FINDING VALUE IN THE ENERGY FUTURE

HOW UTILITIES CAN COLLABORATE WITH LOW-AND MODERATE-INCOME CUSTOMERS TO DO MORE

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ABOUT ROCKY MOUNTAIN INSTITUTE

Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. RMI has offices in Basalt and Boulder, Colorado; New York City; Washington, D.C.; and Beijing.

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EXECUTIVE SUMMARY

The electricity system is fundamentally changing in ways that create new opportunities for utilities to collaborate and serve low- and moderate-income customers differently than they have in the past.

- Low-and moderate-income (LMI) customers represent a large group, with roughly a quarter of US households qualifying for federal energy assistance. Many LMI customers suffer inequities of elevated energy burdens and detrimental health and environmental impacts from power generation.

- Utilities have largely relied on traditional approaches to serving these customers, offering bill discount programs, but new opportunities are now emerging.

- New technology and business model changes are creating new opportunities for utilities to collaborate with LMI customers to create value for both customers and utilities.

- Emerging program models are starting to capture this value with new on-bill financing structures for energy efficiency, shared solar subscriptions for LMI customers, advanced demand response, and other programs.

- The next generation of innovative models could expand this potential, with innovative LMI-focused rate design, virtual power plant and non-wires alternative projects, home comfort and thermal electrification packages, and other integrated services for LMI customers.

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UTILITIES

Utilities are finding it increasingly important to serve low- and moderate-income customers effectively

02 The energy system is fundamentally changing in ways that create opportunities for new value

03 New models are emerging for utilities to serve LMI customers

04 To make these models most successful, utilities and communities must collaborate in new ways

05 The evolving utility business model aligns with these new models for serving customers

UTILITIES

Utilities face the regulatory imperative to serve LMI customers affordably and equitably

Energy is less affordable for these customers, and utilities face pressure to improve energy affordability.

Utility and federal programs currently attempt to relieve the energy burden for LMI customers through bill assistance and discount programs.

The legacy of environmental injustice has disadvantaged LMI communities.

LMI customers are, on average, more costly for utilities to serve due to less-efficient homes, arrearages, and more frequent disconnections for nonpayment.

UTILITY AND FEDERAL PROGRAMS

Utility and federal programs predominantly address LMI customers' energy burden through bill assistance

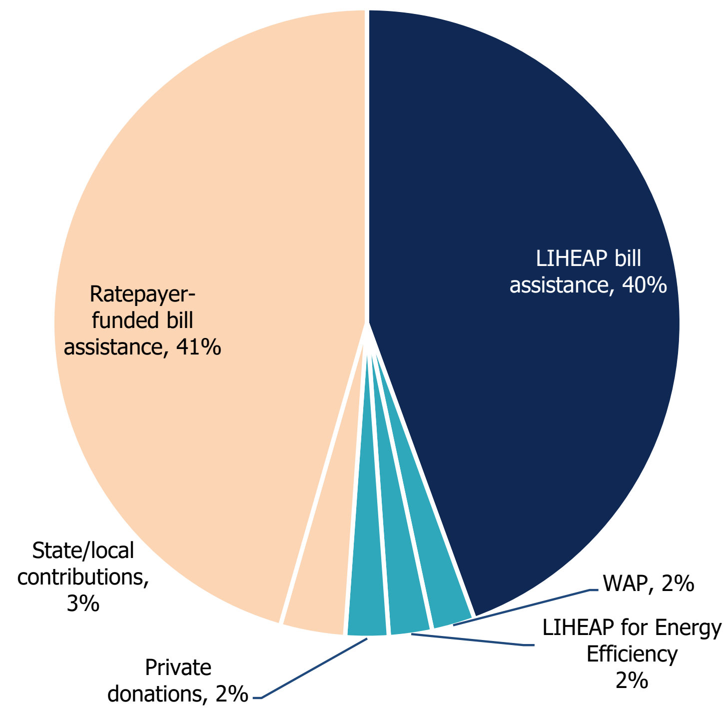
Both utility and government programs have relied on bill assistance and discounts as the primary way to serve LMI customers.

While these programs serve a necessary and important function, they are often oversubscribed, subject to budget constraints, and susceptible to cuts.

The Low Income Home Energy Assistance Program (LIHEAP) is federally funded, but restrictions and limitations are determined at the state level. A small portion of assistance funding is for home improvements through the Weatherization Assistance Program (WAP).

Utility discount programs are funded by small charges on ratepayer bills and are generally administered by utilities, using LIHEAP eligibility guidelines. In some areas, a high proportion of customers participate in discount programs; for example, ConEd has over 400,000 customers (out of 3.4 million) on discount programs.

LMI assistance funding by type, 2013



$3–4 billion is spent annually on LIHEAP bill assistance

Source: https://energyefficiencyforall.org/sites/default/files/Lifting%20the%20High%20Energy%20Burden_0.pdf

UTILITIES

Energy is less affordable for these customers, and utilities face pressure to improve energy affordability

Low-income households consistently spend a higher percentage of their overall income on energy expenditures; **the median energy burden for low-income households is 7.2% of household income**, while the median energy burden for other households is just 2.3%.

In some geographies, like Memphis, TN, the energy burden for low-income customers is as high as 13% of overall income.

In our conversations with utilities and at e-Lab events, we consistently hear that utilities are under **constant pressure to reduce customer bills** across the board, but especially for their low-income customers. This pressure drives decision-making and new programs.

7%

INEQUITIES OF POWER GENERATION

The legacy of environmental injustice continues to highlight how power generation has disadvantaged communities

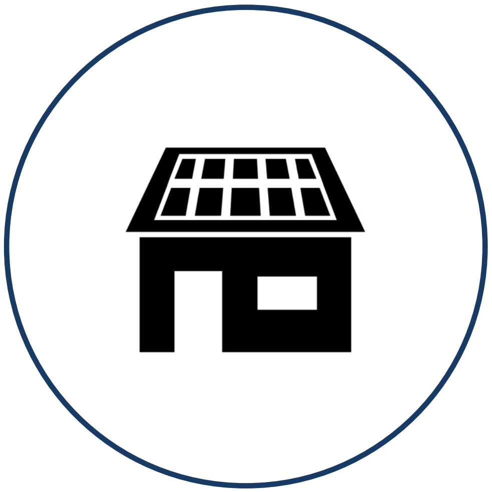
Historically, power plants have been sited in low-income communities and communities of color—68% of African Americans and 40% of Latino people in America live near a polluting power plant.[1]

Living in close proximity to this pollution has significant health effects, including a heightened risk for asthma, and consequently increased medical costs.

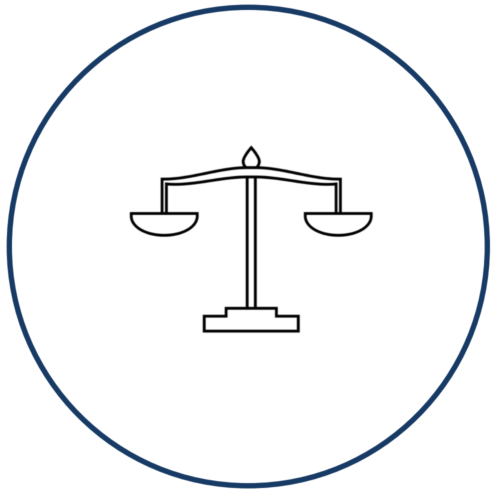
[1] Mustafa Santiago Ali, "Environmental injustice is rising in the US. Minorities and the poor pay the price," *The Guardian*, December 3, 2017, accessed August 10, 2018, Link.

UTILITIES

Utilities are responding to new factors that create new urgency to serve LMI customers differently



Emerging distributed energy resource (DER) technologies create opportunity for utilities to provide new value to customers, and for customers to provide value to the energy system.



New regulatory and legislative action is forcing utilities to serve LMI customers and disadvantaged communities differently.

Customer expectations are changing as companies in other industries transform their customers' experiences.

UTILITIES

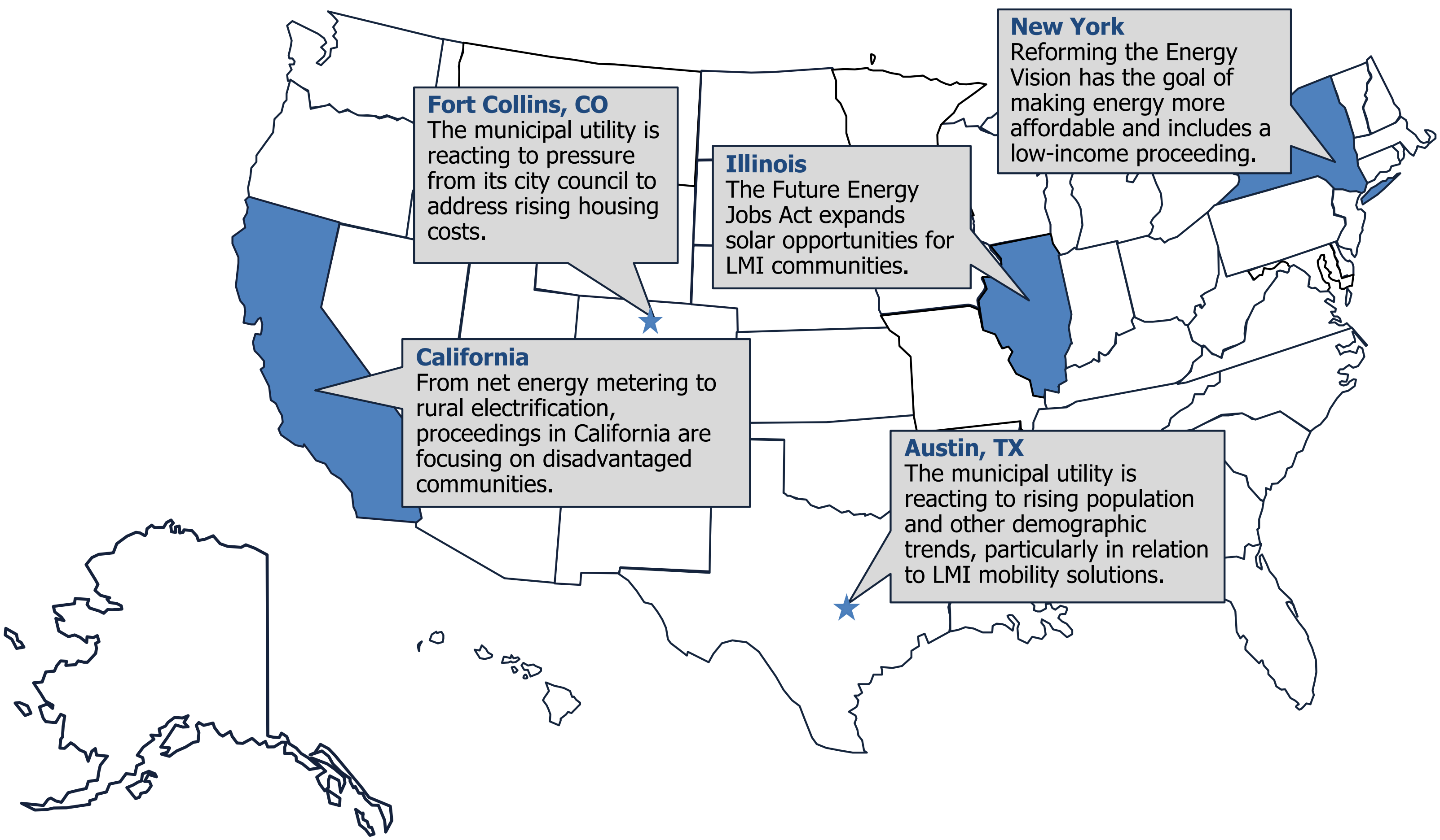
New DER technologies create opportunities for utilities to provide new value to customers, and for customers to provide value to the energy system

Utilities are introducing new programs, including:

- Low-income community solar, which allows new customer groups such as renters to participate in solar
- Energy efficiency programs, which have overall system benefits while reducing costs and increasing comfort for households
- Beneficial electrification programs, which can reduce costs for customers while offering grid services and larger electricity demand to utilities

UTILITIES

New regulatory and political action is pressuring utilities to serve LMI and disadvantaged communities differently



CUSTOMERS' EXPERIENCES

Customer expectations are increasing as companies in other industries transform the customers' experiences

Companies like Amazon, Uber, and Apple have increased the quality of service customers expect from their service providers.

Through user interface, an end-to-end digital platform, and a high quality of customer service, customers have come to expect a well-designed, user-friendly experience from companies across industries.

This instant service delivery can be especially critical for LMI customers facing additional demands on their daily schedules.

In our conversations with utilities, we hear that utilities are actively trying to respond to these new customer expectations.

amazon

02

THE ENERGY SYSTEM

The energy system is fundamentally changing in ways that create opportunities for new value

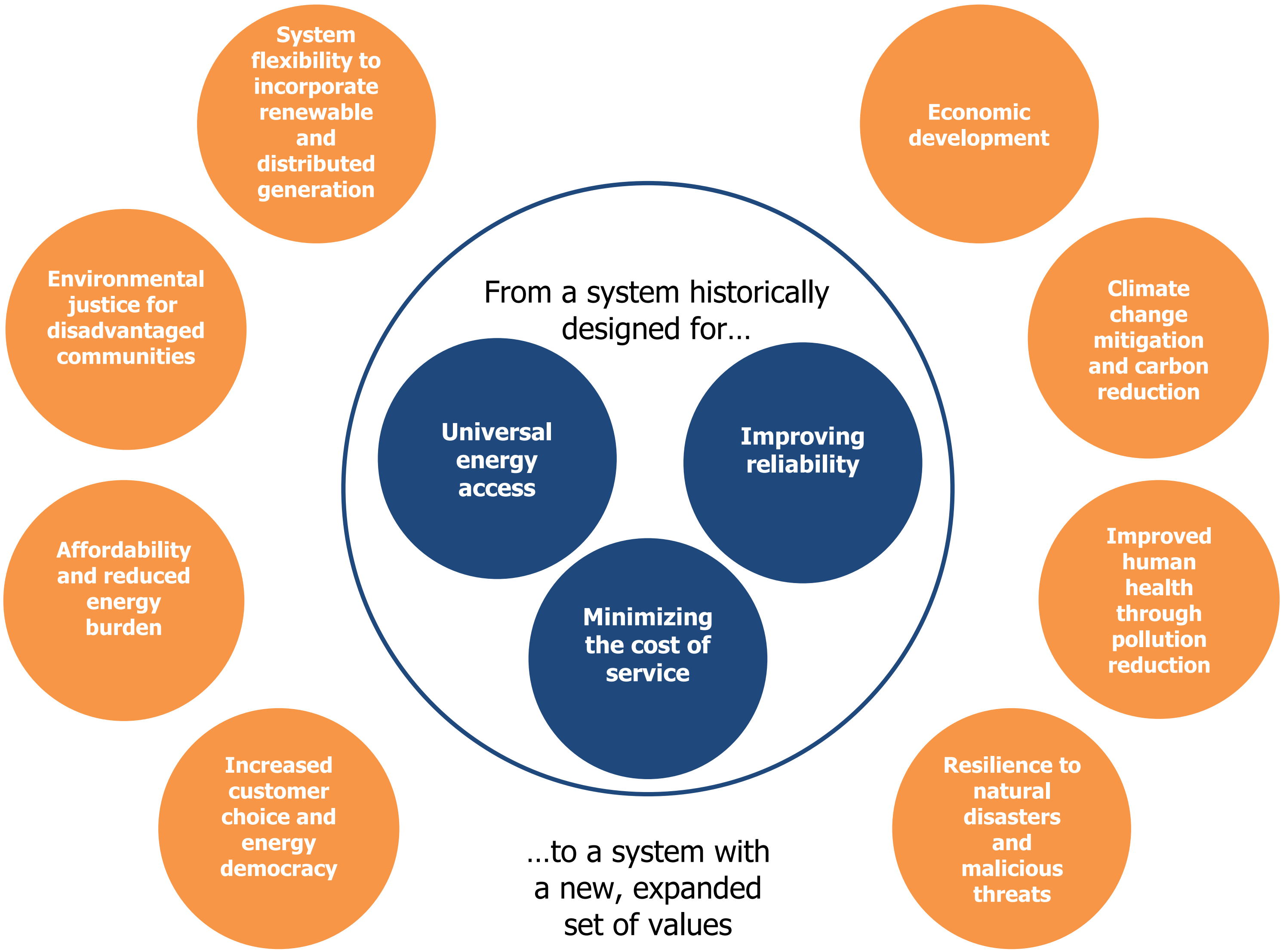
03 New models are emerging for utilities to serve LMI customers

04 To make these models most successful, utilities and communities must collaborate in new ways

05 The evolving utility business model aligns with these new models for serving customers

THE ENERGY SYSTEM

The design principles and societal values of the energy system are expanding



THE ENERGY SYSTEM

New distributed resources expand the range of value customers and utilities can receive or provide

Energy Efficiency

- Customers can lower energy consumption and bills
- Customers often see home comfort improvements and indoor air quality improvements as a result of fixing home leakages and replacing appliances
- Utilities can access deeper savings to meet efficiency targets or performance incentives

Distributed Generation

- Solar can be cheaper than traditional generation, resulting in increased affordability and reduced energy burden
- Customers may have the opportunity to benefit from ownership of rooftop or community solar
- If the utility owns distributed generation, it can help meet renewable portfolio standards

Beneficial Electrification

- Customers may displace high- cost fuels like propane and oil with efficient electrification
- Indoor air quality and health improvements can result
- Electric vehicles or electrified transit can provide new mobility options for customers
- Utilities can open up new revenue streams from the addition of electric loads

Demand flexibility

- Customers can participate in new revenue opportunities, such as demand-response events or time-of-use rates
- Utilities are able to dispatch resources to reduce peak- load events, and potentially defer major infrastructure upgrades

Energy storage

- Customers can use behind-the-meter storage to reduce energy bills through rate arbitrage or reduce demand charges
- Storage can provide customers backup in the event of an outage
- If utilities own or control storage, that storage can be used for renewables integration or to provide grid services

Microgrids

- Microgrids can provide community-level backup in the event of an outage
- Microgrids can provide the opportunity for customers or communities to own or control distributed generation or storage
- If the utility funds a microgrid, it may be able to receive a regulated rate of return on investments

THE ENERGY SYSTEM

Customers are already adopting these technologies, but LMI customers risk being left behind

For example:

- Households with lower incomes adopt solar at much lower rates than households with higher incomes. In 2013, LMI households, which make up 40% of the population, represented just 5% of the rooftop solar market. In addition to the high up-front costs of solar, many low-income households are renters or live in multifamily buildings without appropriate roof space.
- Beneficial electrification and electric vehicles are capital-intensive, which may prohibit lower-income customers from participating in and benefiting from the additional value streams from the services these technologies can provide to the grid.
- While demand flexibility may be less capital-intensive than other DERs, low-income customers may not have the ability to purchase flexible devices, devices, or be informed of means of changing their loads.

If low-income households are left behind in the energy transition, there is a risk that these households will be unable to fully participate and gain new value from these technologies. Utilities may also miss out on the opportunity for these customers to provide value to the grid and the overall system.

THE ENERGY SYSTEM

There is a range of design choices for utility and customer roles in LMI programs that brings trade-offs in value for LMI customers and communities

Pricing and Compensation
What services will new resources provide? How will they be compensated?

Ownership
Who will own solar, storage, efficiency, or demand flexibility assets?

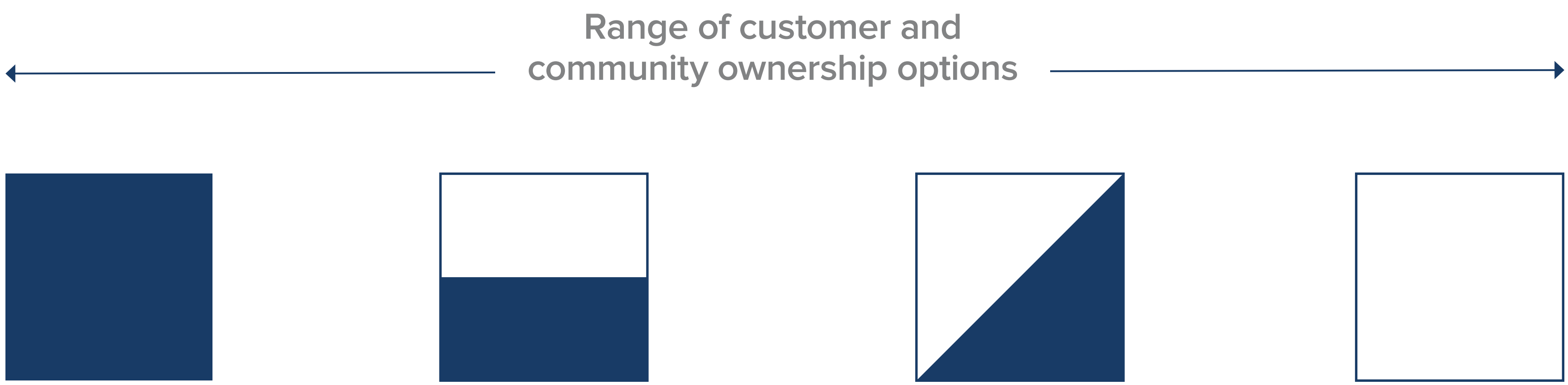
Service Delivery
Who will acquire land, subscribe and bill customers, and install, operate, and maintain systems?

Financing
Who will finance solar, storage, efficiency, electrification, or demand flexibility projects?

Control
How will storage and demand flexibility be optimized and dispatched? Who will manage this dispatch?

OWNERSHIP

Ownership is a key design decision in any business model serving low-income customers with clean energy benefits. Each stakeholder, including the utility, low-income customers or communities, and third parties, plays an ownership role along the spectrum between full ownership and no ownership.



Own

One stakeholder may hold full ownership of an energy project, either realizing the benefits of the project directly, or distributing them to others. Recently, interest in community ownership has grown as a means to capture more financial benefits and enhance energy security.

Partially Own

Partial ownership can either be through true project partnerships, or through ownership of different assets in the same project. For example, in a microgrid project, the community may own generation and the utility may own the distribution infrastructure.

Ownership Flip

In an ownership flip structure, typically a renewable energy project is first owned by an entity that can realize tax benefits, and then flips to the customer after those benefits have been monetized.

No ownership

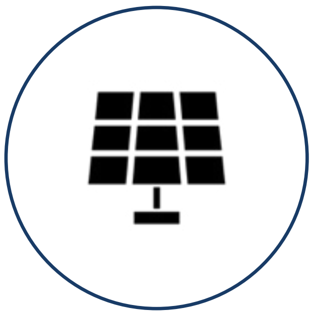
It is likely that stakeholders in a low-income energy project may hold no ownership of distributed energy resource assets, even if they receive some of the benefits of the project. In most situations without community involvement, no ownership will be the default.

FINANCING

Financing is another key design decision. There are two entry points for the roles a funder can play in a low-income program—supporting project development (i.e., the procurement of a solar panel or storage), and supporting customer participation (i.e., providing incentives, a loan loss reserve, or credit enhancement).

Potential financing roles

Support **Project Development**



Some finance roles supporting project development include:

- Provide project equity or debt finance
- Provide a project grant
- Issue project bonds
- Crowdfund for project equity or debt

Support **Customers' Ability to Participate**

Some finance roles supporting customer participation include:

- Provide on-bill financing
- Create a credit enhancement or loan loss reserve
- Provide customer loans
- Provide incentives for generation or installation

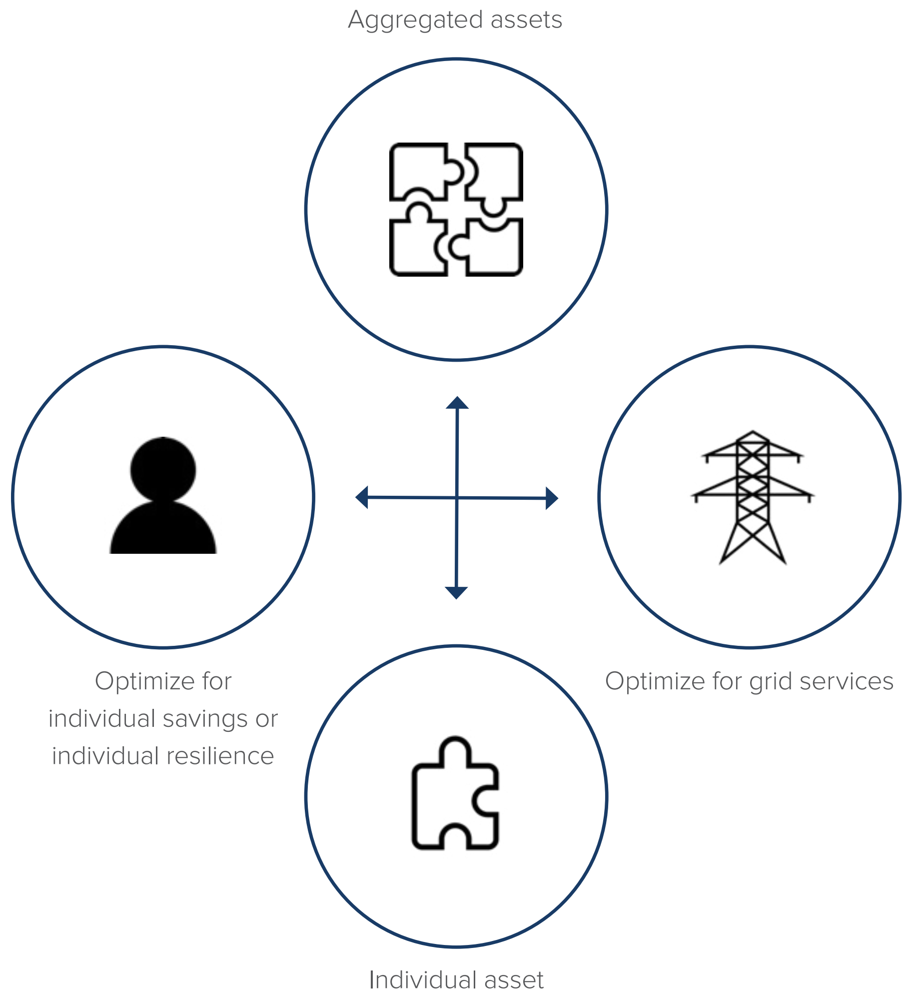
Financiers, the stakeholders playing the above roles, can be traditional financiers, such as commercial and investment banks and tax equity investors, but can also include community development financial institutions, multilaterals, green banks, utilities, third-party developers, and the community.

CONTROL

Control is becoming an increasingly relevant design decision, as demand response and grid flexibility enable utilities to install more distributed energy resources, and manage grid stability and reliability.

Programs can be designed to **engage individual assets**, such as home thermostats that are set by low-income customers to reduce consumption, or **aggregated assets**, such as several behind-the-meter storage systems that are controlled to provide grid services.

Additionally, programs can be designed along a spectrum of optimization. Controllable systems can be designed **to optimize for individual savings**, such as storage systems that reduce demand charges and arbitrage time-of-use rates for a customer, or designed **to optimize for grid services**, such as many behind-the-meter storage systems that provide voltage support in the event a major generator goes offline and causes voltage sag.



SERVICE DELIVERY

Service delivery is a series of design choices that indicate how the project will actually be delivered, and who will perform those roles on the ground. For example, will a site for a project be granted, leased, or acquired? Who will enroll customers, and what will the portfolio of customers look like? Who will perform design and installation of the project? How will billing be structured?

Range of design options

SITE SELECTION	PERMITTING/ INTERCONNECTION	CUSTOMER ACQUISITION	DESIGN/INSTALL	BILLING
Acquire site	Behind the meter	Utility-led	Traditional engineering, procurement, and construction (EPC)	On-bill
Lease site	In front of the meter	Community-led	Local installer	Separate bill
Grant site		Private operator-led	Volunteers & job training	

Customer acquisition and design/ installation options beyond traditional EPC may become easier when communities are incorporated into planning and decision-making.

PRICING AND COMPENSATION

There are different ways programs can be designed with respect to how customers pay for new services and how they are compensated for the value they provide back to the grid. For instance, many demand-response programs offer a fixed monthly bill credit in return for load reduction during peak times. Community solar projects may credit customers through net metering for energy associated with the customer's subscription. Other programs may combine compensation for services with new financing fees, new rate designs, or other payments from customers to the utility.

Mechanisms for how customers pay utilities for new services include:

- Volumetric rate (per kWh), including time-varying rates
- Demand charges
- Fixed monthly charges
- Financing fees
- Subscription fees

Innovations in pricing can make it more affordable to participate as energy and DER consumers.

Mechanisms for compensating customers for the value they provide to the grid include:

- Monthly bill credit
- Reduced volumetric rate (savings per kWh)
- Compensation for grid services
- Discounted products and services
- Volumetric bill credits, as in net metering
- "Adders" to stimulate the LMI market

Innovations in compensation can open up pathways for LMI customers to participate in other roles beyond consumer (i.e., generators or service providers).

TRADE-OFFS

There are trade-offs for the utility or community as a result of these design choices

RISK

If a community owns an asset, it is often responsible for risks and costs associated with operations and maintenance, obsolescence, liability, policy change, or regulatory change. If a utility owns an asset, its ratepayers and shareholders hold these risks.

REVENUES

If the utility owns and finances an asset, it will be the direct recipient of project revenues. The utility may then determine how to pass those revenues on to communities as savings. If a community owns and finances an asset, the project revenues will flow directly to it.

RESILIENCE

If the utility controls assets, its operations and dispatch may be optimized for overall system flexibility or for system-wide resilience. If the customers control assets, they can be optimized to provide local resilience rather than system-wide benefits.

03 NEW MODELS

New models are emerging for utilities to serve LMI customers

04 To make these models most successful, utilities and communities must collaborate in new ways

05 The evolving utility business model aligns with these new models for serving customers

"WIN-WIN-WIN" BUSINESS MODELS

New "win-win-win" business models are being developed to meet the changing needs of utilities, LMI communities, and a low-carbon energy system

LMI customers and communities may value:

- Affordability and reduced energy burden
- Asset ownership
- Local decision-making
- Economic development
- Resilience

Utilities may value:

- Better customer engagement
- New earnings opportunities
- Cost reduction and non-wires alternatives

The broader energy system and society may value:

- Low-carbon generation and climate change mitigation
- Resilient, storm-ready systems
- Greater customer participation
- Greater system flexibility
- Cost reduction and non-wires alternatives

New Business Models & Programs

UTILITY LMI PROGRAMS

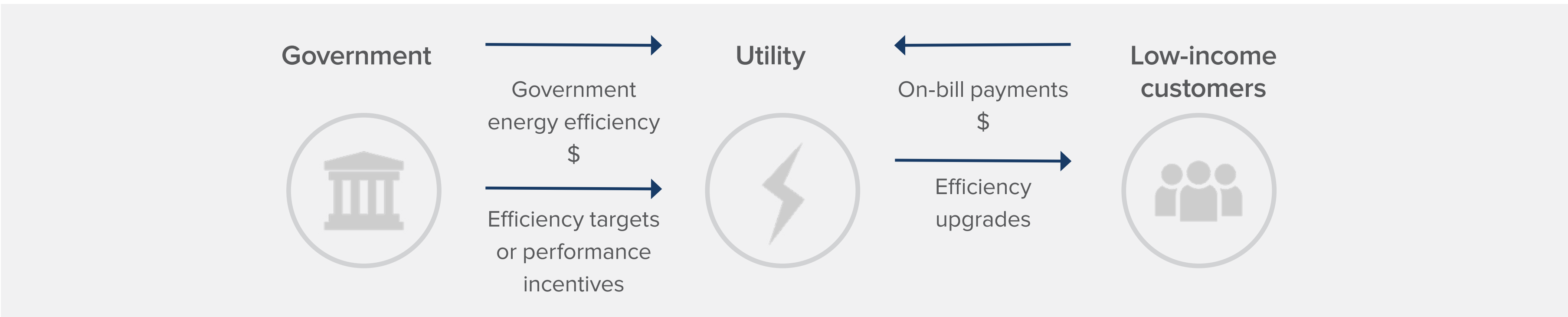
Several established models have expanded the values available from utility LMI programs

	OWNERSHIP	FINANCING	CONTROL	SERVICE DELIVERY
Model 1: Utility on-bill financing for energy efficiency upgrades	Customers have full ownership of energy efficiency upgrades.	Utility provides up-front capital for measures, and on-bill loans for customers.	Energy efficiency assets are controlled by the customer, and not aggregated.	The utility or a third party acquires customers, and the utility provides billing.
Model 2: Utility-owned PV systems that are accessed through lease or subscription	Utility owns photovoltaic (PV) assets.	The utility or a third-party financier provides project finance, and potentially a loan loss reserve for customers.	The utility controls its own PV assets, which can be aggregated in a rooftop model.	The third party contracted to the utility installs systems, and utility provides billing.
Model 3: Utility-administered philanthropic or government funding for customer-owned systems	Customers have full ownership of PV systems.	Philanthropic or government grant funding is used as project finance.	Customers control systems, and are not aggregated.	Third-party installers are contracted through the utility, and customers receive net metering credits on their utility bill.
Model 4: Utility provides controllable load devices for low-income customers	Customers or the utility may own the assets.	The utility provides upfront capital for controllable assets.	The utility controls assets to provide grid services.	Third-party installers are contracted to install devices, and customers receive credits for participation on their utility bill.

MODEL 1:

Utility on-bill financing for energy efficiency upgrades

How it works: The utility provides customers access to energy efficiency upgrade programs, which are repaid on customer bills. These programs can be structured in the style of Pay As You Save (PAYS®) programs, with no up-front customer cost and flat on-bill payments each month, with or without a savings guarantee. Funding can be a combination of utility balance sheet, third-party loans, and federal and state assistance for energy efficiency. Customers receive home upgrades, and bill savings.



EXAMPLES	UTILITY/ORGANIZATION
Help my House is an energy efficiency program where measures are financed using low-cost loans, paid back on energy bills. Installed measures included air sealing, duct sealing, attic insulation, and conversion of electric furnaces to heat pumps.	Electric cooperatives of South Carolina
Kansas How$mart is structured as a Pay As You Save program, and requires that the surcharge on customers' bills be <90% of savings.	Midwest Energy
Upgrade to $ave also uses the PAYS® model and is funded by the USDA's Rural Utility Service, which helps provide infrastructure to rural communities. Upgrades available through this program include insulation, duct and air sealing, heat pump improvements, water heater wraps, and LED lighting.	Roanoke Electric Co-op
Additional Examples: HELP PAYS® (Ouachita Electric Cooperative), How$martKY (six Kentucky Co-ops)	

MODEL 1:

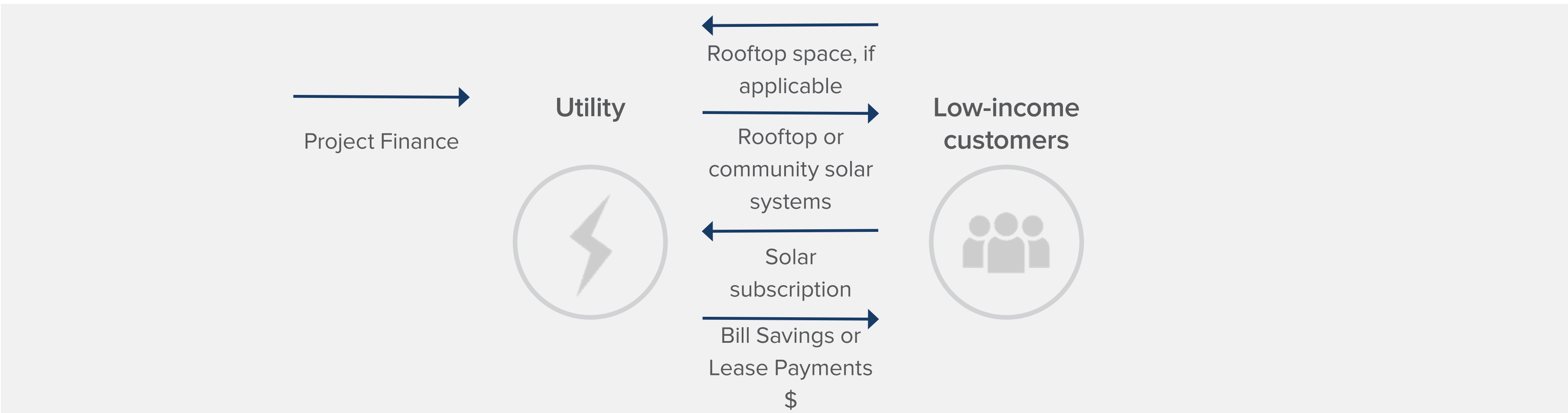
Utility on-bill financing for energy efficiency upgrades

	Customers	Utilities
Benefits	• Customer **bills should decrease** as a result of decreases in consumption due to energy efficiency upgrades. • Customers could see **improved indoor health** and increased home comfort, if upgrades include measures that better seal leaky windows and doors, or provide **new and improved heating or cooling equipment** to replace the old equipment often found in low-income housing. • As a result of these improvements to home comfort and equipment, **home value may increase** accordingly.	• Some utilities earn **performance-based incentives for efficiency goals**, which can be achieved in part through the introduction of an on-bill financing program. • Low-income customers can represent a new opportunity to achieve the **high retrofit penetrations** that unlock additional incentives. • Reducing load can reduce system strain in LMI communities, and can lead to **deferrals in infrastructure upgrades**. • On-bill financing can **increase the likelihood of customer payment** as opposed to separate billing. • An on-bill financing program could be an opportunity for **increases in customer engagement and satisfaction** with relatively little upfront investment.
Trade-offs	• Upgrades are often **limited to a specified payback period**, and do not cover deep retrofits, which results in more limited savings. • Energy efficiency programs and savings can be **hard to access for renters**, who do not own their units and sometimes pay their electricity bills included with rent in subsidized housing. • Upgrades are **tied to the customer's property**, which means savings cannot travel with customers when they move.	• **Accounting for savings is often complex**; calculating expected payback periods of upgrades are difficult to estimate, and measurement and verification of efficiency upgrades is time- and resource-intensive. • Additionally, **changes to customer billing** are required. • Finally, in a utility-financed program, the **utility bears the risk** of customer nonpayment.

MODEL 2:

Utility-owned PV systems that are accessed through lease or subscription

How it works: The utility procures and installs solar PV systems. These systems may be located on LMI rooftops, as community solar gardens in LMI communities, or as community-scale installations outside of LMI communities. Customers provide the utility with subscription payments, which are offset by bill savings or by lease payment to customers hosting rooftop solar.



EXAMPLES	UTILITY/ORGANIZATION
In the **LADWP Solar Rooftops Program (SRP),** low-income customers receive lease payments in exchange for hosting LADWP-owned solar systems on their rooftops.	LADWP
In the **National Grid Fruit Belt project,** National Grid installed 500 kW of solar PV in a low-income neighborhood, and the benefits of generation are dispersed not only to homes hosting systems, but over the entire community.	National Grid
Green Mountain Power partnered with installer SunCommon to develop community solar projects with priority subscriptions for low-income customers.	Green Mountain Power
In the **Consolidated Edison (Con Edison) shared solar pilot,** low-income customers are offered community solar subscriptions for community solar arrays sited on Con Edison buildings and land.	Con Edison
Additional Examples: Duke Energy Shared solar, Madison Gas & Electric Shared solar	

MODEL 2:

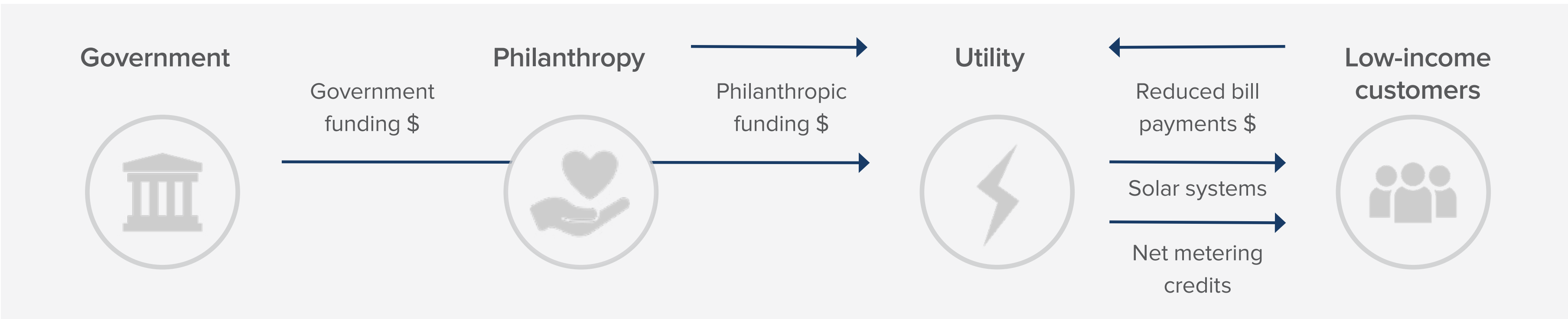
Utility-owned PV systems that are accessed through lease or subscription

	Customers	Utilities
Benefits	• Customers can **reduce energy bills**, especially in the case where utilities subsidize subscriptions for LMI customers. • Customers **receive the benefits or participate in the generation of more affordable, clean energy**, either through the hosting of clean energy systems, or by accessing them through virtual net metering or a subscription on community solar projects. • These options come at **no up-front cost** or necessity to access financing on behalf of the customer.	• Utilities can **site projects to achieve their goals**, such as displacement of polluting assets of reduction to system strain. • Utilities may be able to **rate base assets** and receive a regulated rate of return for their capital investment in systems serving low-income customers; in some regulatory environments the utility may be allowed to own assets to serve low-income customers, even if they are generally prohibited from owning generation. • This model **could also be expanded to other DERs for utility investment**, such as wind or storage.
Trade-offs	Customers **do not benefit from ownership** of the source of their solar generation, for instance from tax credits or long-term savings.	• **Utilities take on the risk** of owning systems, and the risk of customer nonpayment. • Utilities may have a higher cost of capital than third parties. In addition, the perceived risk profile of the customers may be greater. Both of these factors could lead to an overall **costlier project**.

MODEL 3:

Utility-administered philanthropic or government funding for customer-owned systems

How it works: The utility acts as an administrator and designs programs to distribute a combination of philanthropic or state funding to enable the installation of customer-owned systems. For example, the utility may administer solar assistance, such as through MASH and SASH in California. This could also involve the utility purchasing renewable energy credits (RECs), which brings down the solar costs for customers in Massachusetts.



EXAMPLES	UTILITY/ORGANIZATION
The Multifamily Affordable Solar Program (MASH) and Single Family Affordable Solar Program (SASH) in California utilize state funding from the California Solar Initiative. MASH provides qualified low-income households with no-cost solar panels, installed by Grid Alternatives. MASH provides up-front incentives for qualifying low-income properties, at a fixed amount based on installed capacity.	Pacific Gas & Electric (PG&E), Southern California Edison, San Diego Gas & Electric
The District of Columbia's Solar for All Program provides no-cost solar for low-income households and no-cost solar for several low-income multifamily housing developments, houses of worship, and community centers, funded by grants from the Renewable Energy Development Fund and administered by the Department of Energy and the Environment.	DC SEU

MODEL 3:

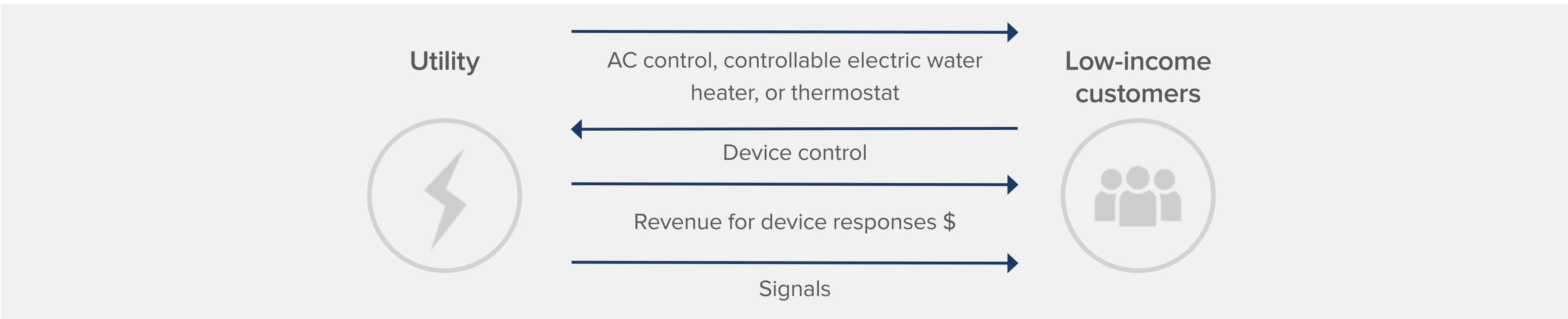
Utility-administered philanthropic or government funding for customer-owned systems

	Customers	Utilities
Benefits	• Customers are given solar systems or are heavily subsidized to procure them, and **receive the full revenues and own the generation** of more-affordable, clean energy. • Utility-administered programs can help **reduce or eliminate up-front costs** for low-income customers, and help to **connect households to state and philanthropic funding.**	• In this model, the **utilities do not own systems or their risks**; the customers fully own their own systems. • This model generally **does not require the utility to take the risk of consumer financing**. • Instead, the utility receives money from the state or philanthropists for the program.
Trade-offs	• **Customers take on the risk** of asset ownership, often including operation and maintenance costs. • Solar systems are **physically tied to the customer's property**, and if a customer wants to move, she must pay for the system to be reinstalled or forfeit the system in her move.	• Utilities may face **added operational complexity** in implementing state and philanthropic programs. • Additionally, utilities may see a kWh **reduction in their sales,** as a result of providing distributed generation to customers.

MODEL 4:

Utility provides controllable load devices for low-income customers

How it works: The utility designs programs that provide low-income customers with controllable load devices, such as programmable thermostats, water heaters, or AC load control. These assets may be controlled by the utility to either automatically reduce customer costs, or to provide them the opportunity to participate in demand-response events such as critical peak pricing.



EXAMPLES	UTILITY/ORGANIZATION
Entergy New Orleans' peak-time rebate pilot enrolled many low-income customers, some with direct AC load control. The program, enabled by smart meters, provided rebates for customers that reduced AC cycling during summer peak events, and received a 96% approval rating.	Entergy New Orleans
Steele-Waseca Cooperative Electric has a Storage Water Heater program in which participants receive a free electric water heater in exchange for significant control of the water heater. Participation in the Storage Water Heater program is a prerequisite for participation in the cooperative's community solar program, the Sunna Project.	Steele-Waseca Cooperative Electric
In the **Brooklyn Queens Demand Management demonstration**, Con Edison enrolled several customers in demand-response programs and installed significant behind-the-meter controllable storage capacity to defer a major substation upgrade in a low-income neighborhood.	Con Edison

MODEL 4:

Utility provides controllable load devices for low-income customers

	Customers	Utilities
Benefits	• Customers' **energy bills are reduced**, or customers **receive payments** for participation in demand-response events when controllable assets are dispatched. • Customers generally **own the controllable load asset**. • Customers see a **more consistent ongoing benefit** through program payments rather than the more uncertain savings on their energy bills from efficiency.	• Utilities can contract with customers to control their loads, which results in an **increase in grid flexibility**. • By using controllable loads, utilities can **better manage peak-load events** that strain the system.
Trade-offs	• Participating in demand-response events **can involve trade-offs**, such as running air conditioning at half-power during the hottest hours of the day. • However, programs set preconditions for comfort to mitigate this trade-off.	• Utilities may find it **difficult to predict the realized benefits** of the program, and predict customer participation if loads are not fully controlled. • Some utilities have found **it difficult to keep customers enrolled** in these programs past the pilot phase, especially if savings are minimal.

UTILITY LMI PROGRAMS

Other models are just emerging now and hold potential to further expand value in utility LMI programs

	OWNERSHIP	FINANCING	CONTROL	SERVICE DELIVERY
Model 5: Innovative low-income rate design	No assets are owned in this model.	Government funding may be leveraged to support this rate.	No assets are controlled in this model.	Reduced rates are delivered to customers through regular utility billing.
Model 6: Thermal electrification for propane and oil customers	Customers or the utility may own electrification assets.	The utility provides project finance for electrification.	The utility or the customer may control assets.	Utility-managed contractor network performs install and maintenance.
Model 7: Solar-plus-storage for low-income customers as a virtual power plant for major infrastructure deferral	Customers or the utility may own the solar-plus-storage systems.	The utility may provide project finance, and may provide loans or incentives to encourage customer participation.	The utility controls assets, optimizing for grid services and offering a degree of customer savings and resilience.	Third-party installers are contracted to install systems, and customers may pay or be compensated for services on-bill or through a separate billing scheme. Customer homes are generally used as sites.
Model 8: Integrated low-income customer services	Customers, the utility, or third parties may own assets.	Customers, the utility, or third parties may act as financiers.	Customers, the utility, or third parties may control assets.	The utility may act as a coordinator in all aspects of service delivery.

MODEL 5:

Innovative low-income rate design

How it works: Utilities are considering designing rates to specifically address low-income household needs.

EXAMPLES	UTILITY/ORGANIZATION
Fort Collins Utilities is trying to implement **income-qualified rates**, which provide a discounted version of its general customer time-of-use rate to its LIHEAP-qualified low-income customers, to levelize energy burden.	Fort Collins Utilities
PG&E is **NOT deploying opt-out time-of-use pricing** to its low-income customers in hot climates, as they are to the rest of their customers.	PG&E

MODEL 5:

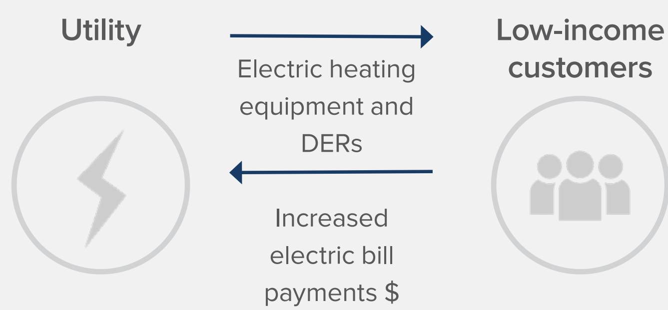
Innovative low-income rate design

	Customers	Utilities
Benefits	• Low-income customers **pay less for electricity**, which decreases their energy burden.	• Utilities contribute to the solution of overall housing affordability in Fort Collins, by **reducing the total expenditure of low-income housing on necessities**. • Additionally, by providing the same time-of-use structure to low-income customers, utilities still receive some of **the benefits of behavior shifts due to rate design**.
Trade-offs	• These rates **do not in themselves provide access to DERs**, nor to an increase in energy choice.	• These rates **may decrease utility revenues or shift costs to other customers**, by reducing the amount billed to low-income customers. • These rates are also likely to be **difficult to implement**, and usually require regulatory approval.

MODEL 6:

Thermal electrification for propane and oil customers

How it works: Utilities are rolling out programs to provide rural customers, who currently are underserved by the grid and use propane and oil for heating, to provide access to heat pumps, rooftop and community solar, or geothermal heating systems.



EXAMPLES	UTILITY/ORGANIZATION
PG&E and SCE are considering electrification projects in the San Joaquin Valley, where **low-income communities are currently underserved by gas infrastructure** and rely on propane for heating. Rather than expanding gas lines, the utilities are considering **electrification through heat pumps**, complemented by rooftop and community solar.	PG&E, SCE
New York utilities are also considering how to **electrify rural and urban customers who rely on propane or heating oil** through a combination of heat pumps and distributed energy resources.	New York investor-owned utilities

MODEL 6:

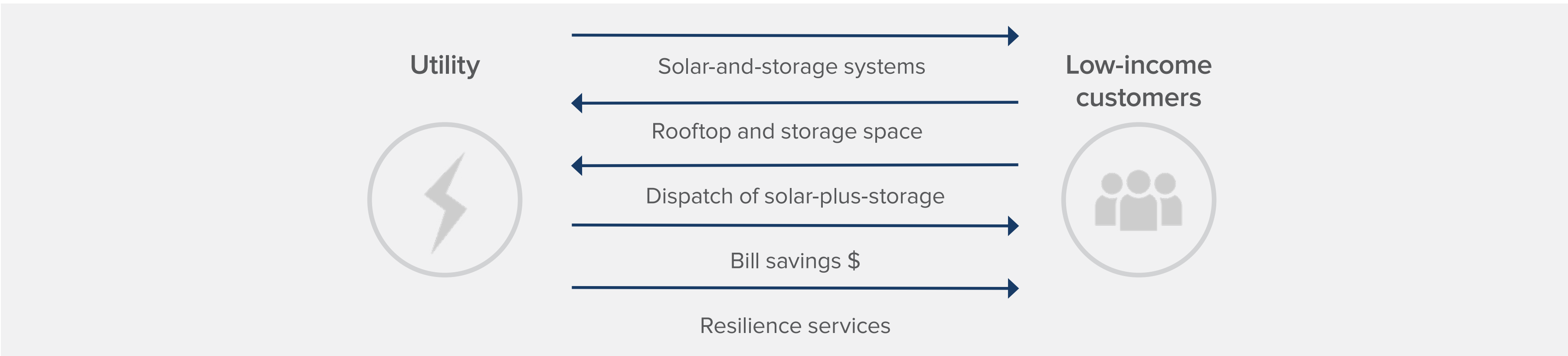
Thermal electrification for propane and oil customers

	Customers	Utilities
Benefits	• Customers receive **more-reliable, and more-affordable heating sources** as solar water heating or combined heat and power displaces diesel generators and household-scale gas generators.	• Utilities **avoid the cost of major infrastructure upgrades** in rural areas, and **increase their electricity sales** by providing electric heating sources.
Trade-offs	• Heating sources may be **tied to property** through the physical installation of rooftop solar panels and electric heating. • If customers move, they are **unlikely to be able to take this equipment and its benefits with them**, unless solar is accessed through a community-solar subscription.	• Utilities may **bear the risk** of financing and owning the infrastructure.

MODEL 7:

Solar-plus-storage for low-income customers as a virtual power plant for major infrastructure deferral

How it works: Solar-plus-storage is installed on customer homes, including low-income customers, at scale, and is aggregated and controlled by the utility to act as a virtual power plant. This is presented as a service offering to customers, as a solar lease, energy cost reduction, or additional service offering.



EXAMPLES	UTILITY/ORGANIZATION
In South Australia, the government proposed rolling out **solar and Tesla Powerwall to 50,000 homes** in a virtual power plant that will be centrally controlled, and claimed the project would lower customer energy costs by 30%. In the first phase of the pilot, solar-plus-storage is being rolled out **at no cost** to 1,100 public housing rental units.	South Australia Power Networks
In New Hampshire, Liberty Utilities is proposing to sell customers highly subsidized Tesla Powerwall batteries at a one-time or monthly rate, which it will **operate as a virtual power plant**. The utility is offering customers the prospect of bill savings through new time-of-use rates, and of backup services.	Liberty Utilities
Green Mountain Power offers Tesla Powerwall batteries to customers, **along with installation, maintenance, and financing**, and dispatches them for grid benefit; customers gain backup energy in the event of an outage.	Green Mountain Power

MODEL 7:

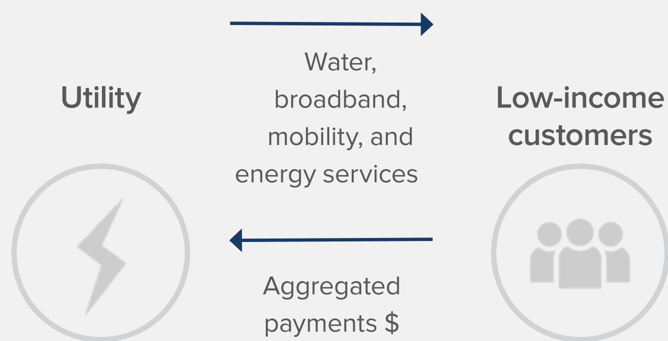
Solar-plus-storage for low-income customers as a virtual power plant for major infrastructure deferral

	Customers	Utilities
Benefits	• Customers either receive **cost reductions** in their energy bills, payments in the form of leases, or **additional reliability services** for their homes. • Customers receive solar-plus-storage systems in their homes, and **participate in renewable energy generation**. • Customers **do not take on the risks of maintenance and operations** if utilities own the systems. • Additionally, some configurations of this business model **may provide resilience** to homes through islanding capability, either at a single home system or aggregated at community-scale.	• Utilities **avoid the cost of major infrastructure upgrades** in congested areas, and can control distributed assets to **maximize renewables consumption** and meet carbon reduction goals, or provide reliability services. • Utilities **do not need to acquire land** to build projects, and instead use customer homes to site systems.
Trade-offs	• Customers **do not have the opportunity to optimize assets** to meet their own reliability or affordability goals. • Systems and their benefits are **tied to the customer's property** and do not transfer with customers who move.	• Utilities **own the risk of financing and owning the infrastructure**, by purchasing home or utility scale solar-plus-storage systems. • There are also likely to be **high customer acquisition and installation costs** due to the complexity of signing up individual homes, as opposed to larger-scale solar-plus-storage installations.

MODEL 8:

Integrated low-income customer services

How it works: The utility acts as an aggregator and platform for low-income services, such as energy, mobility, water, and broadband. It offers bundles of these services to low-income customers.



EXAMPLES	UTILITY/ORGANIZATION
The city of Fort Collins, CO, is creating a municipal broadband utility, and increasingly engaging with other utilities and affordable housing providers to understand the overall affordability of services to low-income residents.	Fort Collins Utilities
Commonwealth Edison (ComEd) is developing "**community of the future" projects in low-income neighborhoods** such as Bronzeville. In the Bronzeville project, the utility is piloting microgrids, shared electric mobility, energy storage, off-grid street lights, distributed automation, and smart meters.	ComEd

MODEL 8:

Integrated low-income customer services

	Customers	Utilities
Benefits	• Customers have access to many services through their utility's platform, which may be **more affordable to them through bundles**. • Customers may **gain access to additional services** that have previously been unavailable or unaffordable.	• Utilities increase the number of touchpoints with customers, which can lead to **increased customer engagement**. • Bundled services can give utilities better **insight into the overall affordability** of services to LMI customers, to help better meet their current and future needs. • It can also provide **new revenue streams** for utilities as they expand into new service offerings.
Trade-offs	• Customers **may not have as many choices** in their services as they do with individual service providers, if they are choosing from utility bundles.	• In this model, utilities are investing in **unfamiliar services**, and must develop new partnerships that may represent a large departure from their current business models. • If utilities choose to also own some of these services and their infrastructure, they take on the additional risks of ownership, especially **ownership of costly and unfamiliar assets**.

04

NEW COLLABORATION

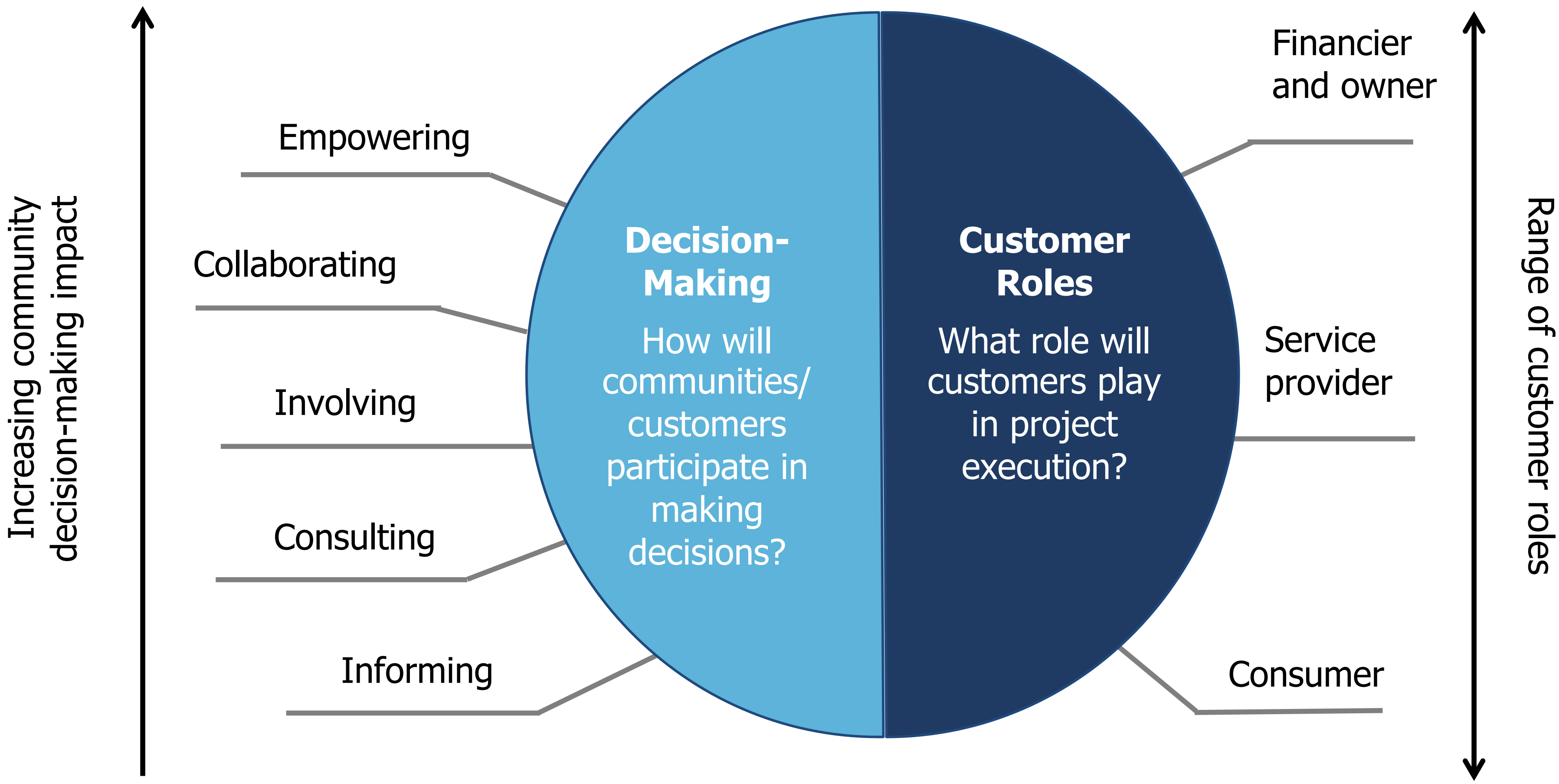
To make these models most successful, utilities and communities must collaborate in new ways

05

The evolving utility business model aligns with these new models for serving customers

NEW WAYS OF COLLABORATION

These new and emerging models and programs require new customer roles and new ways of collaboration[2]

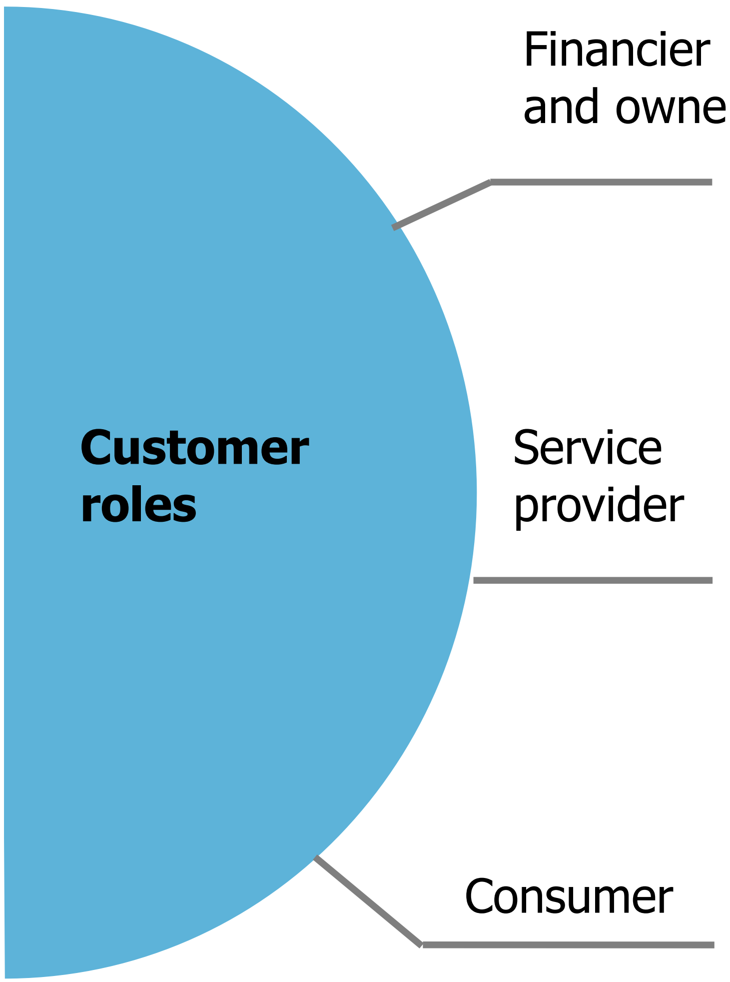


Communities are seeking a wide range of benefits from renewable projects.

[2] Decision-making roles adapted from participation spectrum developed by the International Association for Public Participation

CUSTOMERS

Customers can play roles ranging from traditional market participant to financier or owner



Financier and owner: Customer has financial stake in project or is co-owner of equity shares.

Example: *Cooperative Energy Futures allows community members to own community solar shares via a cooperative business model structure.*

Service provider: Customer provides generation, efficiency, demand flexibility, or energy storage services to the grid.

Example: *GMP is providing Nest thermostats to customers with electric heating, in exchange for the ability to use the device for demand flexibility needs.*

Consumer: Customers receive electricity service from their utility in exchange for payment.

Example: *With increasing DERs and control options consumers can become more active by responding to signals from the utility or by choosing among different utility programs.*

PARTICIPATION

As projects involve larger community roles,[3] customers can participate more meaningfully than simply being "informed"

For some new programs, collaboration can be necessary for success. Many of the emerging models in section 3 will benefit from having customers more engaged in project planning, especially in achieving strong service delivery.

Empowering: Enabling community members to have sole decision-making authority over new programs or services, and allowing professionals to serve only in consultative and supportive roles; e.g., communities determine which buildings are critical for resilient microgrids, with utility engineering support.
Collaborating: Enabling community members to participate in every aspect of planning and decision-making for new programs or services; e.g., inviting a community-based member to sit on a steering committee or project board for a new utility initiative.
Involving: Working with community members to ensure that their aspirations and concerns are considered at every stage of planning and decision-making. Letting people know how their involvement has influenced program decisions; e.g., providing funding for and appointing a community-based member to provide input to utility program design on an ongoing basis.
Consulting: Inviting feedback on alternatives, analyses, and decisions related to new programs or services. Letting people know how their feedback has influenced program decisions; e.g., asking community-based organizations for feedback at key milestones in program design.
Informing: Providing balanced and objective information about new programs or services, and about the reasons for choosing them. Providing updates during implementation; e.g., educating and notifying customers in advance of new programs or rate changes.

[3] Decision-making roles adapted from participation spectrum developed by the International Association for Public Participation

MOVING BEYOND INFORMING

Moving beyond informing improves relationships and strengthens solutions

Collaboration improves relationships between the utility and the customer and community
Unique collaborative opportunities, like those at e-Lab Accelerator, have resulted in community partnerships such as PG&E's Oakland Clean Energy Initiative and Duke's Energy Innovation Task Force.

Collaboration can also make the solutions better
In part due to long-term collaboration with the community via the Energy Innovation Task Force, Duke has agreed to defer building a fossil-fuel peaker plant in Asheville, NC.

Collaboration can lead to future partnerships and initiatives
Strong utility-community partnerships between Duke and the community have led to a number of new joint initiatives.

Partnerships are also crucial for the success of all utility programs that require enrollment.

CASE STUDY:

Con Edison LMI RFI

Context and opportunity:
Con Edison in New York put out a Request for Information (RFI) seeking respondents to collaborate on the design and implementation of innovative solutions for LMI customers. Con Edison offered $25 million as a part of this RFI, to commit toward selected demonstration projects.

Project details:
The RFI laid out three goals for respondents: Access, Affordability, and Impact. Access is defined as helping connect LMI customers to new clean energy technologies and services; affordability is defined as aiding LMI customers in managing energy use and controlling costs; impact is defined as achieving energy savings, greenhouse gas (GHG) emissions reductions, system improvements, and other local benefits.

RFI respondents were allowed to propose demonstration projects that included a variety of approaches—novel energy efficiency methods, distributed energy resources, financing and billing innovations, education and outreach, and other strategies.

This RFI is part of a broader demonstration project effort in New York as a result of Reforming the Energy Vision (REV), to test new business models, energy technologies and service deliver methods that reduce emissions and improve system resilience.

Three project concepts have been selected, and they will be publicly filed with the Department of Public Service in 2018.

The projects include self-sustaining community distributed generation, "pay-for-success" financing for energy efficiency, and behavior-driven energy efficiency using a mobile app and flexible payment.

Utility involvement:
This Request for Information was driven by the utility, and will result in utility-driven demonstration projects.

Innovation:
Rather than developing demonstration projects internally, Con Edison turned to LMI stakeholders and providers in the energy industry for ideas and strategic partnership. By listening and soliciting ideas in this manner, Con Edison believes it will develop more responsive and effective energy programs. This method of stakeholder engagement and cooperative program development is new, and represents a scalable model of utility engagement for other utilities to consider.

CASE STUDY:

Oregon Community Participation

Context and opportunity:
SB 978 instructs the Oregon Public Utility Commission (PUC) to establish a public process to investigate how developing industry trends, technologies, and policy drivers may impact the existing electricity regulatory system. Through this process, issues of equity and access emerged as a place for further focus, and PUC staff brought a team to eLab Forge to focus on these issues.

Project details:
The PUC staff, environmental justice groups and utility and government representatives came together at e-Lab Forge, using the workshop as an opportunity to engage with and educate each other in new and different ways. This team is particularly focused on how communities might move further toward "empowering" on the decision-making spectrum, and to understand more deeply the outcomes that communities would like to see from the regulatory process.

In the Commission's draft report for SB 978, the Oregon PUC highlights its commitment to developing strategies to improve inclusion in PUC processes.

Utility involvement:
If community voices are incorporated more deeply into Commission decision-making going forward, the regulation that utilities need to respond to will in turn be more community-oriented. Portland General Electric was a team member and part of the conversation, offering perspective and insight on the current regulatory process, and gaining a better understanding of community perspectives.

Innovation:
By coming together at e-Lab Forge, PUC staff and community groups were able to uncover what often goes unsaid or is misunderstood. By better understanding what outcomes community groups are seeking, and what inputs or processes would be necessary to achieve those outcomes, the PUC can be more intentional in their public participation process.

05

UTILITY

The evolving utility business model aligns with these new models for serving customers

UTILITIES SHIFT

The growth of DERs is forcing a shift for utilities toward either an expanded monopoly or transformed platform operator model, adding new complexity to utility-customer interactions

Utility ownership or financing of new assets and services, including DERs

Utility serves as a neutral asset integrator and host for market activity

Expanded monopoly underlying beliefs:

- Utility economies of scale and scope lower costs for customers
- Utility can leverage customer relationships to best deliver new services
- Utility experience and grid knowledge ensures high-quality technical solutions
- Utility regulation protects consumers

Transformed platform underlying beliefs:

- Natural monopoly conditions and economies or scale do not apply to customer-sited energy resources
- Competitive markets can provide more innovation, better products and services, and lower costs for customers than regulated monopolies
- Utility participation in markets would preclude more valuable competitive offerings

Why are DERs forcing this shift? DERs give customers more options, both to generate their own power (the traditional utility role), and to interact with the energy system in new ways that provide value. On one end, utility business models may be threatened by the growth and proliferation of DERs and load defection, but on the other there are new opportunities for utilities to capture value from new services in both a platform future and a monopoly future.

UTILITIES SHIFT

These shifts open up several new levers for utilities to serve low-income customers differently, whether they shift toward an expanded monopoly or a transformed platform model

Historic utility levers:
Historically, there have been few levers for utilities to pull to serve LMI customers, beyond bill assistance and reduced rates

The integration of DERs and resulting new values open up several new levers for utilities to serve low-income customers differently, in both a platform and a monopoly future

Examples of expanded monopoly levers:

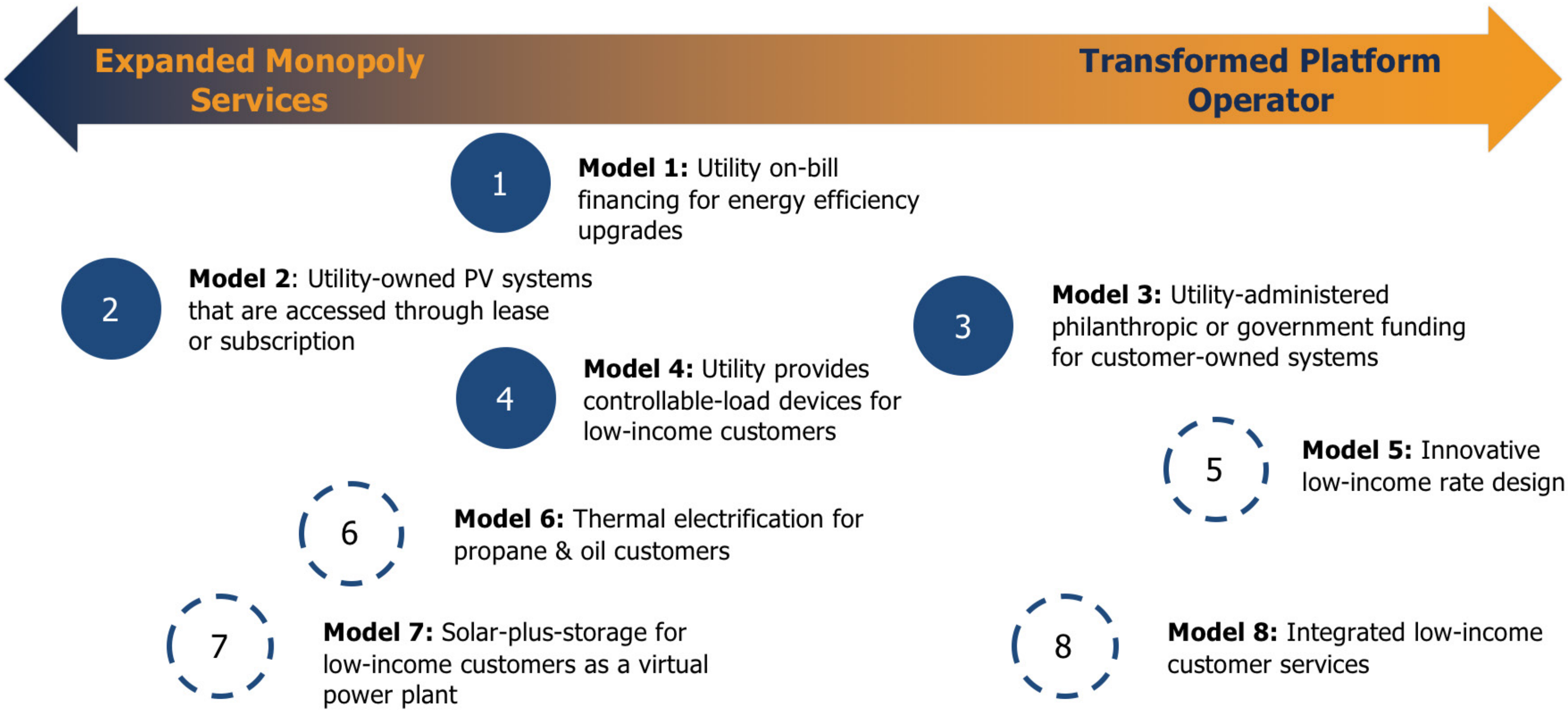
- Utilities may have the opportunity to own rooftop or community solar to serve LMI customers with leases or subscriptions
- Utilities can finance efficiency upgrades, solar installations, or microgrids for low-income customers
- Utilities can expand into new service offerings, such as broadband and electric mobility, and bundle those services into affordable packages for LMI customers

Examples of transformed platform levers:

- Utilities can implement innovative low-income rates, which are designed to reduce energy burden and increase affordability, but also enable low-income customers to respond to price signals such as time-of-use rates
- Utilities can provide opportunities for third-party aggregators of low-income storage or controllable loads to provide grid services, and earn revenue in return

UTILITIES SHIFT

The new models described in this document can align to this spectrum of utility evolution



In practice, this spectrum should not be viewed as a constraint on possible innovations for customer programs, but rather a prompt to explore innovative alternatives. In the next two pages, we explore the question, “How could these models be applied to the other end of this spectrum?”

OPPORTUNITIES FOR INNOVATION:

How could these models apply to the other end of the spectrum?

Expanded Monopoly Services ⟷ **Transformed Platform Operator**

Model 1: Utility on-bill financing for energy efficiency upgrades

1 → Third parties finance upgrades, and utility acts as a pass-through to provide billing.

2 → In a platform, instead of the utility owning PV systems, third parties own and lease them to customers through the utility. Utilities may not have as much control over siting, and may have to design incentives for developers in order to reach performance goals.

Model 2: Utility-owned PV systems that are accessed through lease or subscription

Model 3: Utility-administered philanthropic or government funding for customer-owned systems

3 → The utility would likely not administer this model in a platform future. This funding could be managed through third parties instead.

Model 4: Utility provides controllable-load devices for low-income customers

4 → A third party controls and aggregates the systems on behalf of the utility. Controls respond to price signals and optimize for consumer benefits and system-wide performance in a platform future.

OPPORTUNITIES FOR INNOVATION:

How could these models apply to the other end of the spectrum?

Expanded Monopoly Services ← → **Transformed Platform Operator**

Model 5: Innovative low-income rate design (5)

In a monopoly, a utility provides not just a time-varying rate with protection against bill increases, but also the enabling technology to help customers optimize for these rates, or allows LMI customers to have flat rates (even as other customers are converted to TOU) if they enroll flexible loads in utility demand flexibility programs.

Model 6: Thermal electrification for propane and oil customers (6)

This model does not hold up in a platform future. The utility is acting here as a provider of last resort. To have a third party provide this service, the government or utility would need to provide strong incentives for rural, low-income services. This could include coupling with other models, such as the Model 7, where assets provide grid services.

Model 7: Solar-plus-storage for low-income customers as a virtual power plant (7)

This model in a platform requires a robust market for third-party aggregators and solar-plus-storage providers to bid into with grid services.

Model 8: Integrated low-income customer services (8)

In a further monopoly, the utility expands into ownership and provision of additional service offerings for low-income customers, including mobility services, water, housing, and broadband.

This model has the potential to be a true platform model, aggregating the services of other utilities and providers into integrated offerings.

RECOMMENDATIONS

UTILITIES

- Engage communities early in program design and aim to move beyond simply informing communities about programs
- Expand understanding of LMI communities' needs and opportunities; think beyond bill assistance
- Pursue opportunities to deliver value to LMI customers with local resources that integrate into the utility system
- Build partnerships with state energy offices, cities, other agencies, and other utilities to jointly test scalable LMI solutions

COMMUNITIES AND CUSTOMERS

- Seek collaborative engagement with utilities to design customer programs that balance utility and customer roles to meet local needs
- Expand understanding of current utility business model and grid-wide needs to identify how communities can help support those needs

REGULATORS

- Consider specific intervener funding or other methods to facilitate community involvement in regulatory processes
- Allow and encourage utilities to use dedicated funds to develop and test new approaches to LMI customer programs

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