

Distributed PV + Behind-the-meter Storage Modeling Overview Using dGen Model for CEC

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dGen Model Overview

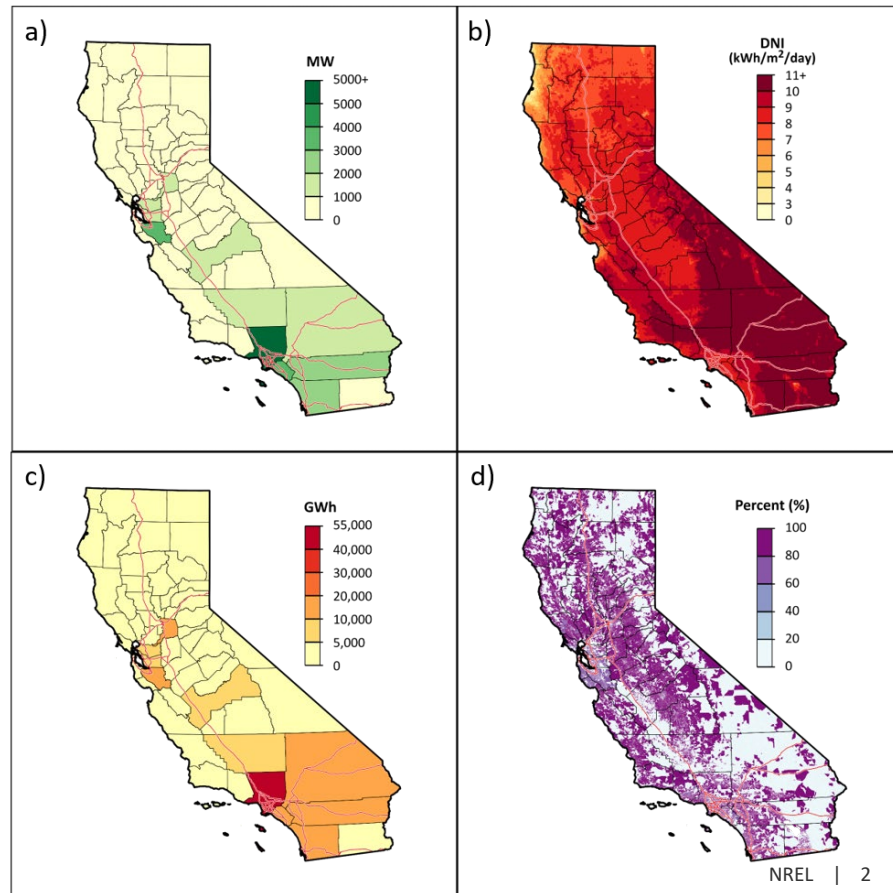
- Forecasts adoption of distributed solar, storage, wind, and geothermal by region and sector through 2050
- Agent-Based Model simulating consumer decision-making
- Incorporates spatial data to understand regional adoption trends

a) Distributed solar economic potential (MW) in 2030 for the TOU Baseline scenario

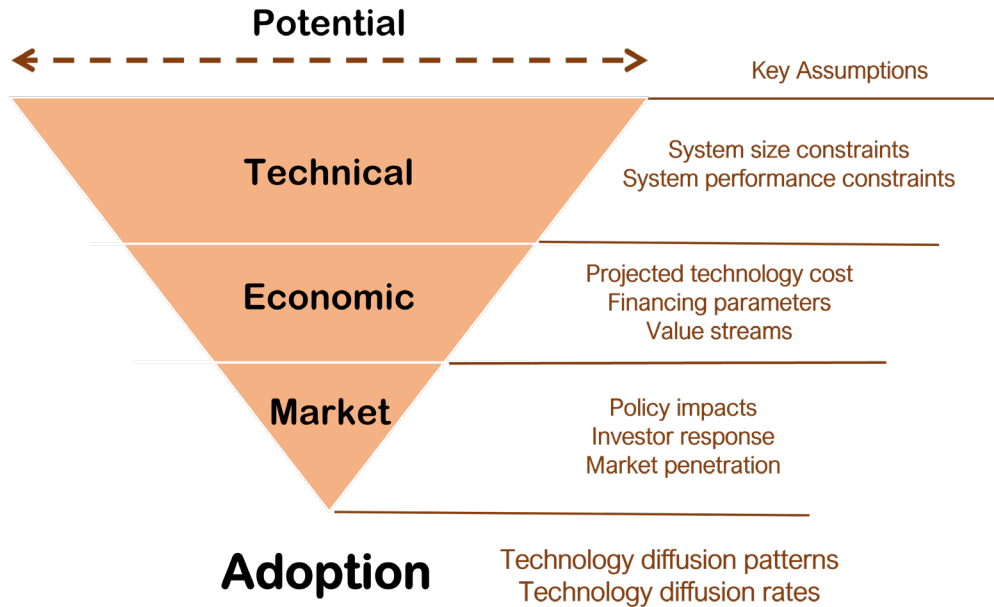
b) Solar resource

c) Annual electricity consumption

d) Distributed solar siting availability



Methodology – From Technical Potential to Adoption



Technical Potential: Maximum amount of technically feasible capacity.

Economic Potential: A subset of technical potential, the total capacity that has a positive return on investment or a positive net present value (NPV).

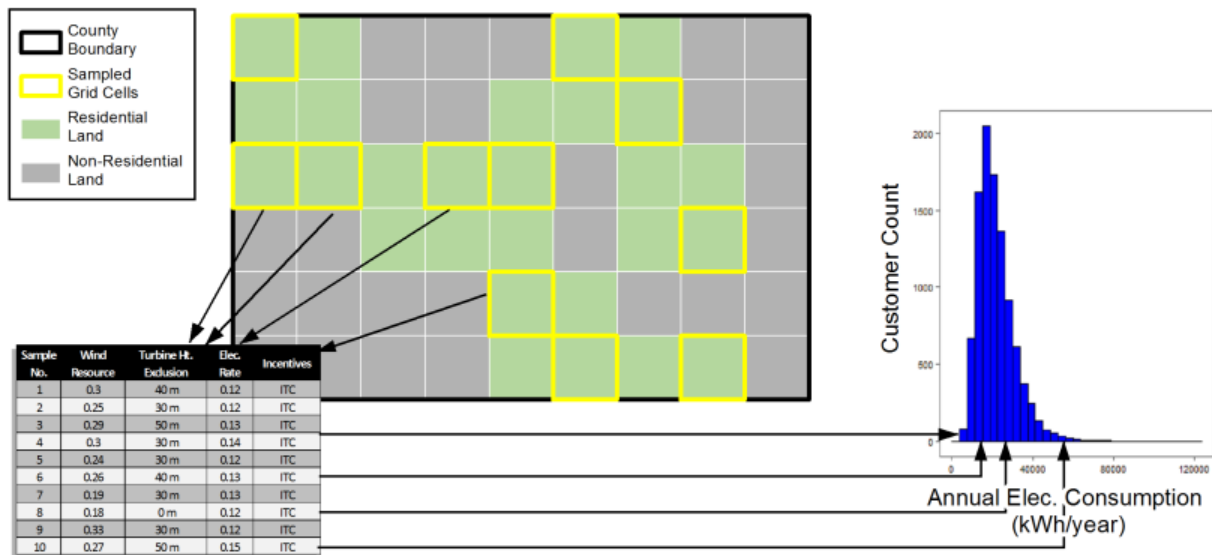
Market Potential: The fraction of economic potential representing the customer's willingness to invest in a technology given a specified payback period.

Create Statistically-Representative Agents

To reconcile data sets of disparate resolutions, we represent customers through a statistical framework

1) Sample eligible spatial points, assigning customers a representative location, used to associate with other spatial attributes

2) Associate customer segments with national distributions, such as customer load patterns



Adoption Forecast in Emerging Markets

New datasets have enabled analysis of emerging markets in California. The non-single-family/owner-occupied market demonstrates strong potential, though analysis limitations still exist in accurately evaluating the nuances of multi-family and/or renter-adopted systems.

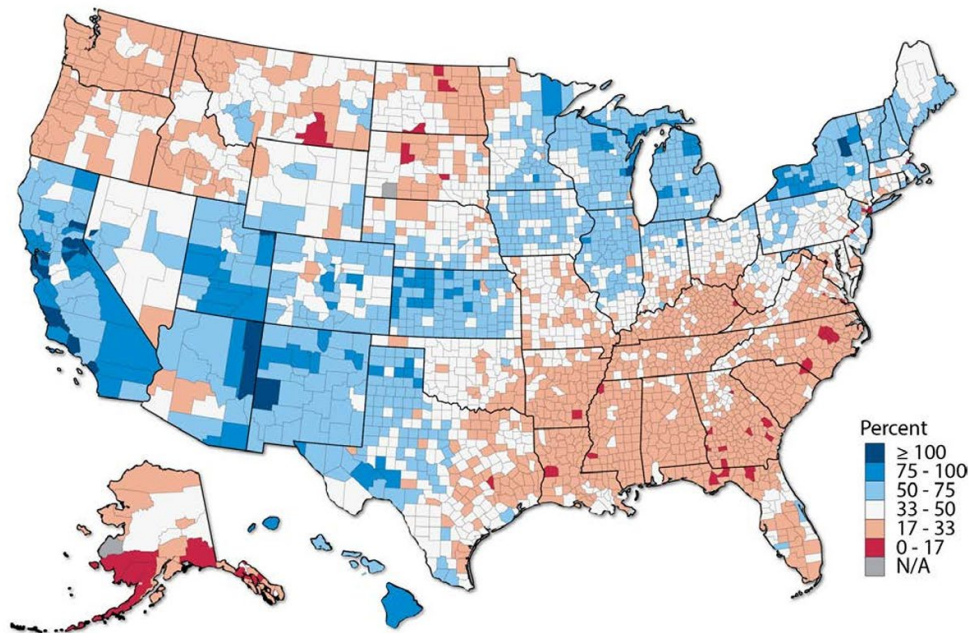
INCOME	BUILDING TYPE	TENURE
Low	Single-family	Owner-occupied
		Renter
	Multifamily	Owner-occupied
		Renter
Moderate	Single-family	Owner-occupied
		Renter
	Multifamily	Owner-occupied
		Renter
High	Single-family	Owner-occupied
		Renter
	Multifamily	Owner-occupied
		Renter

Adoption Forecast in Emerging Markets - REPLICA

Rooftop Energy Potential of Low-Income Communities in America (REPLICA)

– Tract-level solar technical potential by income, tenure, and building type, joined with 10 additional datasets to provide socio-demographic and market context (energy expenditures, demographics, etc.).

<https://data.nrel.gov/submissions/81>



Percent of Low-to-Moderate Income (LMI) energy consumption that can be offset by rooftop solar generation (county)—single-family owner-occupied LMI buildings only

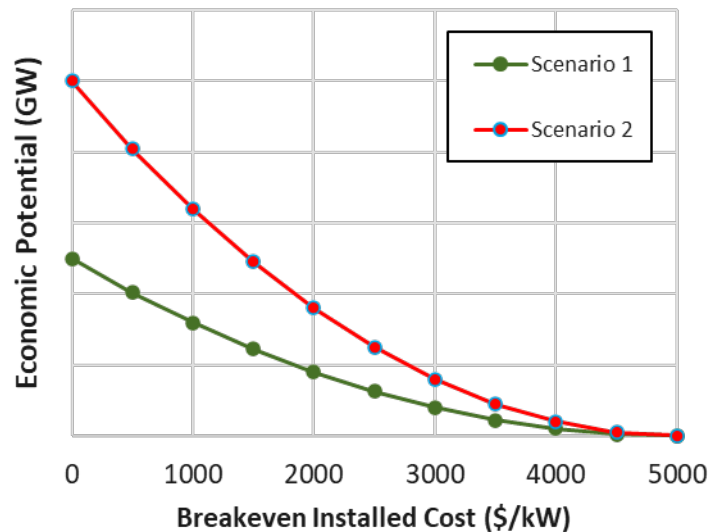
Economic Potential

Agents complete a discounted cash flow analysis that includes:

- System cost and expected maintenance
- Retail bill savings from net exports
- Whether the system is eligible for incentives, rebates, or avoided tax

These result in:

- The system capacity that maximizes the agents' economic return
- Net present value and payback period of potential investment



Example of how dGen outputs can be used to produce supply curves of economic potential and how it varies by scenario, system cost, or degree of compensation for distributed solar

Net Billing Tariff (NBT) / NEM 3.0 Updates

ALJ/KHY/nd3

Date of Issuance 12/19/2022

Decision 22-12-056 December 15, 2022

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

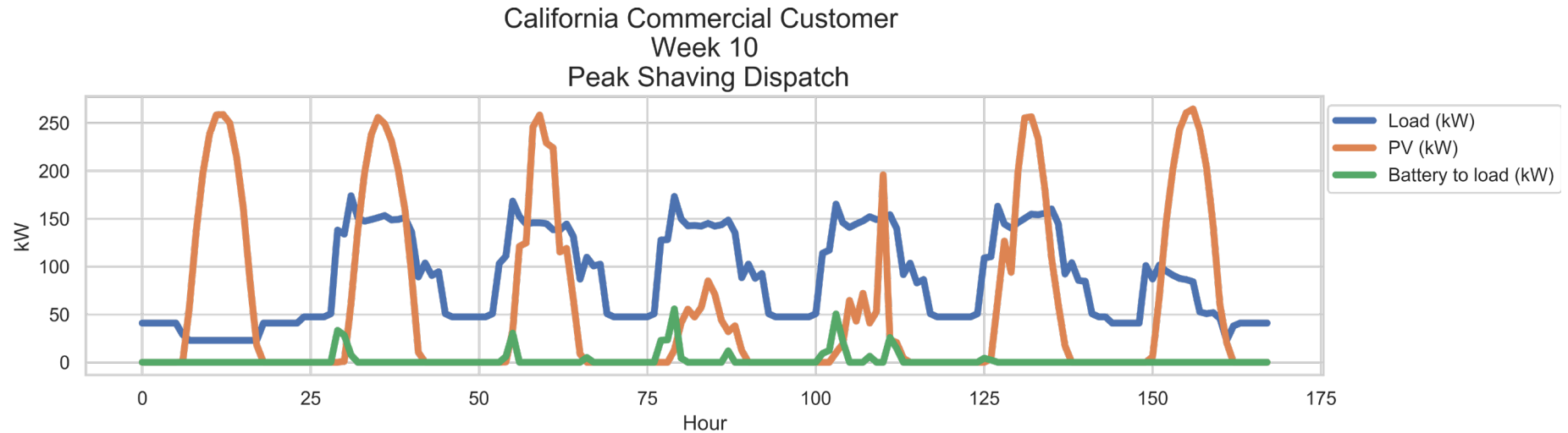
Order Instituting Rulemaking to Revisit Net Energy Metering Tariffs Pursuant to Decision 16-01-044, and to Address Other Issues Related to Net Energy Metering.

Rulemaking 20-08-020

**DECISION REVISING NET ENERGY
METERING TARIFF AND SUBTARIFFS**

- The new Net Billing Tariff (NBT) workbook was analyzed and incorporated in the export compensation modeling framework.
- Reformatted the hourly export rates by planning area and was ingested into the model.
- This also included the incorporation of the ACC Plus Adders for PG&E and SCE.
- Customers moving to Time of Use (TOU) rates according to planning areas.

Storage Dispatch Strategies (1)



Peak Shaving Strategy: Peak shaving to reduce demand charges

Storage Dispatch Strategies (2)



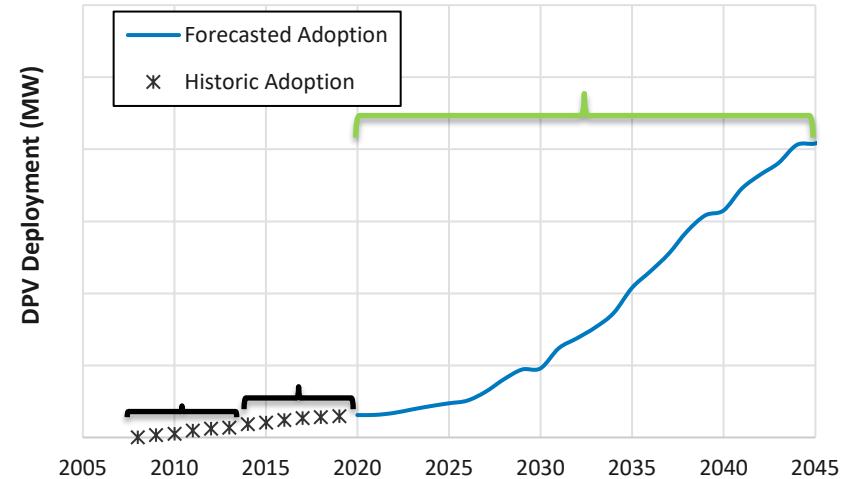
Price Signals Strategy: Combines forecasts of day-ahead load generation, and the utility rates to dispatch the battery in the hours when retail rates are high

Technology Deployment

Training a **predictive model based on historic observations of adoption** to estimate the agents' probability of adoption in each year.

- Only technically eligible agents can adopt
- Probability of adoption increases with NPV and proximity to other adopters
- Ownership status (e.g., multifamily) and income will affect adoption

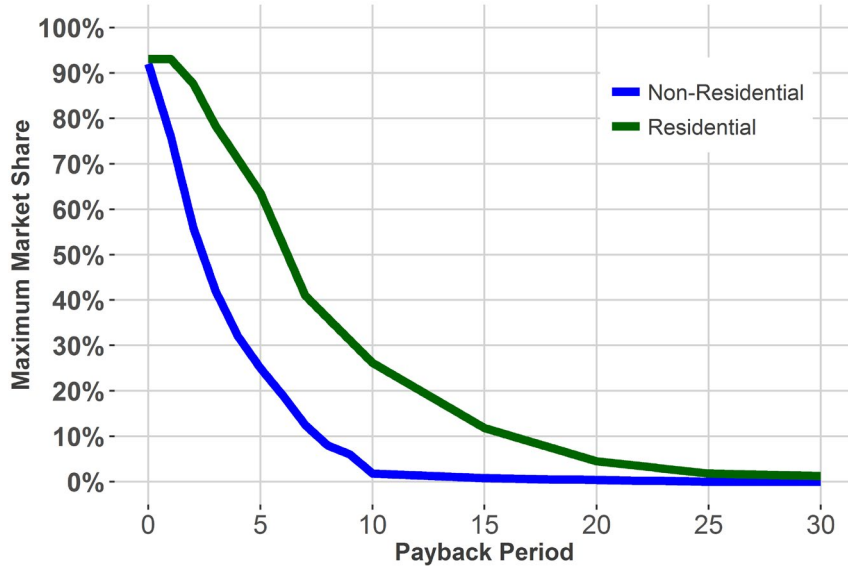
Result: Credible, spatially granular adoption patterns informed by historic trends



Example of model calibration, validation, and application for forecasting. Actual model forecasts may be resolved at the building level but can be aggregated at different geographic levels.

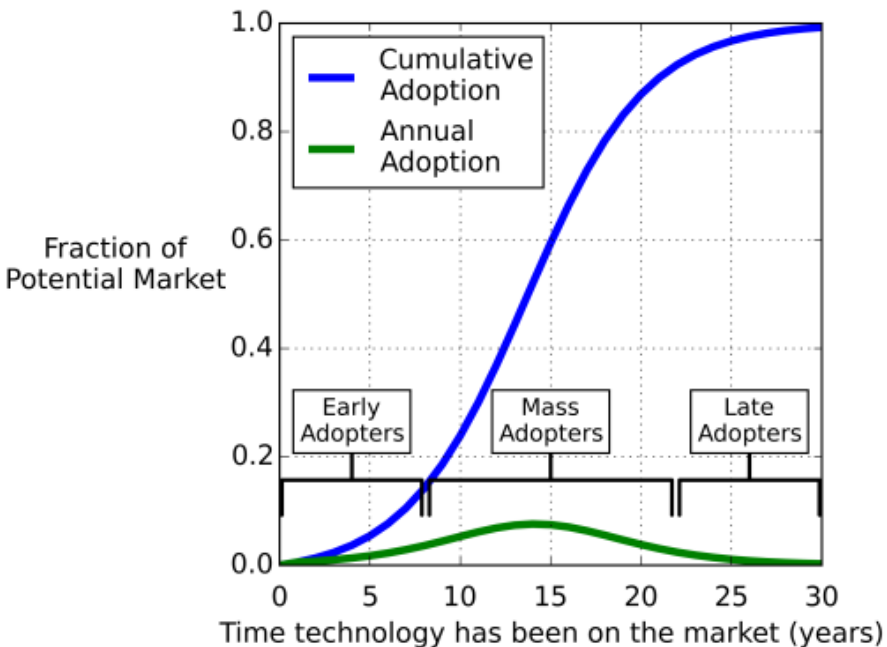
Customer Adoption

Previously conducted surveys to understand **customer willingness to pay (WTP)** at various payback periods.

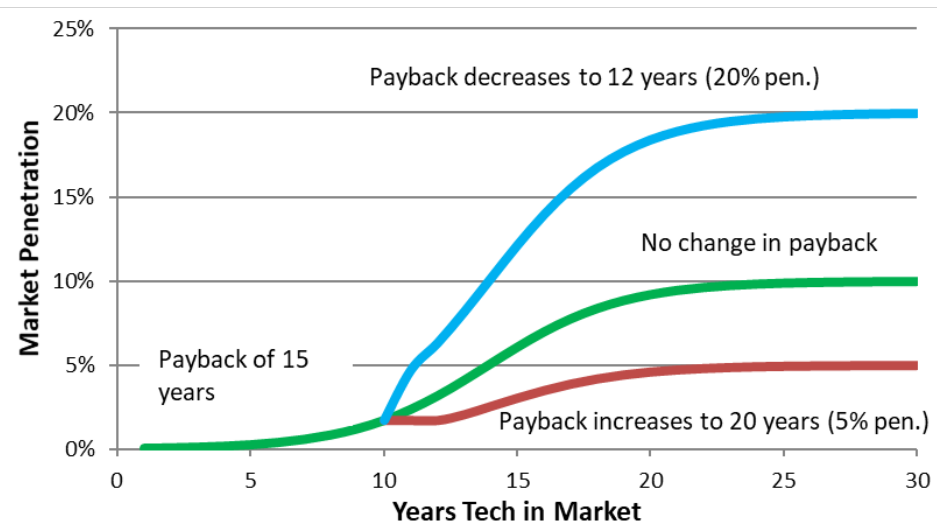


	Yes	Maybe	No	I don't know
I would seriously consider solar if the payback time was 1 year or less	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would seriously consider solar if the payback time was 2 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would seriously consider solar if the payback time was 3 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would seriously consider solar if the payback time was 5 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would seriously consider solar if the payback time was 7 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would seriously consider solar if the payback time was 10 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would seriously consider solar if the payback time was 15 year	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would seriously consider solar if the payback time was 20 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would seriously consider solar if the payback time was 25 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would seriously consider solar if the payback time was 30 years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Modeling Solar Adoption



Using consumer surveys, relate the system payback to the fraction of consumers that would adopt solar



Use the Bass Diffusion model to simulate adoption over time, using the “Maximum Market Share” as the terminal adoption level

Questions?

www.nrel.gov

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Learn More: <https://www.nrel.gov/analysis/dgen/>

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