The New Economics of Solar+Storage for Affordable Housing in Massachusetts

May 1, 2020

LISC BOSTON

CleanEnergyGroup
Innovation in Finance, Technology & Policy

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Formerly Jewish Community Housing for the Elderly (JCHE)

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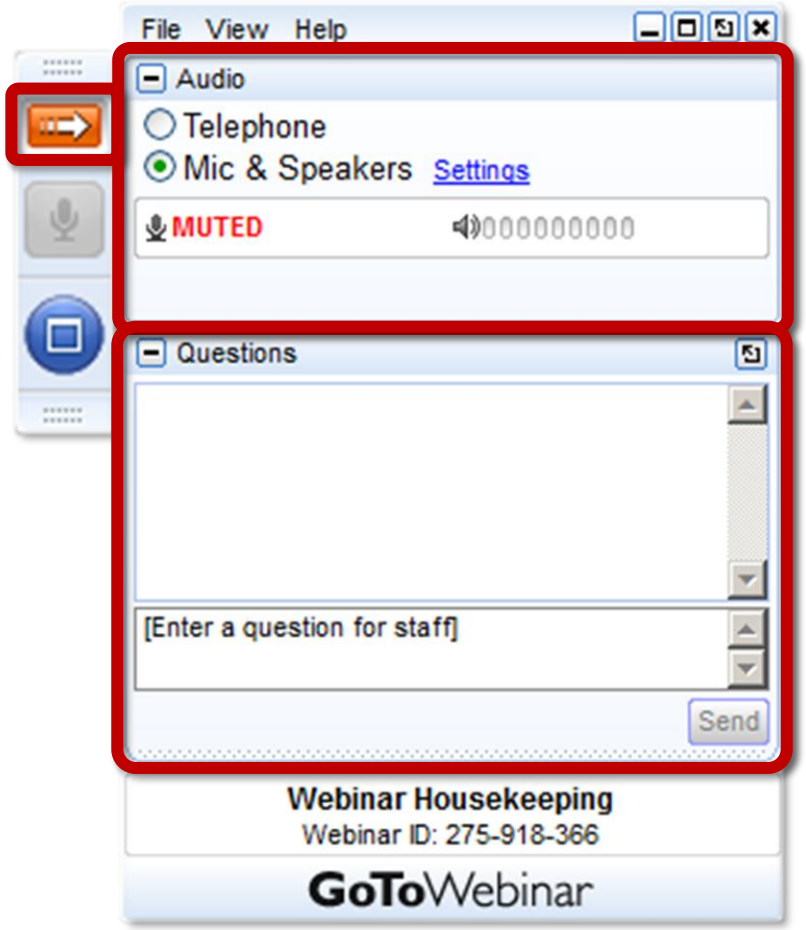
HOUSEKEEPING



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PANELISTS

- **Emily Jones**, Senior Program Officer, LISC Boston
- **Todd Olinsky-Paul**, Project Director, Clean Energy Group
- **Geoff Oxnam**, CEO and Founder, American Microgrid Solutions
- **Tabetha McCartney**, Director of Asset Management and Sustainability, 2 Life Communities
- **Rob Sanders**, Senior Finance Director, Clean Energy Group
- **Travis Simpkins**, Founder and CTO, muGrid Analytics
- **Amy Simpkins**, CEO, muGrid Analytics
- **Seth Mullendore,** Vice President & Project Director, Clean Energy Group (moderator)

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Todd Olinsky-Paul
Project Director
Clean Energy Group

Clean Energy Group

SUPPORTING 150+ PROJECTS ACROSS THE COUNTRY

U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

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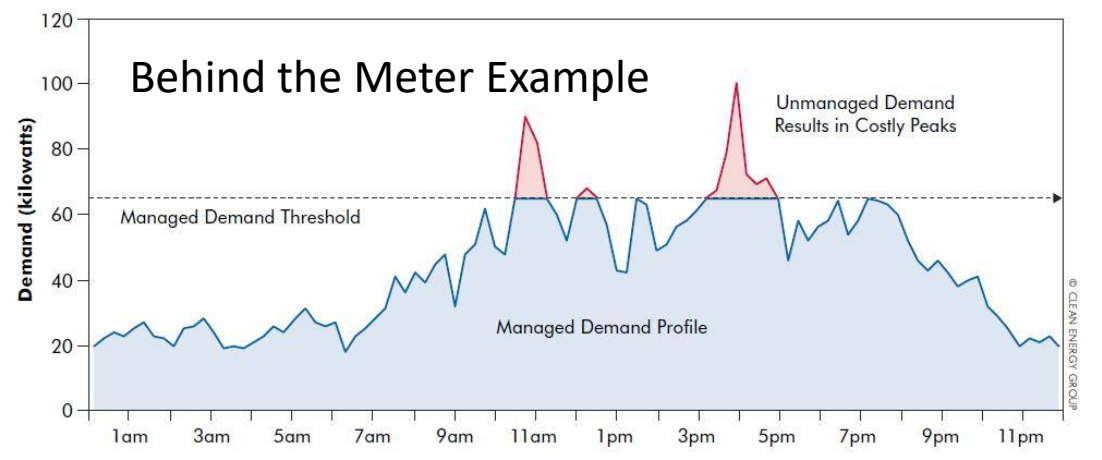
Energy Storage in Massachusetts:

Three major opportunities

1. **Demand charge management**
   - Massachusetts commercial customers pay demand charges among the highest in the nation (Eversource territory). Energy storage can be cost effective for DCM alone.
2. **Solar Massachusetts Renewable Target (SMART)**
   - Massachusetts offers the SMART solar incentive with stackable adders for storage, low income properties and other features.
3. **ConnectedSolutions**
   - Mass Save (MA three year energy efficiency plan) includes battery storage as a peak demand reducing measure: customer performance payment through utility contract.

1. Demand Charge Management



Peak reduced from 100 kW to 65kW = **35 kW reduction**

Savings depend on **cost of demand**

Demand charges @ $10/kW = **$4,200 annual savings** ($10 X 35 kW X 12 months)
Demand charges @ $20/kW = **$8,400 annual savings** ($20 X 35 kW X 12 months)

Generally, commercial customers paying **$15/kW or more** in demand charges may be able to install batteries economically for demand charge management

Massachusetts:

- $3.92 - $6.00/kW (National Grid)
- $10.74 - $41.25/kW (Eversource)

2. SMART Solar Program

- SMART replaced the SREC program in 2018
- Deployment incentive with adders, operational requirements
- Adders are stackable – includes adders for storage, low income properties, public entity, etc.
- To qualify for adder, storage must be paired with new solar
- Storage must be at least 25% of the rated capacity of the associated solar, and at least 2 hours duration
- Adder based on relative size and duration of storage system

3. ConnectedSolutions (BYOD program through the Energy Efficiency Plan)

- Massachusetts 2019-2021 energy efficiency plan includes BTM storage for Active Demand Reduction (first in the nation)
- Storage customers paid for performance based on peak demand reduction
- Five-year utility contract

Example incentive payment calculation (summer season):

60 kWh battery = 20 kw/hr load reduction averaged over 3-hour calls

20 kW average hourly load reduction x $200/kW incentive rate = $4,000 maximum payout for the season

Advantages of the ConnectedSolutions Model:

Owner Benefits

- **De-risking investment** by providing reliable, contractual revenue streams and defining standardized eligible systems, to make storage "bankable."
- **Making storage viable for many more customers** by making storage economics work broadly, for any customer type, utility region or tariff.
- **Improving economics** by shortening payback periods.
- **Supporting more customer resilience** by supporting bigger and longer-duration batteries.

Policy Benefits

- **Providing demonstrable grid benefits** by more accurately aligning customer battery discharges with regional demand peaks.
- **Creating a tool to achieve additional societal benefits** by bringing customer batteries into state-regulated programs.
- **Addressing utility ownership issues** by giving utilities a way to manage BTM storage resources without having to own them.
- **Ensuring a diverse storage market** by involving customers and third-party developers/aggregators as partners in an aggregated system.

Key Elements for Developers and Owners

- **De-Risking (Reliable, predictable revenue stream)**
  - Multi-year, pay-for-performance utility contract
  - Batteries become bankable
  - Revenue is risk-free (no predicting peaks)
- **Affordable and available to all**
  - Demand charge management model works for large commercial customers with peaky load curves, who pay high demand charges
  - ConnectedSolutions makes storage economical for all customers
- **Improved economics**
  - Shorter payback periods
  - Associated programs like SMART and HEAT lower up-front investment
- **More resilience**
  - Optimizing for ConnectedSolutions results in larger batteries than DCM
    - More resilient back-up power **and** more cost-effective batteries

We Want Your Feedback!

Please ask questions and share your thoughts on the information you are about to see.

Your feedback will help us improve our understanding of the issues and barriers you face.

Todd Olinsky-Paul
Project Director
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Todd@cleanegroup.org

The New Economics of Solar+Storage for Affordable Housing in Massachusetts

American Microgrid Solutions

www.americanmicrogridsolutions.com

Overview

- Solar+Storage benefits affordable housing owners, residents, grid and other ratepayers
- New clean energy incentive programs improve project feasibility
  - Higher rates of return
  - Lower payback periods
  - More predictable revenue streams
  - More resilience during outages
  - Improved sustainability
- Four affordable housing case studies demonstrate how value-stacking incentives improved forecast project IRRs and reduced payback periods
- Toolbox should include solar+storage in coordination with other tools (supply hedging, energy efficiency, demand management) to maximize returns

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Incentives

- Solar Massachusetts Renewable Target (SMART) - pays for each unit of energy generated for a fixed period of time.
- ConnectedSolutions - pays energy storage systems based on performance during specific hours of the year when Grid is most challenged.
- Other value streams (utility, state, federal, philanthropic) should be stacked.

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SMART Incentive Summary

	Property 1	Property 2	Property 3	Property 4
Utility	Eversource	Eversource	Eversource Cambridge	Eversource Boston G2
Rate	B7	B7	G2	
SMART Block	3	3	3	3
Service Area	GreaterBoston	GreaterBoston	Cambridge	Greater Boston
Base Compensation	$ 0.235	$ 0.235	$ 0.235	$ 0.235
Location Based Adder (Roof)	$ 0.020	$ 0.020	$ 0.020	
Off-taker Based Adder (Low Income Property)	$ 0.030	$ 0.030	$ 0.030	$ 0.030
Total Compensation Rate	$ 0.285	$ 0.285	$ 0.285	$ 0.265
Value of Energy	$ 0.110	$ 0.110	$ 0.118	$ 0.127
Solar Incentive Payment	$ 0.175	$ 0.175	$ 0.167	$ 0.138
Storage Adder	$ 0.057	$ 0.057	$ 0.057	$ 0.057
Total SMART Incentive	$ 0.232	$ 0.232	$ 0.224	$ 0.195

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Connected Solutions Program

	Summer Daily	Summer Targeted	Winter
Season	June – September	June – September	December – March
Event Window	2P-7P	2P-7P	Any
Duration	2-3 hours	3 hours	3 hours
Events per Season	30-60	2-8	4-6
Payment	$200/kW per summer	$100/kW per summer	$50/kW per winter

- Sites with energy storage compensated for discharging batteries during peak network load
- Summer Daily, Summer Targeted, Winter programs
- Payment is pay-for-performance based on average discharge over all events
- No penalty for failure to participate. However, compensation for participation only
- Example: A 50 kW battery participating in summer daily with average discharge of 25 kW
- 25 kW x $200 / kW = $5,000

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Case Studies

Sites

- **Property 1:** 209 apartments (built 1978, renovated 2018)
- **Property 2:** 146 apartments (built 1984, renovated 1998)
- **Property 3:** 98 apartments (under construction)
- **Property 4:** 150 apartments (built 2010)

Finance

- Cash (Site owns system)
- Financed (Site pays PPA)

System Design

- Solar-Only
- Solar + Storage (max economic)
- Solar + Storage (max resilience)

Financial Scenarios

- Avoided Energy + SMART
- Avoided Energy + ConnectedSolutions
- Avoided Energy + SMART + ConnectedSolutions

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Results

- **Design**: Programs favor larger batteries increasing power 2.8x and energy 4.8x increase on average
- **Return**: IRR improves in all cases when SMART is combined with ConnectedSolutions averaging 9.1% in financed cases
- **Simple Payback**: SPP declines by approximately half when SMART is combined with ConnectedSolutions averaging less than 9% in financed solutions.

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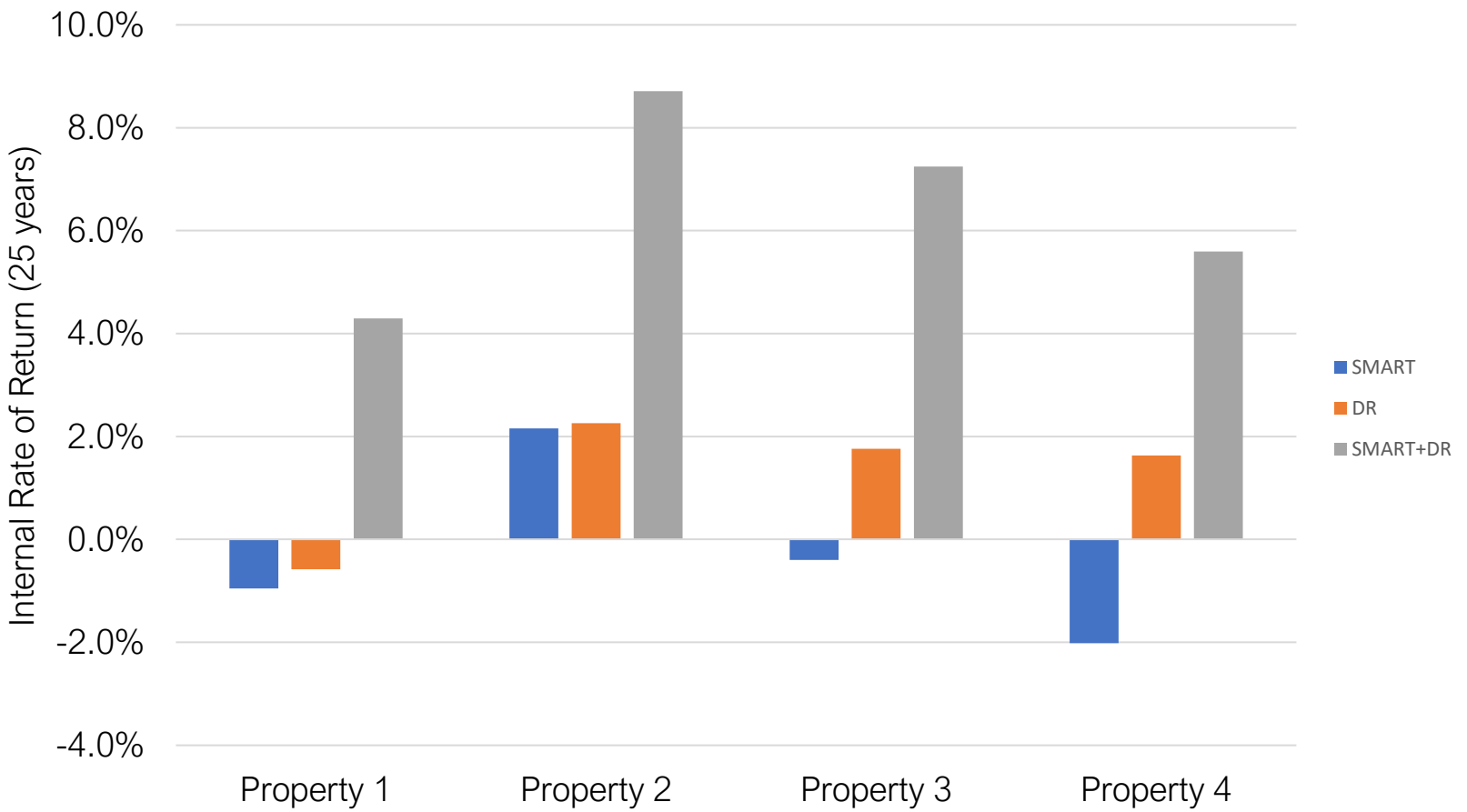
Internal Rate of Return

Cash	SMART	Connected Solutions	SMART + Connected Solutions
Property 1	-1.0%	-0.6%	4.3%
Property 2	2.2%	2.3%	8.7%
Property 3	-0.4%	1.8%	7.2%
Property 4	-2.0%	1.6%	5.6%
Average	-0.3%	1.3%	6.5%

Financed	SMART	Connected Solutions	SMART + Connected Solutions
Property 1	1.6%	1.6%	6.8%
Property 2	5.0%	4.7%	11.4%
Property 3	2.4%	4.2%	9.9%
Property 4	0.7%	4.0%	8.2%
Average	2.4%	3.6%	9.1%

Internal Rate of Return - Cash



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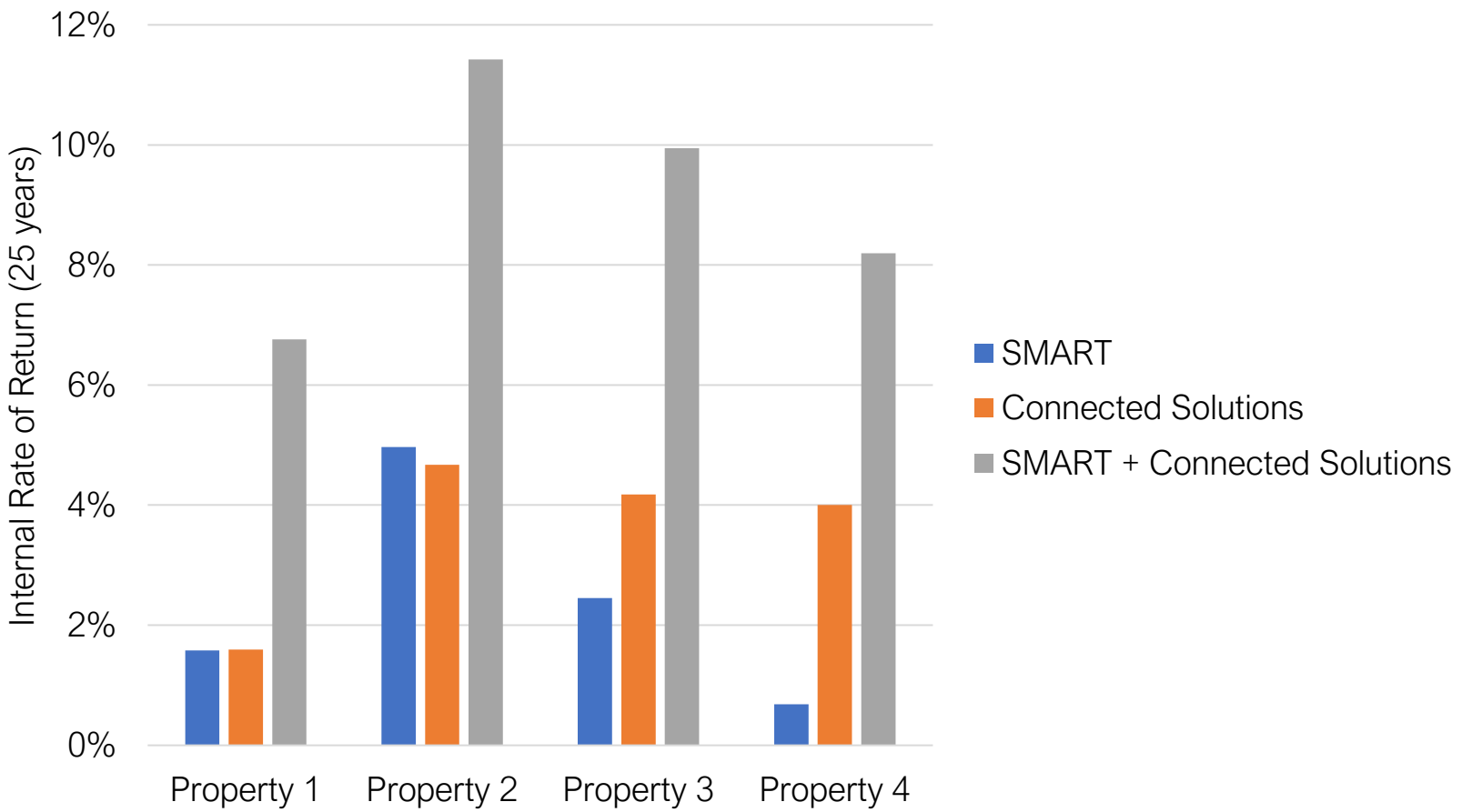
Internal Rate of Return - Financed



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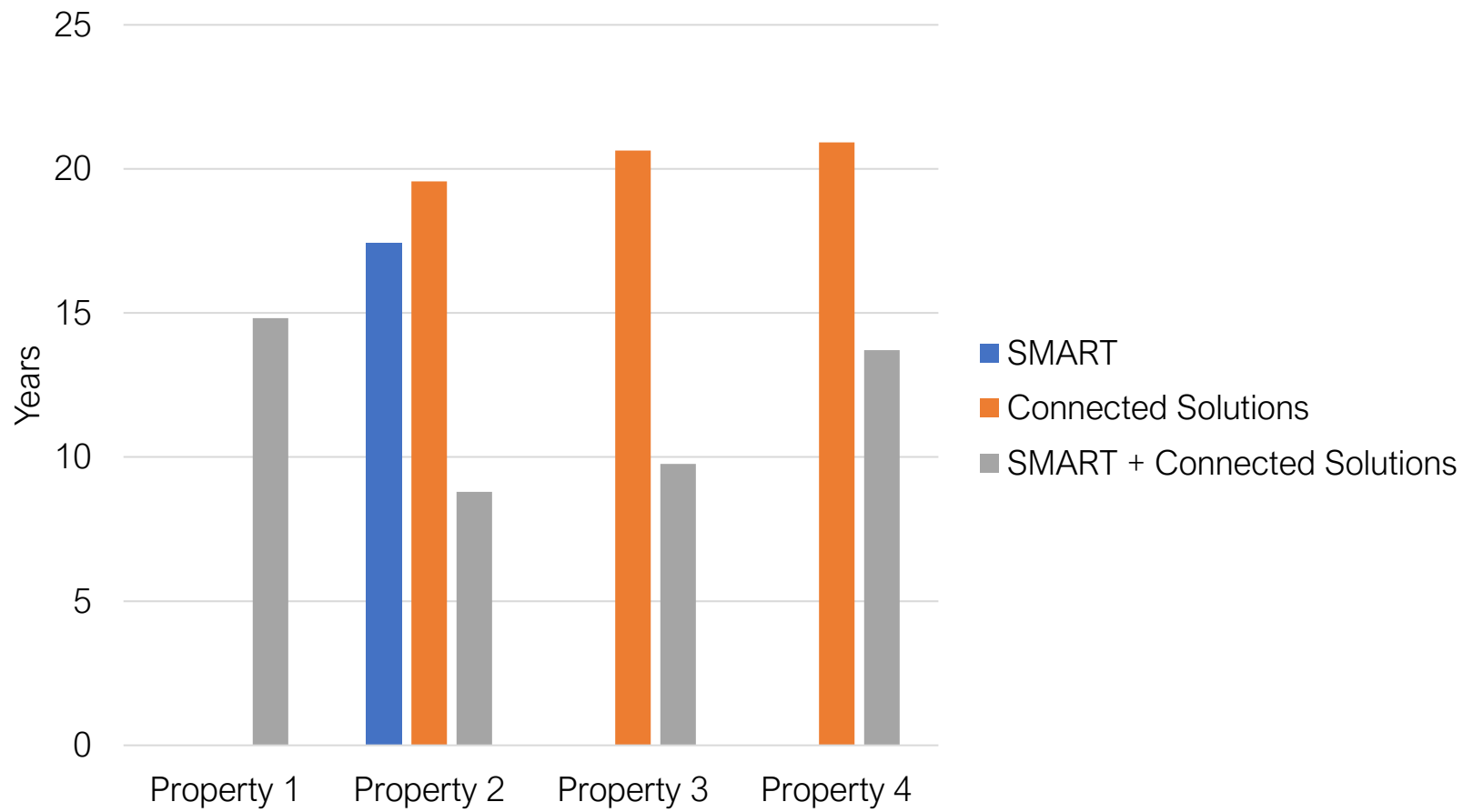
Simple Payback (years)

Cash	SMART	Connected Solutions	SMART + Connected Solutions
Property 1	none	none	14.8
Property 2	17.4	19.6	8.8
Property 3	none	20.6	9.8
Property 4	none	20.9	13.7
Average	17.4	20.4	11.8

Financed	SMART	Connected Solutions	SMART + Connected Solutions
Property 1	18.1	20.5	11.4
Property 2	13.1	14.8	6.9
Property 3	16.6	15.7	7.6
Property 4	20.7	16.0	8.8
Average	17.1	16.8	8.7

Simple Payback Period - Cash



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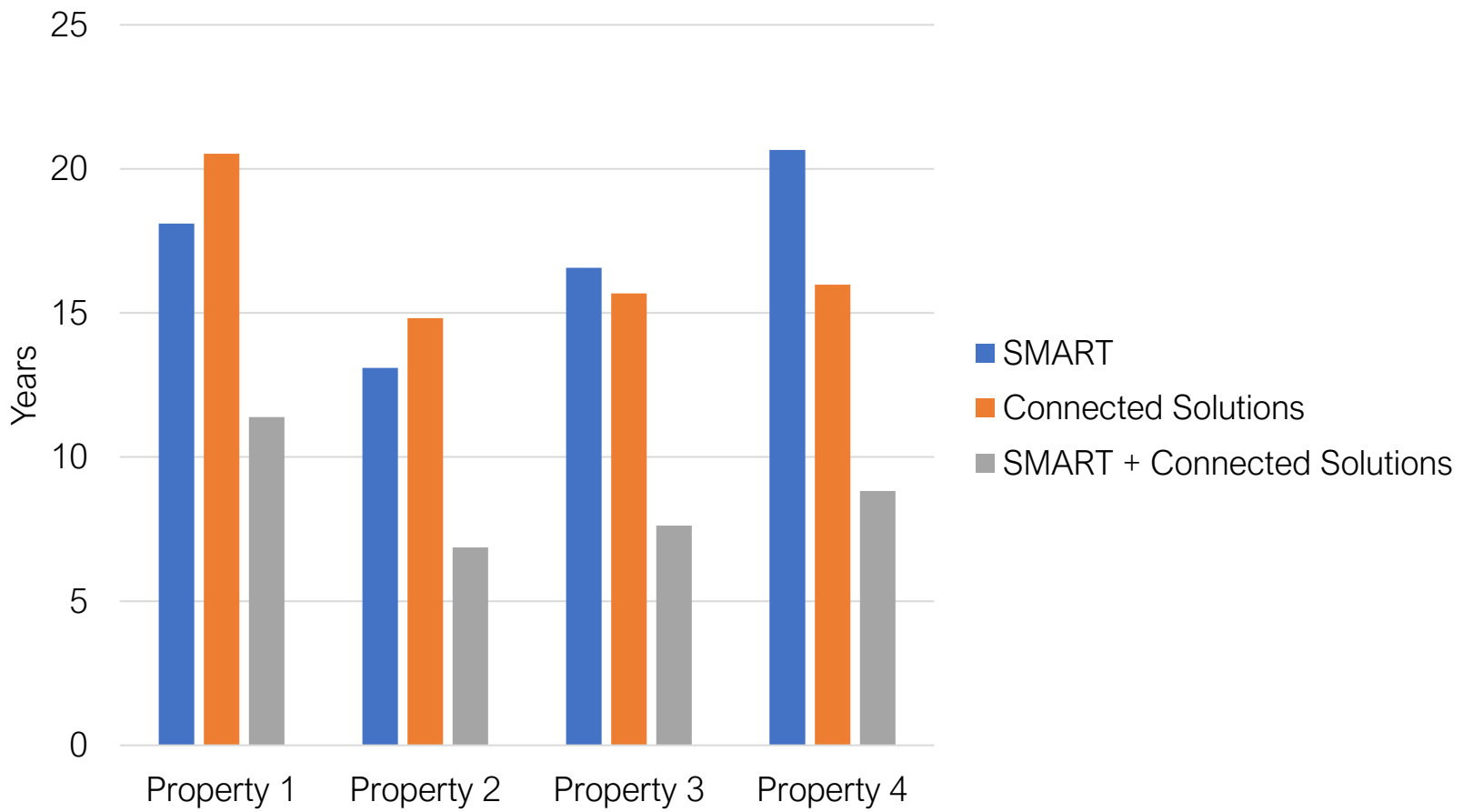
Simple Payback Period - Financed



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Recommendations

- Start with a portfolio approach
- Use the whole toolbox
- Value-stack solutions
- Set goals early, but firmly
- Align team around the goals
- Conduct solution/vendor agnostic techno-economic feasibility analysis

- Avoid waiting too incorporate assets
- Avoid implementing single-solution, piecemeal approaches over time
- Don't assume all engineers, developers or vendors share the same approach and goals
- Don't jump to resilient power before reviewing efficiency

Takeaways

- SMART & ConnectedSolutions improves project economics by:
  - Improving returns
  - Reducing risk
  - Encouraging more resilience
  - More resilience
- Performance is highly subject to site conditions, incentives, tariffs, goals and economic assumptions
- Maximizing return requires the right team, consensus on the goals and holistic approach

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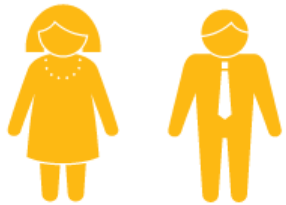
2Life Communities By the Numbers

Across our four campuses,
1,500 residents
live in our 1,250 apartments.



66% Women 34% Men

39 countries of origin

Less than 3% percent of 2Life Communities residents move to nursing homes in any given year…

…Those who move to nursing homes are on average 89 years old versus a national average of 79 years old.

80 average age

$10,930 median income

20 total languages spoken

2Life Journey Towards Sustainability

2011

Opened Shillman House - first building built to Enterprise Green Community Standards

2012

Installed 74kW Co-gen unit Ulin House

2014

LED Bulbs installed in all common areas + 4 bulbs in each unit

Installed 74kW Co-gen unit in Leventhal House

2016

20 year contract for 1,000,000 kW solar power through virtual net metering

2017

Reached BBC Goal - reduced source energy consump-tion by 24% across the portfolio

2018

Started to research Solar + Storage as strategy to reduce demand charges

2Life Journey towards Sustainability

Received Analysis of feasibility of Solar + Storage for Shillman house. paid for with grant funding from The Clean Energy Group

Entered into LOI with American Microgrid Solutions for the design and project management for a 222kW ground mount solar system with battery storage to be owned by a third party with a PPA between the owner and 2Life

2019

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American Microgrid Solutions develops turnkey power solutions that enhance resiliency, security, savings and sustainability. They work with each community partner to identify mission-critical operations, existing sources of power supply and areas of vulnerability for which a microgrid will provide essential support. They then design a modular solution, scaled and phased to meet the needs, timing and resources of the communities they serve.

Shillman House
Max Solar + 60-120 Battery

5/27/2019

Prepared By

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muGrid Analytics solves wicked problems at the intersection of energy technology and economics with math and modeling. Their custom modeling and analysis form the foundation of expert advising and guidance for implementing energy solutions specifically tailored to client needs. muGrid serves C&I owners, utilities, project developers, financiers, and hardware manufacturers, bringing value throughout the project life cycle, from planning, feasibility, design, and project financing to operational strategy, optimized asset dispatching, and performance monitoring. muGrid's core values are fierce integrity, relentless curiosity, dynamic agility, and 360° collaboration with clients, stakeholders, and best-in-class partners.

Together, AMS and muGrid can help you make sound data driven decisions, guide you through the technology implementation process, and get the most out of your renewable energy investments.

2020

System Goals

- **Utility Savings** – estimated at $37,000
- **Resiliency** – up to 55 Hours of additional power for 15 % critical load
- **Sustainability** – Offset 40% of electric consumption through on-sit solar

Challenges

- **FINANCIAL**
  - Lack of investment capital due to the structure of non-profit affordable housing developments
  - Inability to take advantage of Tax Credits or depreciation arising from the project
  - Risks of project not working as projected
  - No room in operating budget to expand staff for development or operation and maintenance
- **LOGISTIC**
  - Lack of expertise in managing design and installation of system
  - 2Life staff not technical adept to maintain and service the system
  - No permitting experience for this type of project
  - Constantly changing state and federal incentive programs

CONTACT INFO

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