

WELCOME!

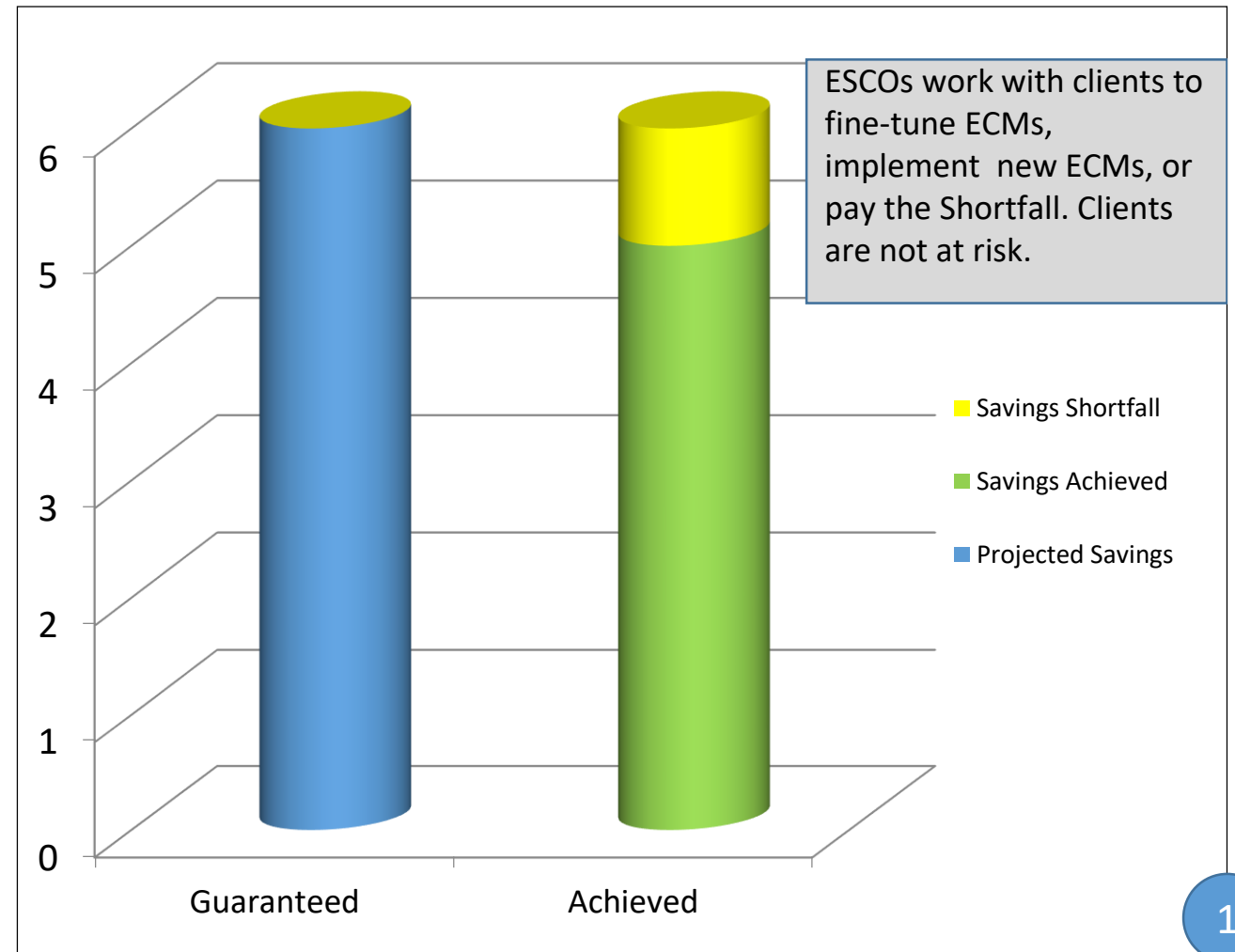


SEOUL ENERGY CORPORATION

September 21, 2017

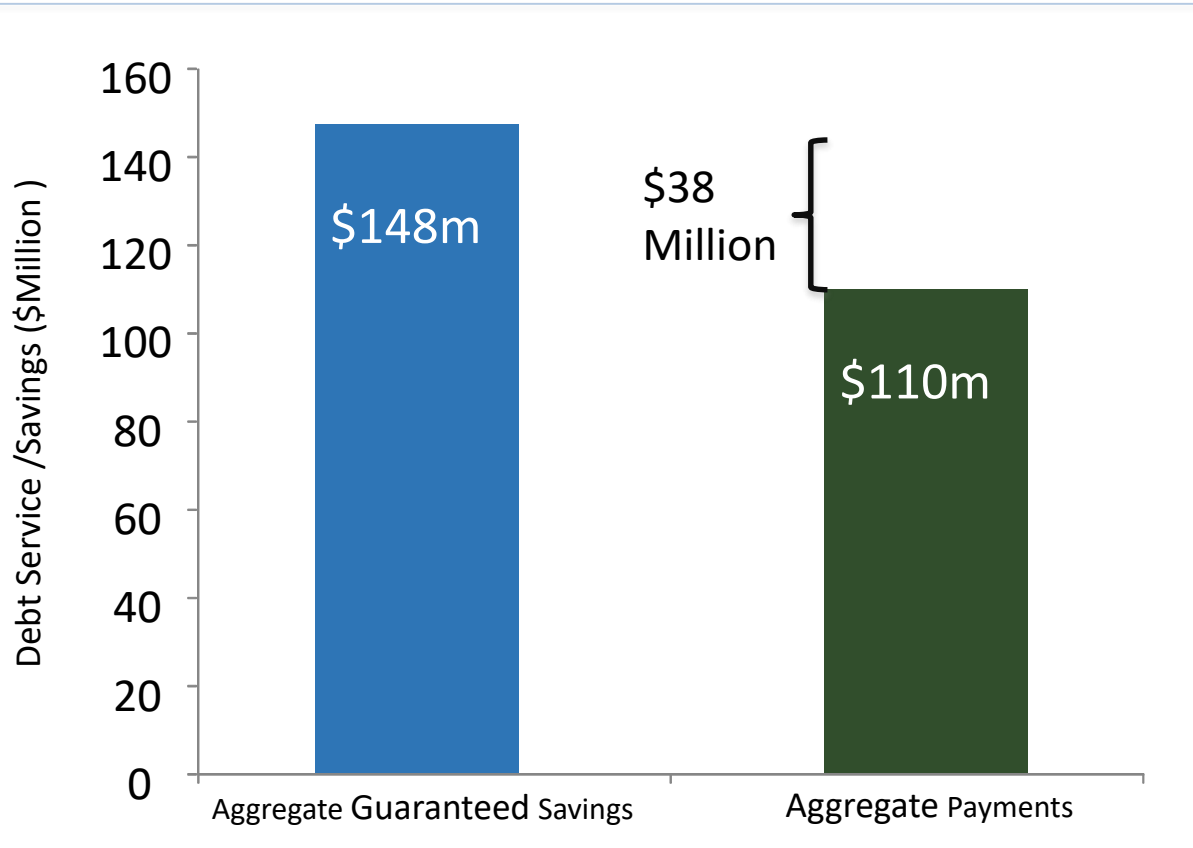
FREE's Services

- ✓ Research-driven program and policy design
- ✓ Contract and program documents that serve the interests of public and non-profit clients
- ✓ Assistance in technology assessment:
 - ✓ Energy, water, and materials conservation
 - ✓ Distributed generation (e.g., solar PV, storage)
 - ✓ Microgrids
 - ✓ Smart energy management
 - ✓ CHP
- ✓ Diagnostic M&V
- ✓ Financing
 - ✓ Capital markets, banks, other
 - ✓ Flexible approach



ENERGY EFFICIENCY MARKET DEVELOPMENT: SCALING UP “NEGAWATT” INVESTMENTS

The Delaware Sustainable Energy Utility: New Policy & New Economy for the New Climate



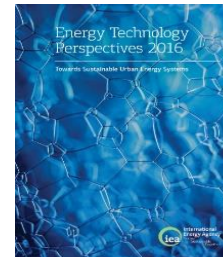
JUNE 2011

ASIA CLEAN ENERGY SUMMIT COMMUNIQUE
ASIAN DEVELOPMENT BANK RECOMMENDS USE OF
THE SEU MODEL TO THE REGION'S POLICY MAKERS



DECEMBER 2011

U.S. BETTER BUILDINGS CHALLENGE
RECOGNIZES THE DELAWARE SEU MODEL FOR
ACCOMPLISHMENTS MERITING NATIONAL ATTENTION



MAY 2016

IEA'S ENERGY TECHNOLOGY PERSPECTIVES 2016
ENCOURAGES CONSIDERATION OF THE SEU MODEL
FOR PLANNING URBAN ENERGY TRANSFORMATIONS

Lessons Learned

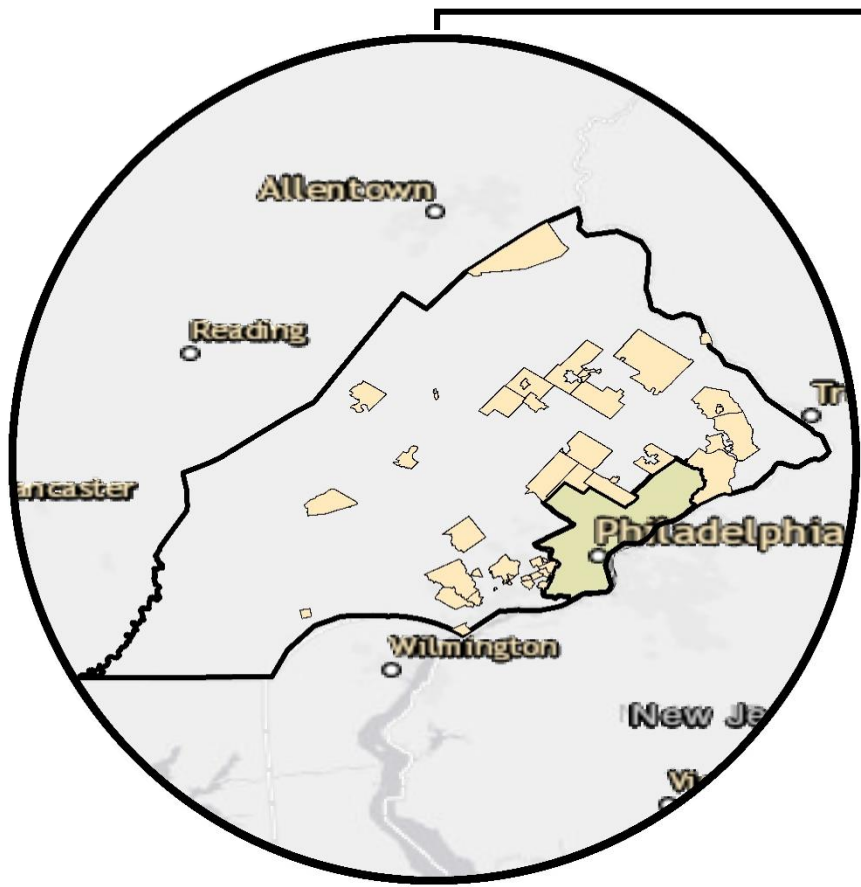
✓ Energy efficiency market development requires:

- ✓ Programs dedicated to sustainable energy problem-solving
- ✓ Programs able to pool project investments into cost-efficient financing scales
- ✓ Programs that provides independent, objective monitoring and verification of investment performance

✓ Solar energy development requires:

- ✓ Programs capable of creating a secure investment climate to attract large-scale capital
- ✓ Open and equitable access to the technology
- ✓ Support for cross-cutting market development

PENNSEF 1.0: REGIONAL STREET & EXTERIOR LIGHT PROJECT



BROAD PARTICIPATION

35 PARTICIPATING MUNICIPALITIES ACROSS
4 PENNSYLVANIA COUNTIES

LARGE-SCALE PROJECT

TOTAL PROJECT COST: \$14,922,544

RETROFIT > 28,000 STREET AND EXTERIOR LIGHTS

- ABOUT 600 KM OF ROAD LIGHTED *
- EQUIVALENT TO:
 - 20% OF LOCAL ROADS IN PARTICIPATING AREAS (3313 KM)
 - ABOUT THE LENGTH OF A ROUND-TRIP FROM WASH DC TO NYC

DEEP AND SIGNIFICANT ENERGY AND FINANCIAL SAVINGS

GROSS SAVINGS: \$30,586,648

NET SAVINGS: \$15,633,874

AVERAGE PAYBACK: 10.64 YEARS

* Estimate based on average distance between streetlights of 125 ft. - 150 ft. (~38 m - 45 m). Streetlights are placed opposite each other.
Data source: Pennsylvania Spatial Data Access (<http://www.pasda.psu.edu/>)

Participating municipalities

Pennsylvania Treasury Sponsors PennSEF

- **Pennsylvania Treasury**
 - Custodian of over \$100 billion in state assets
 - Must act as a *prudent investor*
- **Recognized as a national leader among public investors in the green capital space**
 - Treasury created Keystone HELP, a residential energy efficiency financing program made more than 14,000 loans deploying over \$110 million
 - Treasury helped create a national loan aggregation and financing facility, WHEEL, and executed the first securitization of the new asset class in the US
- **Partnered with FREE to create PennSEF – a statewide sustainable energy program**
 - Serves governments and non-profit institutions
 - Relies on FREE's expertise and innovative and comprehensive services
 - FREE's experience with the Delaware SEU program bolsters confidence in program success

Pennsylvania Governor's Award for Local Governmental Excellence

PennSEF's Regional Street Lighting Program in co-operation with the Delaware Valley Regional Planning Commission supported 35 municipal lighting projects and was recognized as an example of innovation in intergovernmental cooperation.

Annual Benefits

- Electricity savings of 100,000 MWh
- Avoidance of 5,400 metric tons of CO₂ emissions
- Lowers energy and operational costs for its municipal participants by nearly \$1 million



Benefits of the PennSEF Approach

- Procurement process assures qualified contractors
- Rigorous deep audit process defines the scope of the project
- Guaranteed Savings Agreement assures achievement of savings
- Standard documents provide efficiency and favorable terms
- Pooled financing delivers low interest rates and reduced costs
- PennSEF provides expert support for legal, technical, and financial development of projects (“one-stop-shop”)

Program Protections

- ✓ Limited risks of participation
 - ✓ Prequalification of contractors
 - ✓ Standard RFP format – customized for each municipality's facilities
 - ✓ Free preliminary audit – no financial commitment
- ✓ Contracting support
 - ✓ Investment grade audit determines detailed scope of work, price and guarantee
 - ✓ Benchmarked energy costs lower financial risk for municipalities
 - ✓ Guaranteed Savings Agreement is a transparent construction contract with a strong guarantee that spells out the measurement and verification plan in detail
- ✓ FREE's Trusted Advisors **protect** communities
 - ✓ Search for best-suited technology
 - ✓ Design strategies that produce local jobs and a better local economy
 - ✓ Enable communities to find environmentally sustainable outcomes for future generations

Advantages of Aggregation

- Pooled procurement of streetlights or solar panels reduces cost
- Pooled financing
 - Eligible for lowest interest rate
 - Reduces transaction costs
 - No cross collateralization and no cross funding
- Hybrid projects
 - Include energy efficiency, active controls, generation and storage
 - Co-manage electric and thermal loads and water use

Microgrids

- A microgrid is a local energy system:
 - That has the ability to provide energy and energy management services needed to meet a significant proportion of the included load on a non-emergency basis,
 - That is capable of operating either in parallel or in isolation from the electrical grid, and
 - That, when operating in parallel, can provide some combination of energy, capacity, ancillary or related services to the grid
- PennSEF contracts and financing work for Microgrids
 - Equipment includes Controls, HVAC, storage
 - Ancillary services revenues don't come with long term contracts
 - Energy savings aren't a "revenue stream" to pledge
 - Generation is mostly used on site

Policy-Driven Solar Economics

$$\textit{Electricity Price}_{\textit{Incumbent}} + \textit{SREC} = \textit{Financeable cost per kWh}$$

$$\textit{Electricity Price}_{\textit{Incumbent}} + \textit{FIT} = \textit{Financeable cost per kWh}$$

Example benefits of Policy-driven Solar economics:

- Improves policy compliance
- Generates a secure investment climate
- Accelerates market diffusion of new technology

The Delaware SREC Procurement Program

Combines RPS and FIT characteristics to develop Delaware's solar market

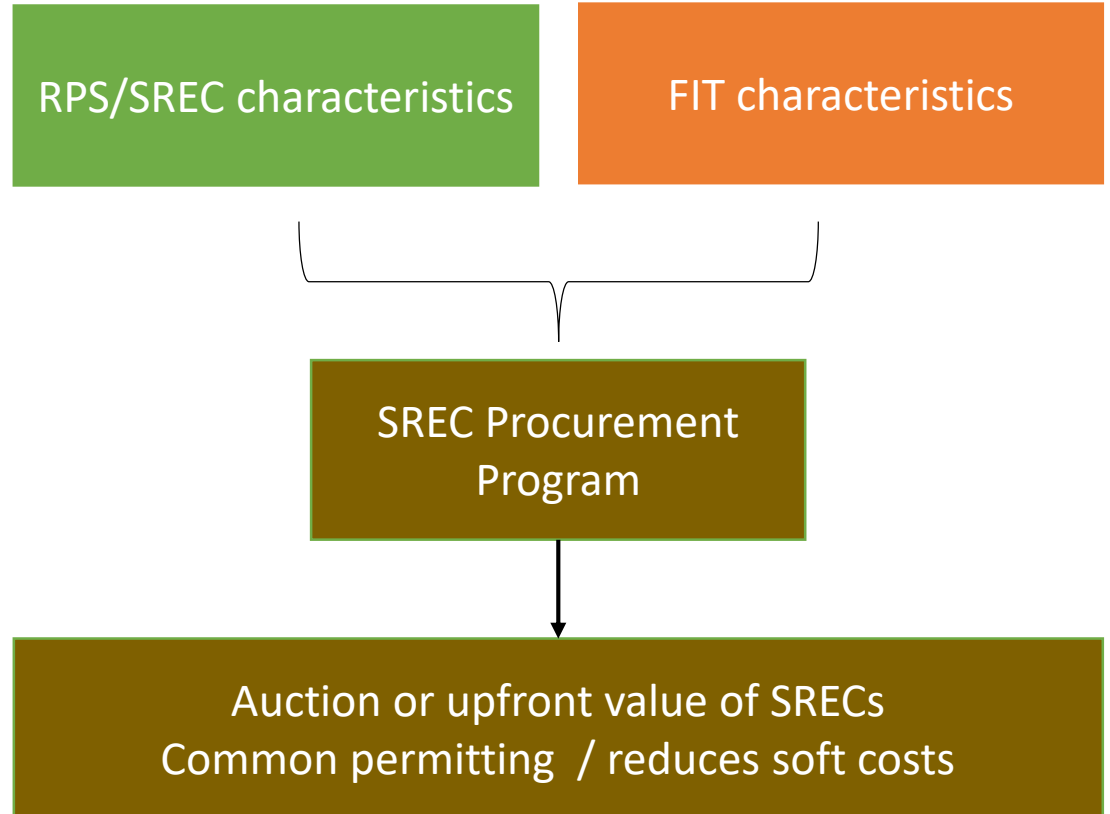
Tiered market development to support all segments of the market:

- Nameplate capacity rating tiers from small scale to large-scale
- 91% of winning systems are small-scale systems (below 100 kW), 61% of which <10 kW
- Delaware systems of 10 MWp & 15 MWp have also been installed.

Long-term price contracts to avoid SREC price volatility for certain system designs

State-wide development:

- Projects in place throughout the state



Policy-driven Solar Economics Yields Strong Results

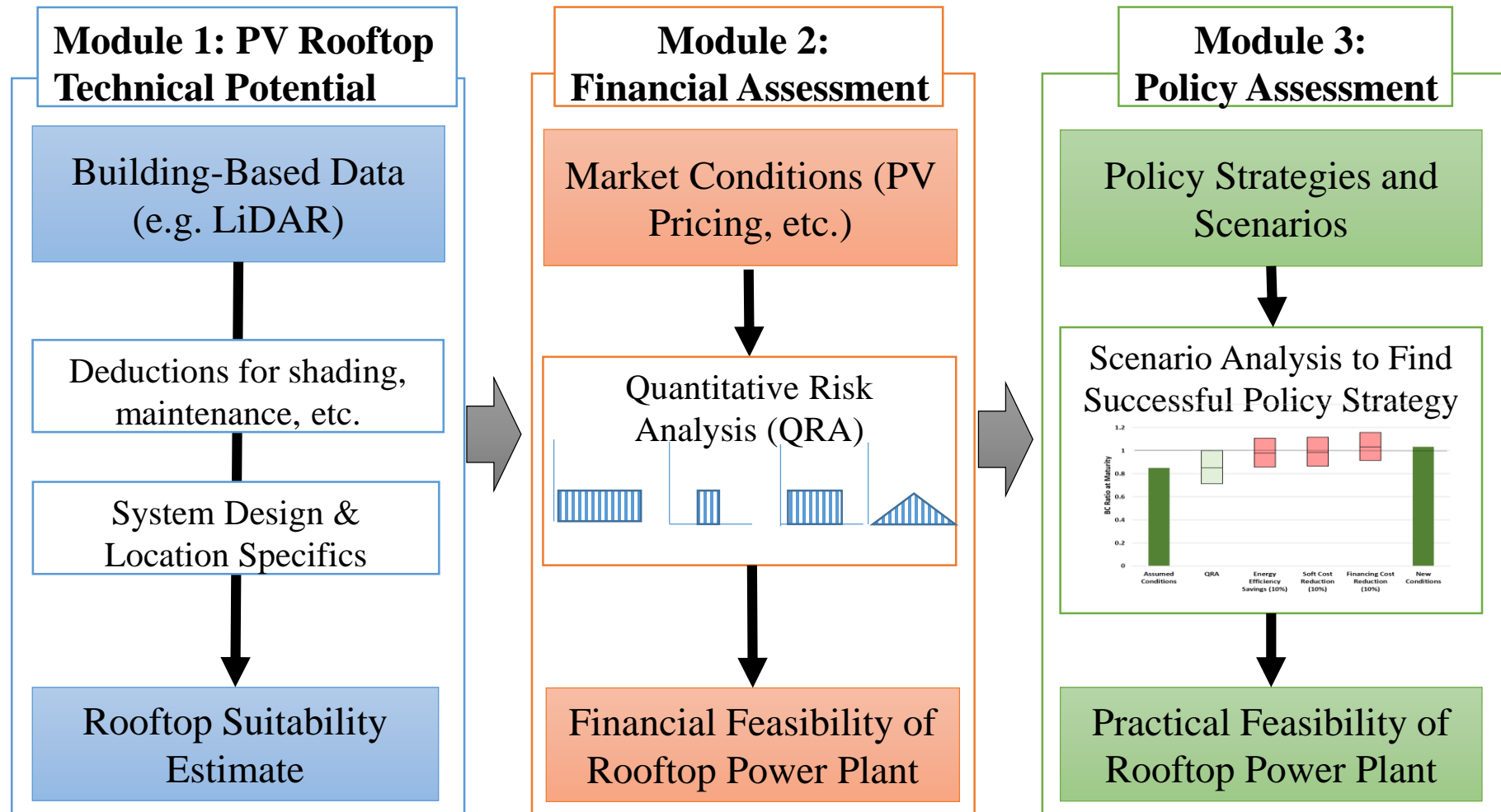
	DELAWARE	SEOUL
Cumulative Installed PV Capacity	113 MW _p	125 MW _p
Annual % Growth Rate	32%	19%

Note: U.S. data collection sources and methods are changing.
An earlier estimate placed Delaware 7th in the nation.

	State	W/capita
1	Nevada	570.26
2	Hawaii	461.37
3	California	374.76
4	Arizona	373.68
5	Utah	333.08
6	North Carolina	283.65
7	New Mexico	274.39
8	Vermont	233.75
9	Massachusetts	231.19
10	New Jersey	218.40
11	Idaho	148.18
12	Colorado	131.58
13	Delaware	129.19
14	Maryland	127.47
15	Connecticut	88.13
...
	Seoul	10.20

Source: EIA Electric Power Monthly. PV Net Summer Capacity, June 2017

FREE *Solar Cities* Modeling



FREE's *Solar Cities* Modeling: Philadelphia's Public Buildings

1

82 MWp
~413,000 m²
Investment size: ~\$164 Million

2

Quantitative Risk Assessment:
Financing viable under variable
risk conditions

3

Policy Upgrades can realize 8 yr.
financing

