clean energy markets suffer from expensive or lack of capital

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## Markets With Adequate Private Capital

- High-credit residential rooftop solar
- Credit-rated large commercial efficiency projects

## Markets With No or Expensive Private Capital

- Mid-and-low credit residential solar
- Group/community solar
- Non-rated commercial solar
- MUSH and non-profit rooftop solar
- Residential energy efficiency
- Non-rated commercial energy efficiency
- Grid storage and micro-grids
- Alternative fuel vehicles and infrastructure
- Biomass, biofuels, CHP and fuel cells

# Financing for utility-scale projects may soon become harder, too – not just a challenge for distributed

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- **Best sites for utility scale projects already taken**
  - A site with lower natural resource produces means lower return for investors or higher electricity price
  - Plus, best sites are often very far from load (people) – transmission adds cost and complexity
- **Federal tax credits may go away**
  - Will instantly raise the price of renewable electricity
  - May push some of the largest tax equity investors out of the market

*Cost & availability of capital will soon become a concern for all kinds of clean energy*



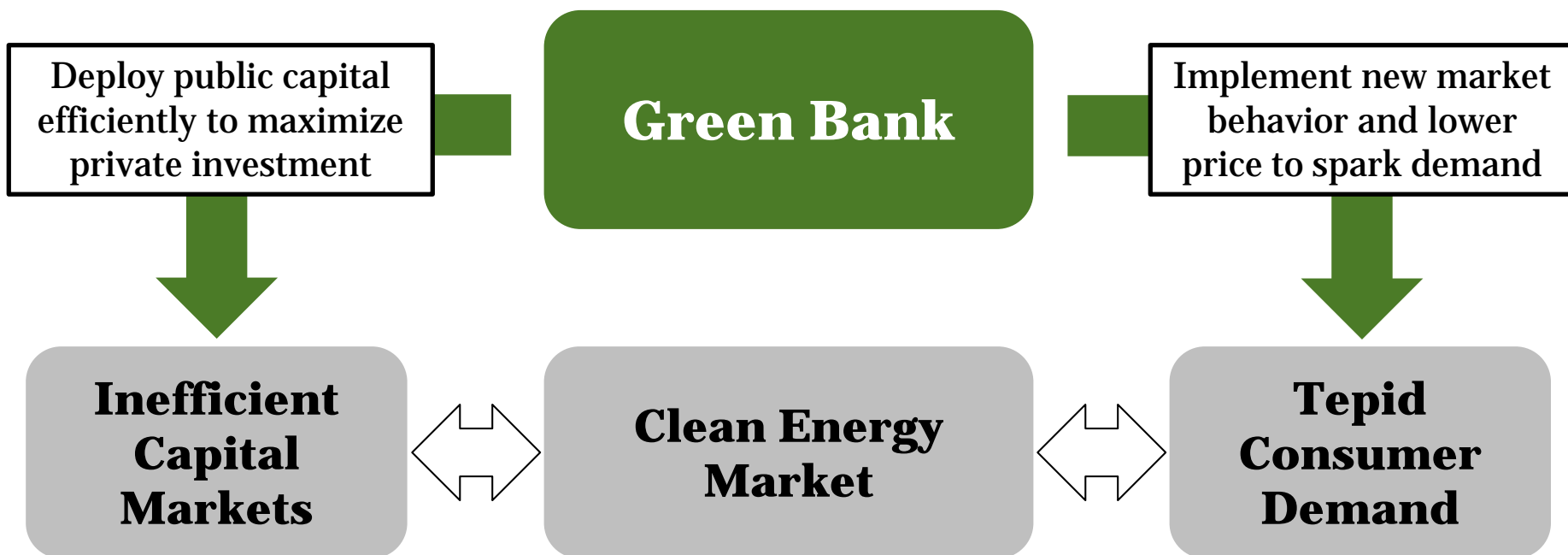
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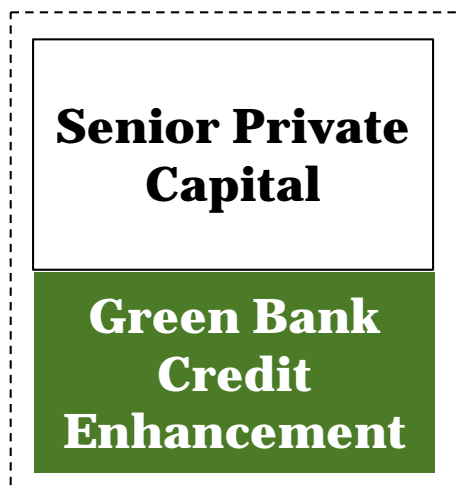
# Green banks fill the financing gap and draw in the capital needed to make clean energy markets grow

*A green bank is a public financing authority that leverages private capital with limited public dollars to accelerate the growth of clean energy markets*



# Green banks use multiple structures to draw in more investment capital at better financing terms

## Credit Support



## Co-Investment



## Warehousing



# Green bank capital lowers price of clean

## Price of Solar (cents/kwh) with Increasing Green Bank Capital

**% of Green Bank Capital in Structure**

Solar Install Cost (\$/Watt)	% of Green Bank Capital in Structure					
	0%	10%	20%	30%	40%	
<b>\$4.50</b>	21.0	18.7	16.3	14.0	11.7	
<b>\$4.00</b>	17.4	15.4	13.3	11.2	NA	
<b>\$3.50</b>	13.9	12.1	10.3	8.5	NA	
<b>\$3.00</b>	10.3	8.8	7.2	5.7	NA	

**Green Bank Lowers Price!**

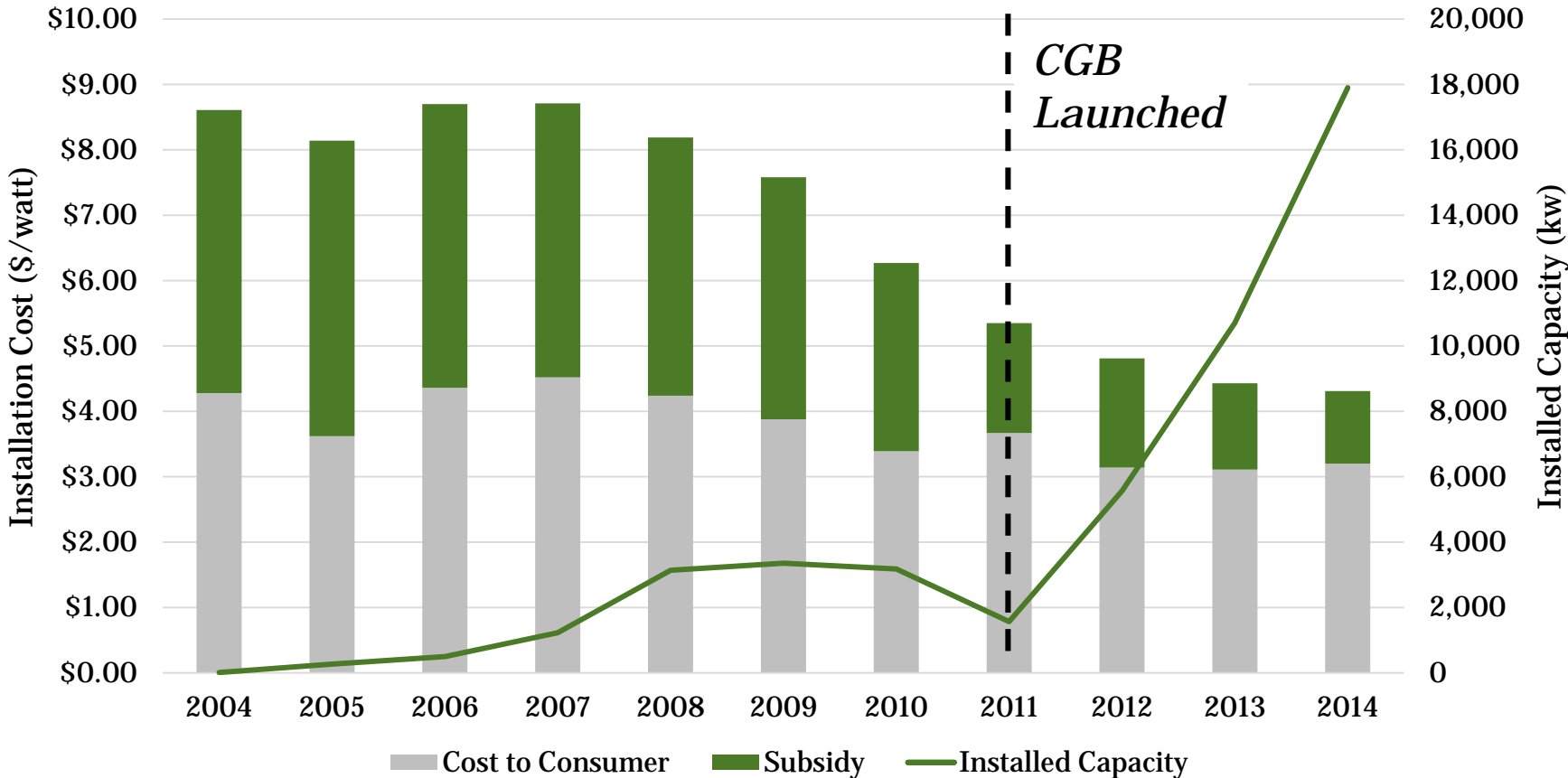
# Cheaper capital can also compensate for poor resource, preserve return to project owner

## Wind Project ROI with changing Windiness & Cost of Capital

		Wind Capacity Factor								
		50.0%	47.5%	45.0%	42.5%	40.0%	37.5%	35.0%	32.5%	30.0%
Cost of Capital	8.50%	30.2%	27.6%	25.1%	22.7%	20.3%	18.1%	15.9%	13.8%	11.7%
	8.00%	30.5%	27.9%	25.4%	22.9%	20.6%	18.3%	16.1%	13.9%	11.9%
	7.50%	30.9%	28.2%	25.7%	23.2%	20.8%	18.5%	16.3%	14.1%	12.0%
	7.00%	31.2%	28.5%	26.0%	23.5%	21.1%	18.7%	16.5%	14.3%	12.2%
	6.50%	31.5%	28.9%	26.3%	23.8%	21.3%	19.0%	16.7%	14.5%	12.3%
	6.00%	31.9%	29.2%	26.6%	24.0%	21.6%	19.2%	16.9%	14.7%	12.5%
	5.50%	32.2%	29.5%	26.9%	24.3%	21.8%	19.4%	17.1%	14.9%	12.7%
	5.00%	32.6%	29.9%	27.2%	24.6%	22.1%	19.7%	17.3%	15.1%	12.9%
	4.50%	33.0%	30.2%	27.5%	24.9%	22.4%	19.9%	17.5%	15.2%	13.0%
	4.00%	33.3%	30.6%	27.8%	25.2%	22.6%	20.2%	17.8%	15.4%	13.2%
	3.50%	33.7%	30.9%	28.2%	25.5%	22.9%	20.4%	18.0%	15.6%	13.4%
	3.00%	34.1%	31.3%	28.5%	25.8%	23.2%	20.7%	18.2%	15.9%	13.6%

*Lower Cost of Capital = Higher ROI*

# Example: Connecticut Green Bank changes grants to loans, and expands solar penetration



# Green Banks work!

## Connecticut Grant-Making Authority versus Connecticut Green Bank

	FY 2000 – FY 2001 (CCEF)	FY 2012 – FY 2014 (CGB)	FY 2015 (CGB)
<b>Model</b>	Subsidy	Financing	Financing
<b>Years</b>	11	3	1
<b>Energy (MW)</b>	43.1	65.3	62.6
<b>Investment (\$MM)</b>	\$350	\$350	\$365
<b>Leverage Ratio</b>	1:1	5:1	5-10:1
<b>Investment % Loans</b>	9%	57%	77%

# Green Banks are quickly spreading across U.S.

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## *Green Banks Operating Or Under Development/Consideration*

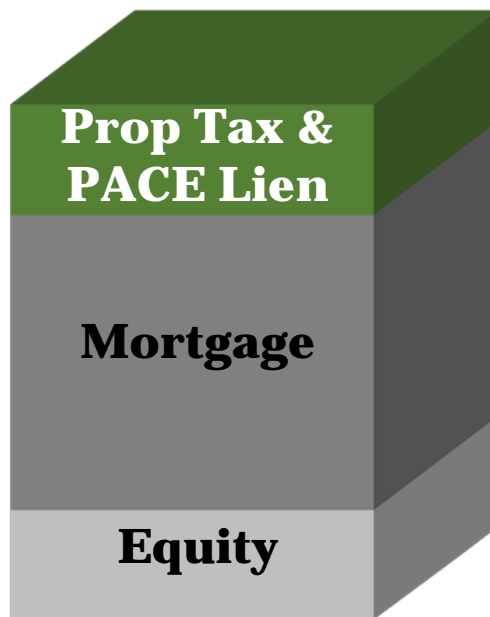




# PACE financing is new construct designed to increase lending security, make building investments appealing

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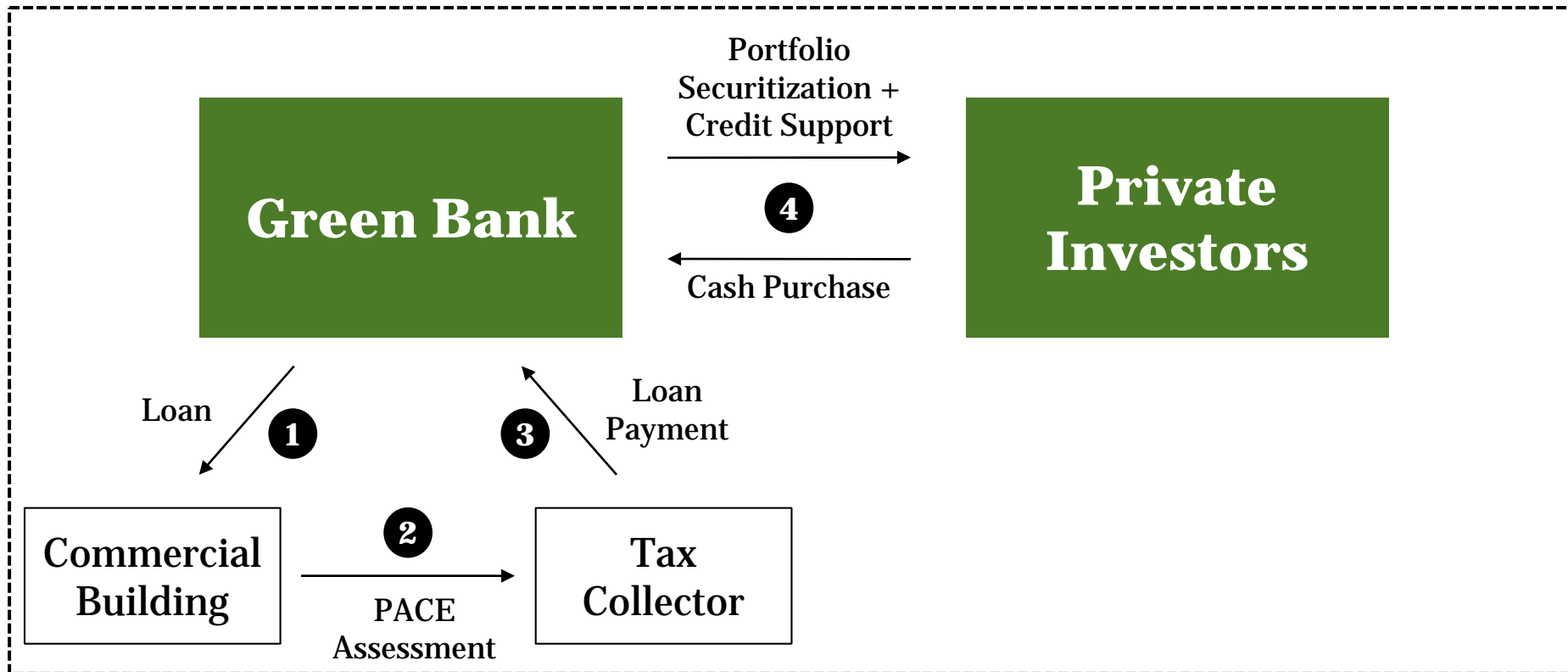
## *Commercial Building Capital Stack*



- PACE lien is new tax assessment
- PACE is lower cost, longer term than commercial loan
- PACE seniority secures repayment
- **PACE stays with property upon sale**

# Example: CGB's C-PACE enables secure efficiency investment at scale

## Centralized State-wide Green Bank Administration



# On-bill financing/repayment is similar to PACE, but payment through utility bill instead of property tax

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- **On-bill financing (OBF)** – utility provides loan capital
- **On-bill repayment (OBR)** – open platform that any capital provider can lend, utility only does collection
  
- **Benefits**
  - Lower default rate – people pay their electricity bills!
  - Overcomes principal-agent challenge – can be used by renters
  - **Loan can stay with the meter** – payment picked up by next occupant
- **Challenges**
  - May involve technical complexity to upgrade utility systems
  - Shut-off provisions?

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# To comply with CPP, state's may presume that it will be “expensive”

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- Expensive how?
  - Will electricity prices go up?
  - Will the public sector have to provide grants?
  - Will customers have to pay to construct new clean energy?
- With bad policy, the answer to every question is yes
  - Lack of capital & high cost of capital can make renewables pricey
  - States fall back on grants, expensive & often not necessary
  - With no state effort to increase financing, customers have to pay out of pocket to adopt clean energy
  - Loss of tax credits means financing for large projects dries up

# Typical policy tools can lower the *price* of clean energy, but don't directly target *financing*

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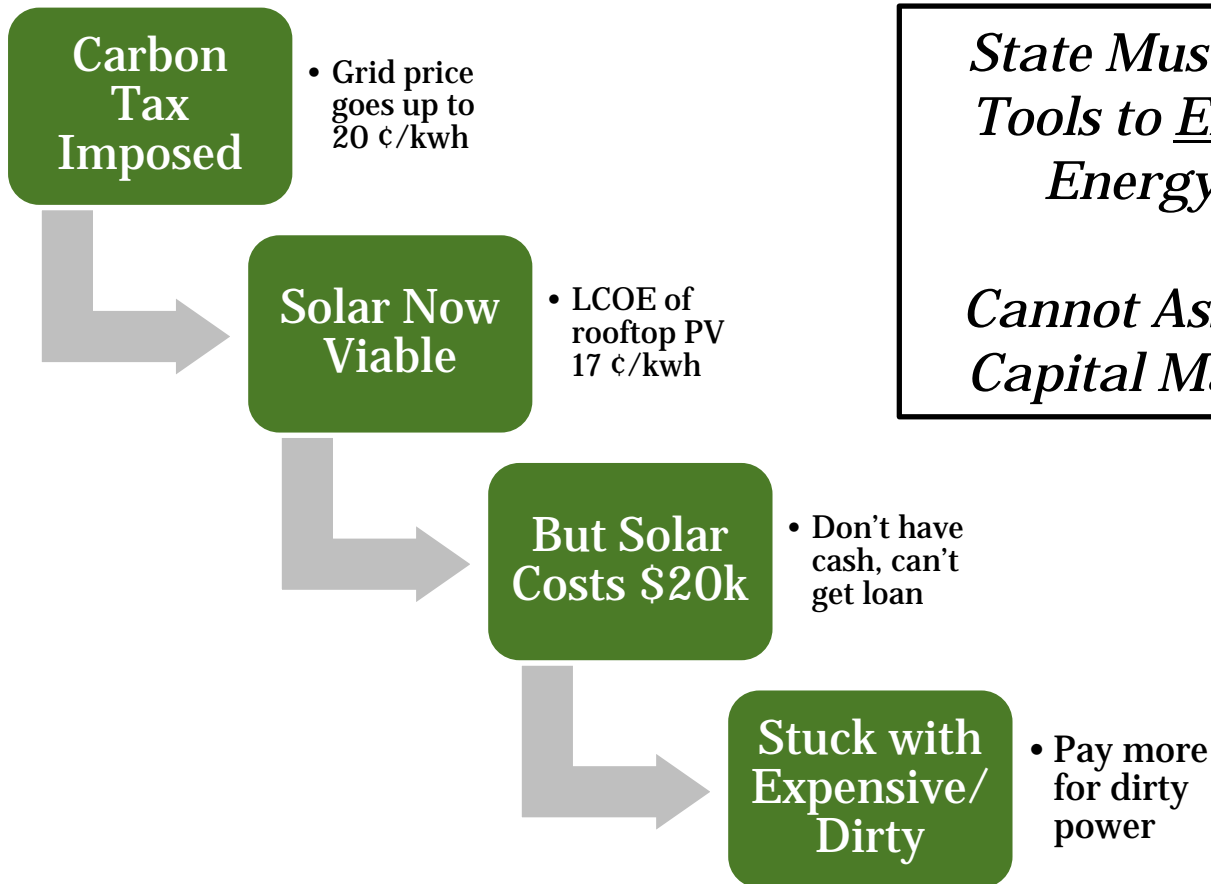
- Subsidies

- Direct cash grants → Reduce upfront cost, but still requires large cash outlay, must come from somewhere
- Tax credits → Like grant, added challenge of needing tax liability
- Performance based incentives → Stream of future benefits, not a source of upfront capital
- Feed-in tariffs → Very secure future stream of future benefits, but still not a source of upfront capital

- Credits

- Renewable energy credits → Future benefits at uncertain value, hard to monetize, not a source of upfront capital
- Carbon emission credits → ???

# A cap-and-trade system or carbon tax without ensuring available financing is incomplete policy



*State Must Provide Finance Tools to Enable A Switch in Energy Consumption*

*Cannot Assume that Private Capital Markets are Perfect*

# No matter specific framework of SIP, all states will need to consider how construction will be financed

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- Cannot deploy clean energy at scale w/o financing
  - Cost of capital directly impacts price of renewables
  - Cost & availability of capital drives demand for efficiency
- States concerned with compliance cost need to consider financing policies
  - Loss of PTC/ITC will increase LCOE of all renewables
  - Grants more expensive than loans, don't solve upfront cost problem
- Merely creating a credit trading system or making dirty electricity more expensive doesn't mean third-party capital will flow at good terms
  - Private investment capital does not automatically flood all viable clean energy project opportunities





**coalition for green capital**

# **Thank You**

Comments and Questions:

Jeffrey Schub, Executive Director,

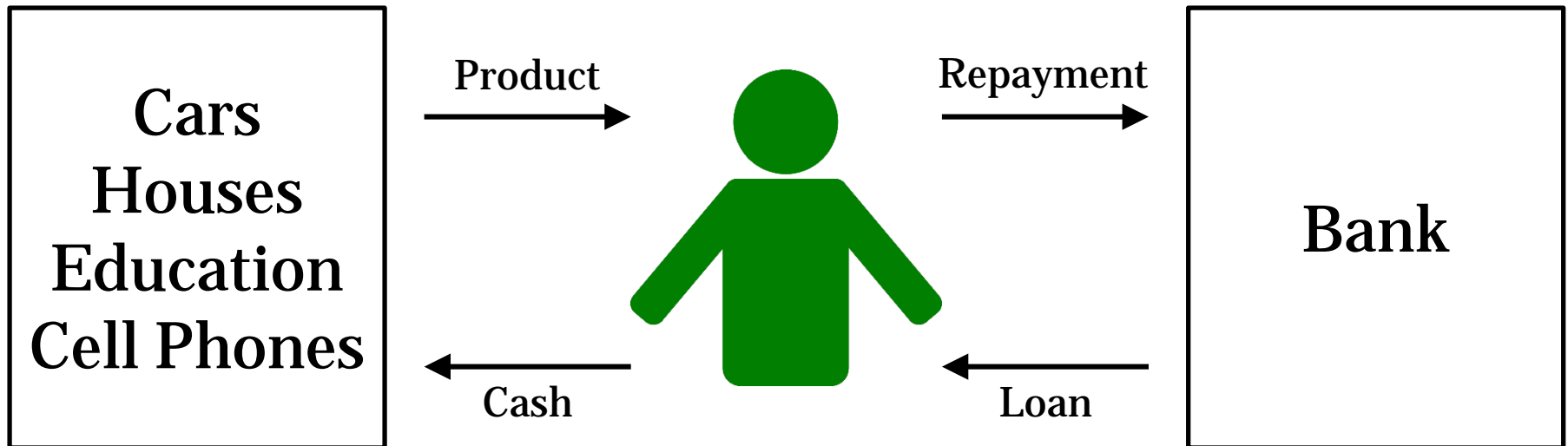
Coalition for Green Capital

[jeff@coalitionforgreencapital.com](mailto:jeff@coalitionforgreencapital.com)

With distributed clean energy, individual consumers become the borrowers – not utilities or IPPs

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## We Already Finance Everything



# Would you buy a house without financing?

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\$300,000

Mortgage

Down  
Payment

Price

Bank financing, aka Mortgage,  
eliminates 80% of upfront cost.

Down  
Payment

Upfront

Mortgage  
Payment

Year 1

...

Mortgage  
Payment

Year 30

# 85% of all vehicle purchases are financed with a loan or a lease

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\$25,000

Auto Loan

Down  
Payment

Price

Auto loans can eliminate 100% of  
upfront cost of a car.

Down  
Payment

Upfront

Loan  
Payment

Year 1

...

Loan  
Payment

Year 5

# But how do you get rooftop solar or energy efficiency without financing

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\$30,000

Upfront Cost  
with no  
Financing

**Price**



**Upfront**

Without financing  
for clean energy, you  
have to pay the  
entire cost upfront!

# Different types of investment in energy projects have varying expectations of return, structure

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## Equity

- An equity investor owns the project
- Typically the project developer
- No certain flow of repayment
- Expectation that equity will appreciate, but ROI not fixed

## Debt

- Debt broadly means a loan
- Can be from a bank, institutional investor, others
- Repayment is required at regular intervals, set interest rate
- Debt investor wants certainty that project can repay loan

## Tax-Equity Investor

- Equity investor primarily seeking to extract tax benefits, not cash
- Technically a project owner, but only for limited period under specific conditions

# Any discussion of clean energy finance must address the federal tax benefits

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## Investment Tax Credit (ITC)

- 30% of the cost of the system
- Most frequently used for solar
- *Credit*, not a deduction – must have tax liability
- Scheduled to decline at end of 2016

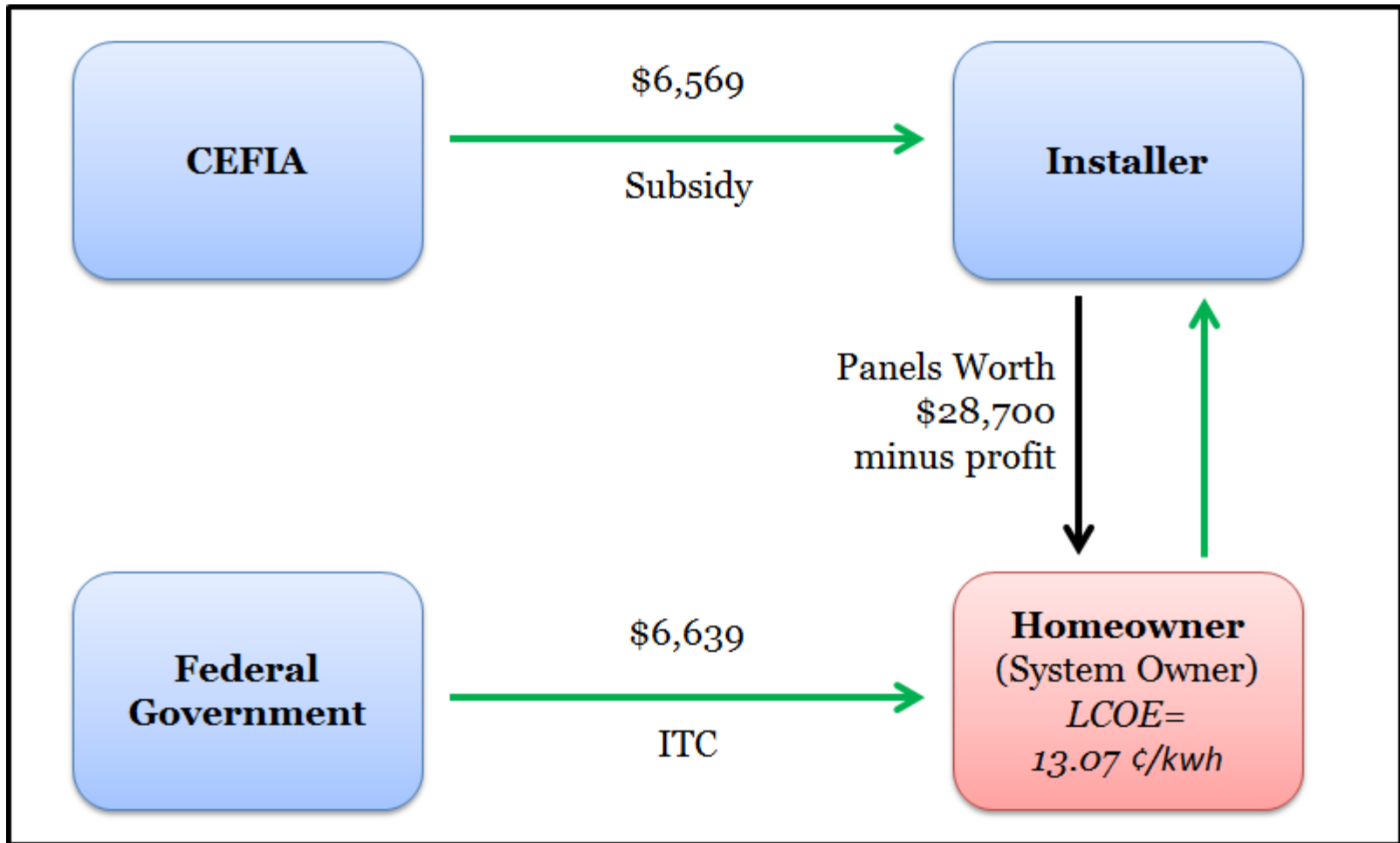
## Product Tax Credit (PTC)

- Performance-based incentive
- 2.3¢/kwh for 10 years of generation
- Also a credit, not a deduction – must have tax liability
- Technically expired, but not really – as long as “in construction”

## Depreciation (MACRS)

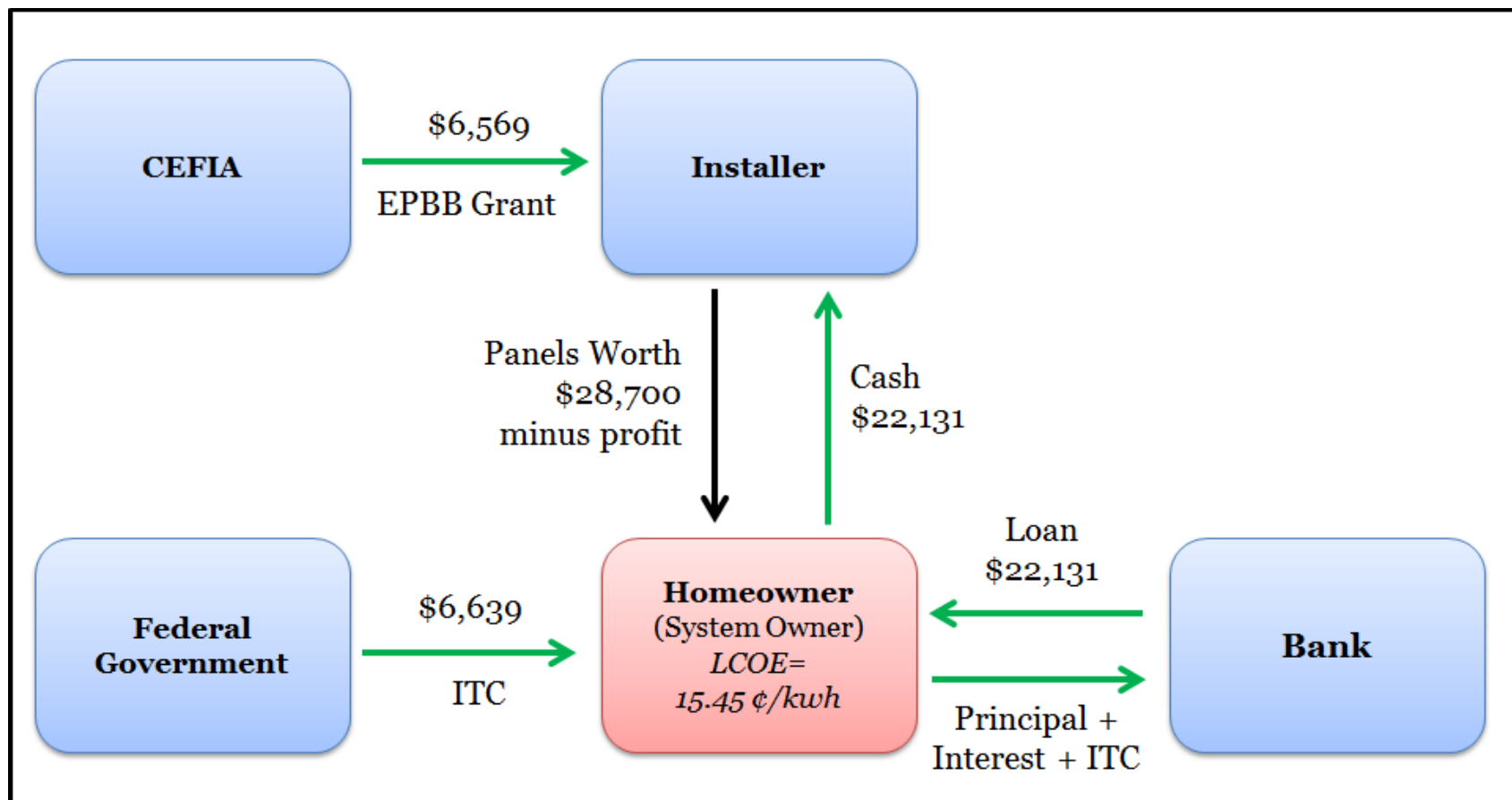
- Renewable project owner can depreciated value over 5 years; accelerated schedule
- Creates a tax benefit roughly equal to 25% of system cost
- Must be a corporation to take benefit; individuals don't take depreciation

# EXAMPLE: Value flow of residential solar purchased with cash by homeowner in CT

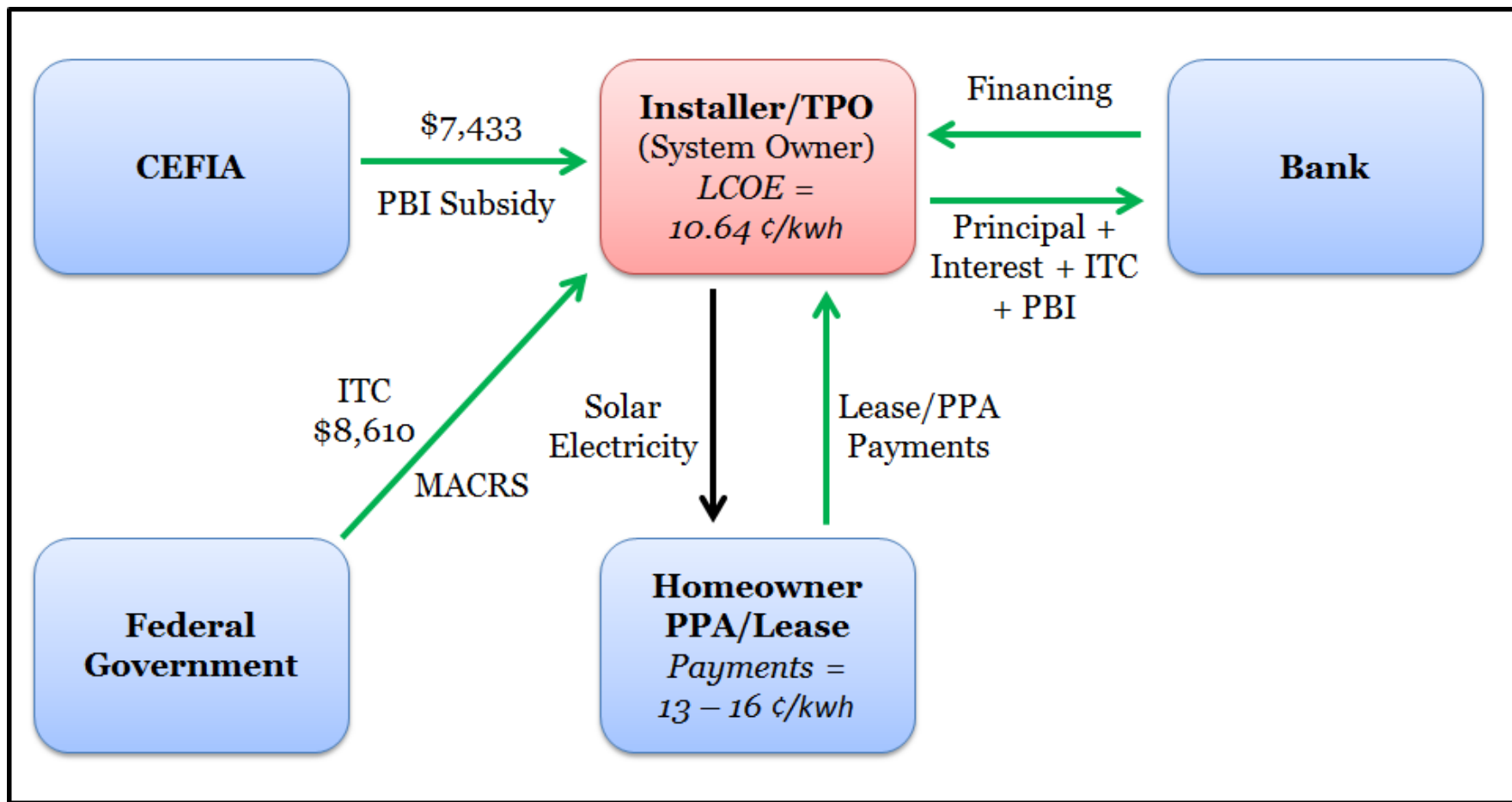




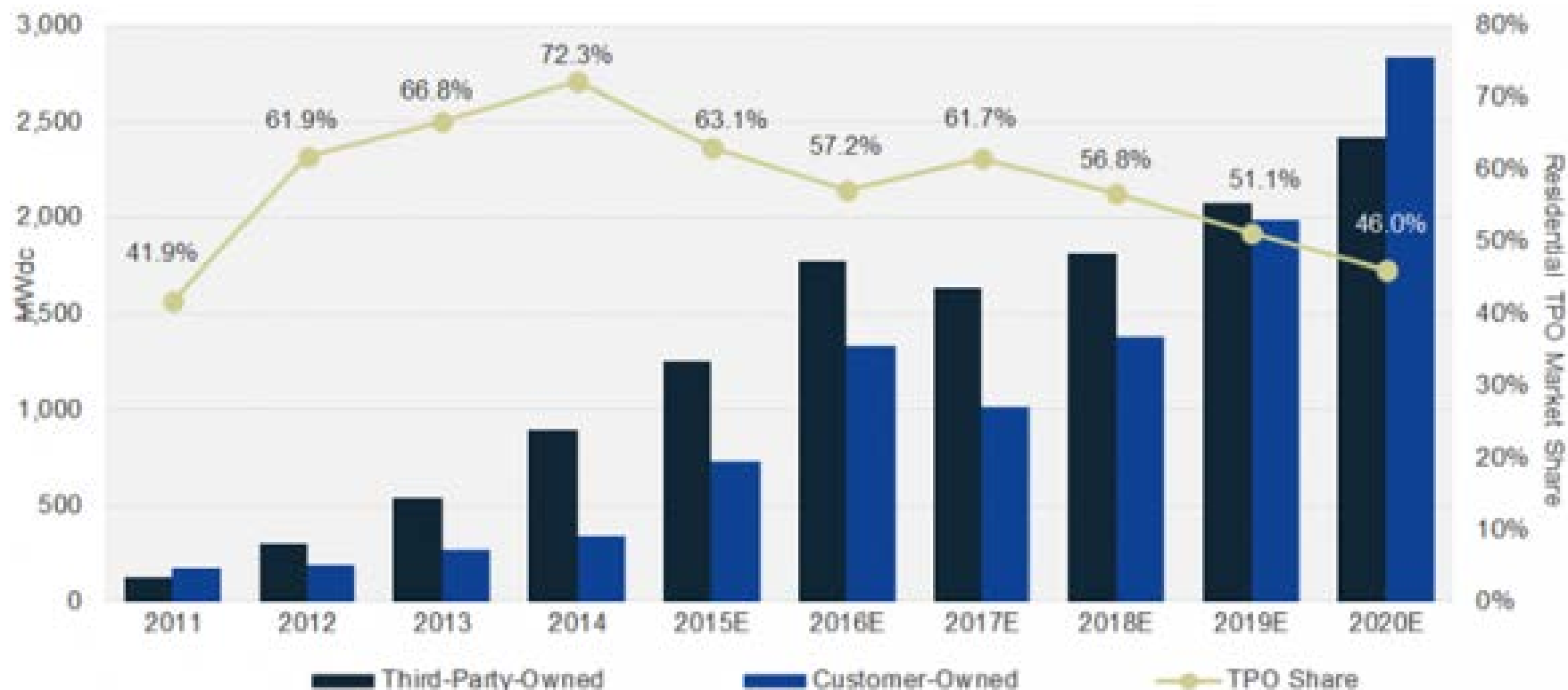
# EXAMPLE: Value flow of residential solar purchased with loan by homeowner in CT



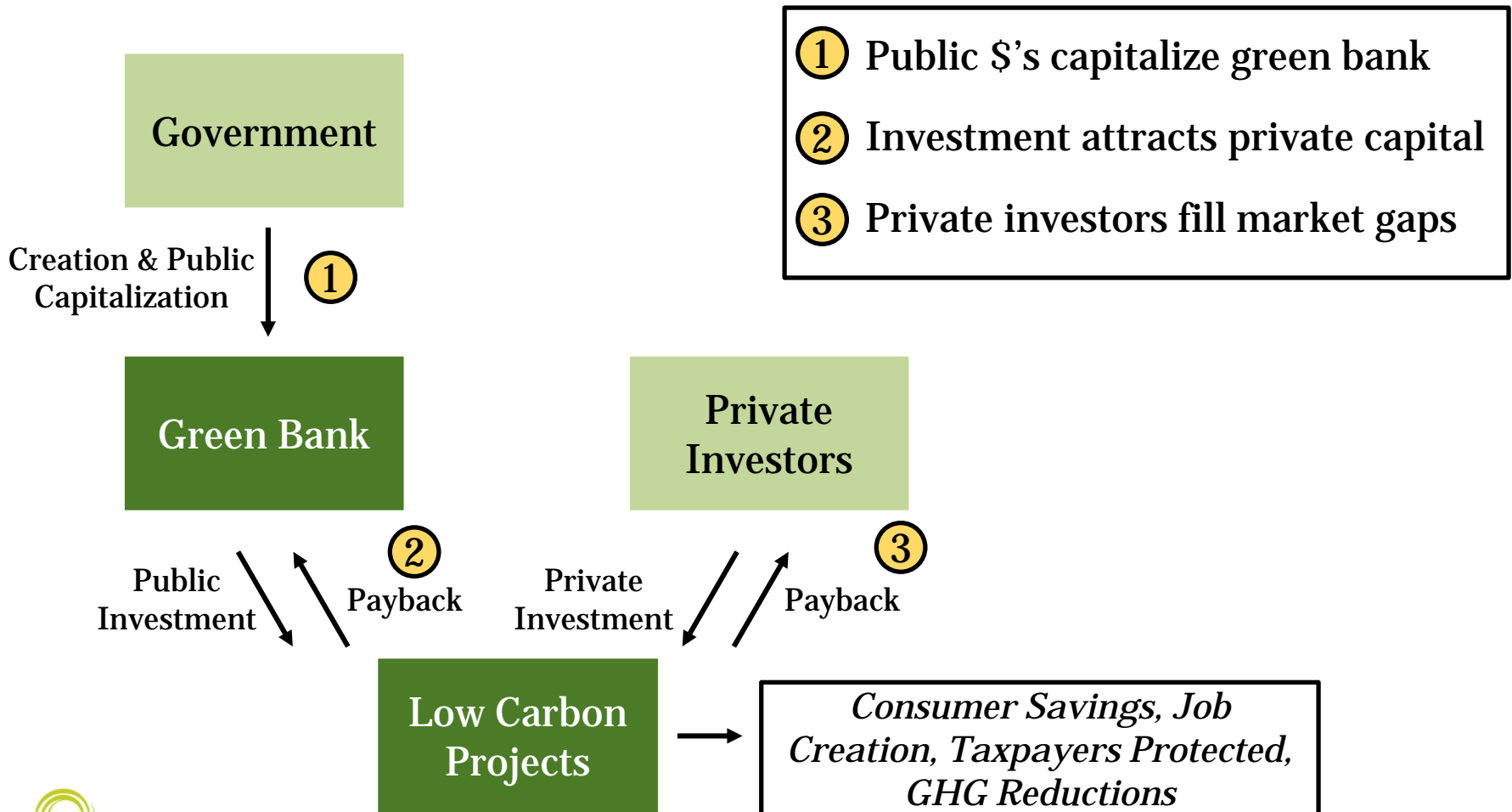
# EXAMPLE: Value flow of residential solar electricity consumed by homeowner via TPO lease/PPA in CT



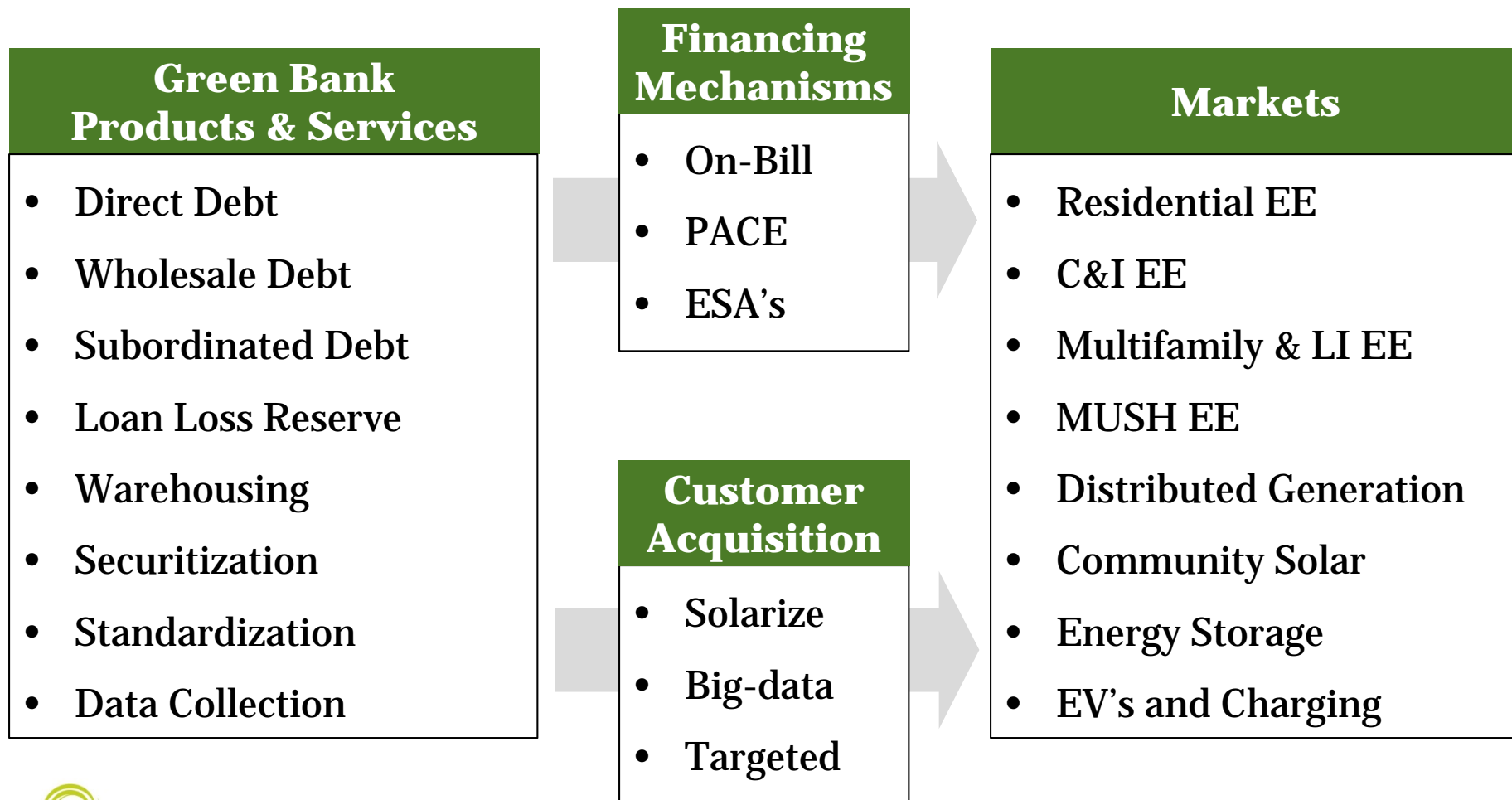
# Market is starting to transition away from complex TPO lease structure and toward traditional loans



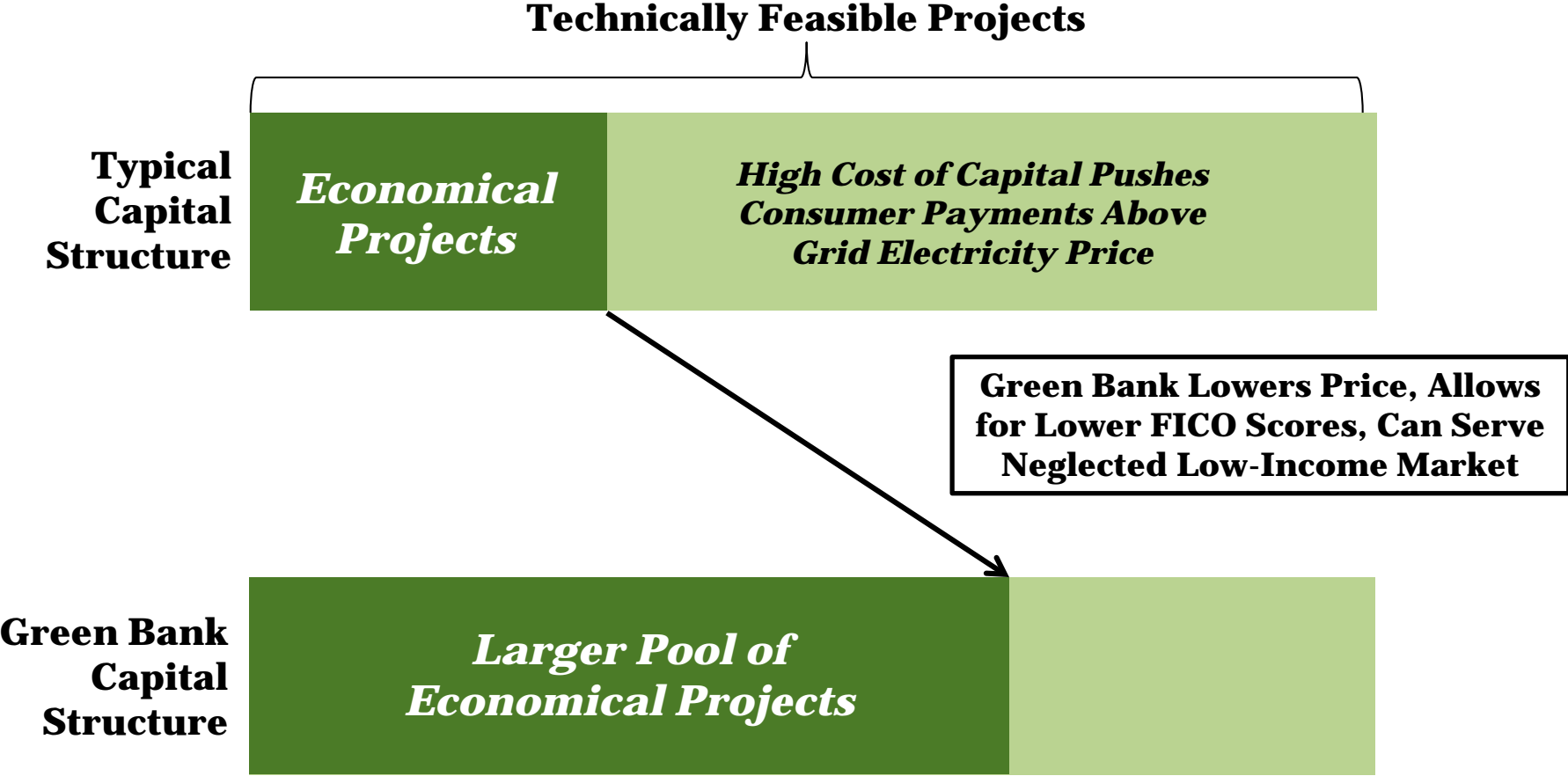
# Green Bank is a public institution that channels public & private investment



# Range of green bank financial tools, applied to prioritized markets, through innovative structures



# Green banks expand pool of viable projects with lower price and credit enhancements



# Example: CGB's Residential Solar Tax Equity Fund expands customer access to rooftop solar

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- CGB created unique public-private financing platform
- Product enables local developers to offer financing to customers who otherwise would have to pay all upfront

