Reaching for Zero Net Energy: Commercial Solar and Advanced Energy Storage

Presented by City of Chula Vista's Sustainable Communities Program

June 29, 2016

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

Welcome to today's workshop!

- Housekeeping
  - Help yourself to complementary lunch
  - Please sign-in and complete feedback survey at end
  - Please silence your phone
  - Restrooms & emergency exit

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

Today's Workshop: Reaching for Zero Net Energy

Goals

- Zero Net Energy (ZNE) overview & nonresidential resources
- Present renewable technologies that are imbedded in ZNE
- Q&A with panelists

Sustainable Communities Program Partner

- **Marissa Spata**, Center for Sustainable Energy www.energycenter.org

Center for Sustainable Energy Expert Panel

- **Laura Williams**, California Solar Initiative Nonresidential Project Manager
- **Andrea (Andi) Woodall**, Self Generation Incentive Program Project Associate
- **Jonathan (Jon) Hart**, Self Generation Incentive Program Project Associate

SDGE A Sempra Energy utility
Center for Sustainable Energy
CITY OF CHULA VISTA

Sustainable Communities Program

- Provides resources to the stakeholders of Chula Vista's built environment to improve compliance with **energy efficiency** and **green building codes** and to promote construction of **sustainable buildings**.

- Part of the **City of Chula Vista's Local Government Partnership program**, funded and administered by San Diego Gas & Electric® under the auspices of the California Public Utilities Commission.

SDGE A Sempra Energy utility™

Center for Sustainable Energy™

CITY OF CHULA VISTA

Sustainable Communities Program

- Benefits for Chula Vista development community, businesses & citizens
  - Free community workshop series on energy efficiency & sustainable building topics
  - City staff are connecting programs & ordinances with state sustainability and zero net energy strategies
  - Energy Code Coach staffs Chula Vista Sustainability Desk to assist applicants!

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

Sustainable Communities Program

2016 Workshop Series

Smart Cities: LEED Neighborhood Development, EV Charging Stations, etc.

- *Wednesday, September 14*

Advanced Building Technologies: Advanced framing, high performance attics, and building performance strategies!

- *Wednesday, October 12*

Register at www.energycenter.org/events

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

What is "Zero Net Energy"?

- A Zero Net Energy (ZNE) Building is one where the ***net amount of energy produced by on-site renewable energy resources*** is equal to ***the value of the energy consumed in one year*.**

- The more efficient a building is by ***design***, ***equipment***, and ***occupant behavior*** the less energy it should need to generate.
  - Energy efficiency first!

SDGE A Sempra Energy utility™ Center for Sustainable Energy™ CITY OF CHULA VISTA

What does ZNE mean for California?

California's ZNE Goals

- All **new residential construction** will be ZNE by 2020
- All new and 50% of existing **state-owned public buildings** will be ZNE by 2025
- All **new commercial buildings** will be ZNE by 2030
- 50% of **existing commercial buildings** will be retrofit to ZNE by 2030

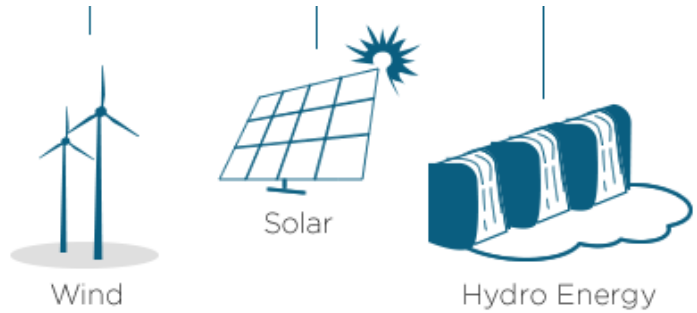
To Create a Zero Energy Building...

STEP 1 Increase energy efficiency

- Efficient building construction
- Efficient systems and appliances
- Operations and maintenance
- Change in user behavior

STEP 2 Address remaining needs with on-site renewable energy generation

Green = low hanging fruit



High performance insulation

High performance windows

Low-flow water fixtures

Daylighting & shading

Lighting with controls

High efficiency heating & cooling system

Monitor building energy use

Analyze Plug Loads

Advanced Energy Storage

Rooftop solar PV

Solar thermal water heating system

Blue = next steps!

Source: *Commercial Buildings: Zero Energy Buildings,* Department of Energy

Nonresidential ZNE Case Studies & Resources

- Zero Net Energy Case Study Buildings (PG&E)
  - https://energydesignresources.com/media/19864463/zne_case_study_buildings-11.pdf
  - Google: "energy design resources ZNE case study"
- ZNE Roadmap for Local Governments (CSE)
  - http://energycenter.org/zne
- Bacon Street Offices: *ARCHITECTS hannah gabriel wells* (New Buildings Inst.)
  - http://newbuildings.org/wp-content/uploads/2015/12/ZNE_ProjectBrief_BaconStreet.pdf
  - Google: "bacon street offices case study"
- CSE Benchmarking Coach (CSE)
  - benchmarking@energycenter.org or (858) 244-4849
  - For owners & operators of commercial, multi-fam, & public buildings in San Diego County
  - No-cost technical support for benchmarking in ENERGY STAR Portfolio Manager

Solar PV for Businesses

Getting Started with Solar PV

Laura Williams,
CSI Commercial Solar Project Manager

SDGE A Sempra Energy utility

Center for Sustainable Energy™

City of Chula Vista

CSE Disclaimer

- Workshops are provided as a public service with the understanding that the Center for Sustainable Energy makes no warranties, either expressed or implied, concerning the accuracy, completeness, reliability, or suitability of the information.

- **The Center for Sustainable Energy does not endorse any particular product, manufacturer or service** mentioned and does not represent that any goods or services are fit for any purpose or use.

- Along the same lines, this is an informational workshop designed for homeowners. **If you are in the energy efficiency or solar market, please refrain from pitching your products or services in this workshop.**

GO solar CALIFORNIA

California Solar Initiative

Current Status

Achieved **98.7MW, 19.2 MW reserved**
commercial solar systems currently installed

Waitlist **10.398 MW** on the Waitlist ($5,512,431)
Waitlist closed 5/9/2016

Goal **96 MW**
of solar photovoltaic installed

GO solar CALIFORNIA

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

Chula Vista Solar PV Installations

- 17 Elementary, Middle and High Schools
- Southwestern Community College
- City of Chula Vista
  - Loma Verde Recreation Center, Civic Center, Animal Shelter, Heritage Park, Veterans Park, Salt Creek Recreation Facility, Otay Recreation Center, Norman Park Center, Montevalle Park
- 10.981 MW Nonresidential
- 2.699 MW Residential

SDGE A Sempra Energy utility™ Center for Sustainable Energy™ CITY OF CHULA VISTA

What's a Watt?

1 Light Bulb

= **100 Watts (W)**

10 Light Bulbs

= **1,000 Watts (W)**

or

1Kilowatt (kW)

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

If you keep10 bulbs turned on for 1 hour…

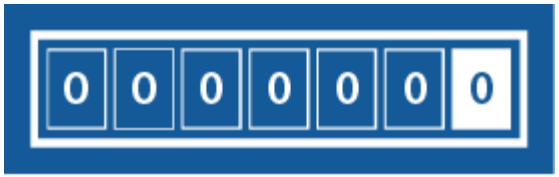
1 Kilowatt-hour (kWh)

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

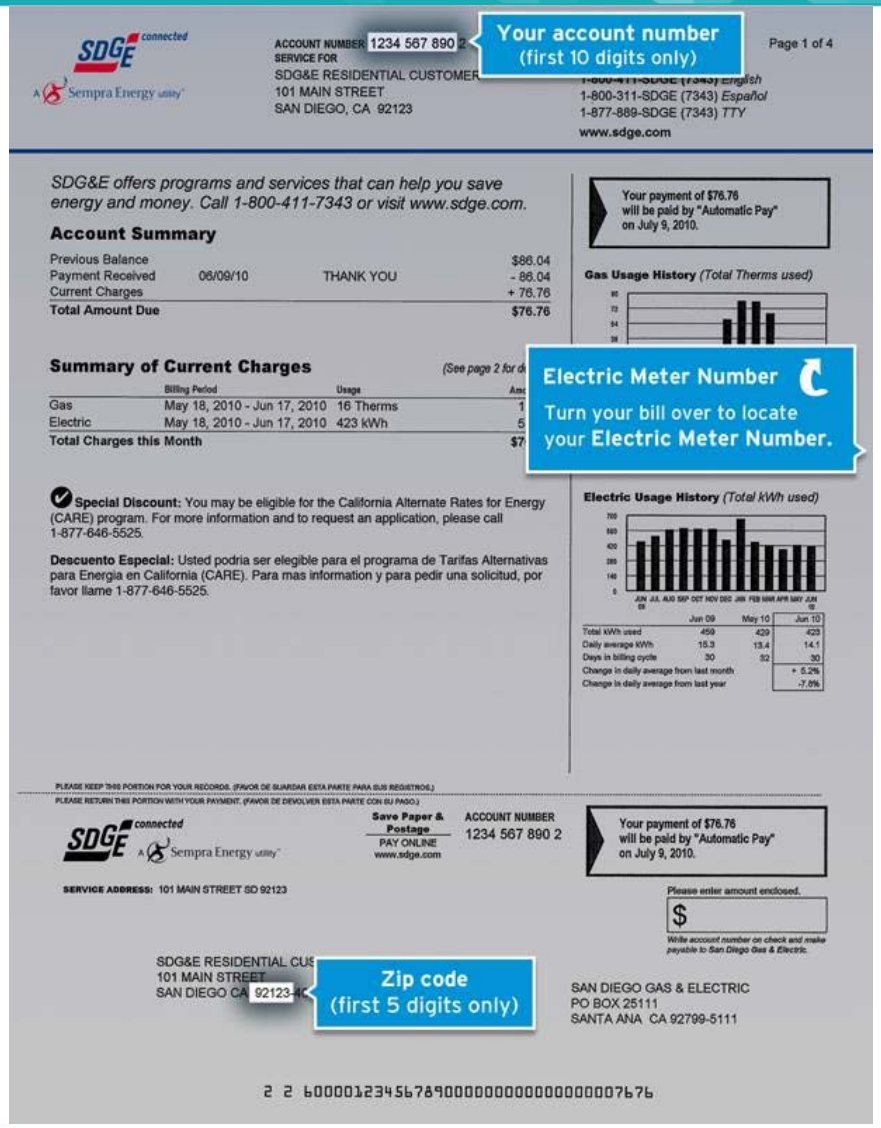
Measuring Electricity



- **kW**: unit of *power*
  - Power is the **rate** at which electricity is generated or used
- **kWh:** unit of *energy*
  - Energy is a measure of **how much** electricity over a specific period of time

Watts your electricity use?

Know your energy use before contacting contractors.



Determining your electricity usage

L20

	A	B	C	D	E	F	G	I	J	K	AI	AJ	Total Cons
1	Bill Date	Account #	Meter #	Type	Name	Address 1	Address 2	Cons End Date	Billing Days	Rate Cod	Other $	Total Bill $	
2	Feb-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	2/14/2011	32	DR	5.16	176.49	1007
3	Mar-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	3/16/2011	30	DR	5.29	190.09	1034
4	Apr-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	4/14/2011	29	DR	5.03	177.23	976
5	May-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	5/16/2011	32	DR	4.75	174.54	919
6	Jun-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	6/15/2011	30	DR	4.47	193.84	871
7	Jul-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	7/15/2011	30	DR	5.45	250.85	1055
8	Aug-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	8/15/2011	31	DR	5.21	232.9	1005
9	Sep-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	9/14/2011	30	DR	5.18	233.61	996
10	Oct-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	10/13/2011	29	DR	4.66	207.41	901
11	Nov-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	11/11/2011	29	DR	4.51	177.3	872
12	Dec-11	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	12/13/2011	32	DR	4.83	157.01	934
13	Jan-12	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	1/13/2012	31	DR	4.54	143.1	873
14	Feb-12	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	2/13/2012	31	DR	5.38	178.94	1024
15	Mar-12	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	3/14/2012	30	DR	4.09	121.66	777
16	Apr-12	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	4/13/2012	30	DR	4.43	136.27	838
17	May-12	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	5/14/2012	31	DR	4.86	169.22	924
18	Jun-12	123456789	9876543	E	John Doe	56476 Moonrock Rd.	SAN DIEGO	6/13/2012	30	DR	4.69	188.15	894

Sys Size Check | Util History | IC Size Check

Ready

www.energywave.sdge.com

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

Demand (kW) vs. Consumption (kWh)

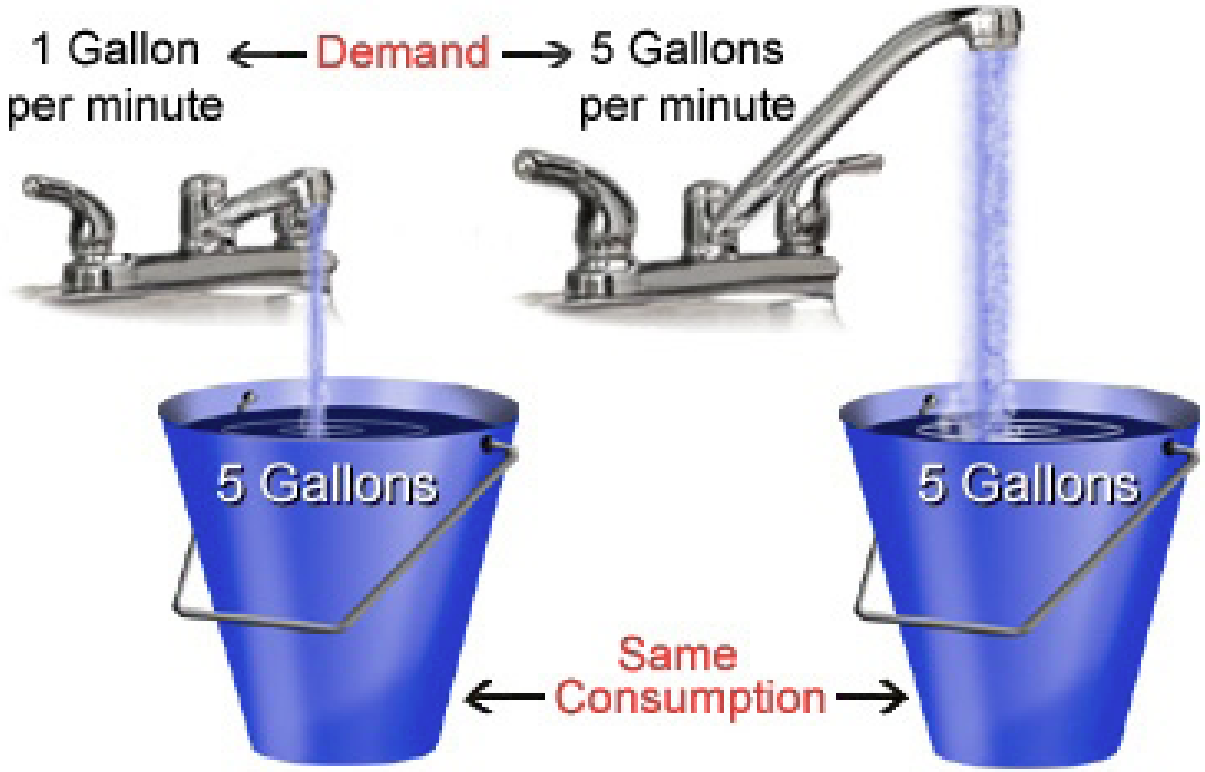
Monthly Energy Charge

Total amount of energy consumed (measured in kWh) in a month

Monthly Demand Charge

Maximum average rate of energy consumed (i.e., Power, measured in kW) over any 15-minute interval that month

Demand (kW) vs. Consumption (kWh)



Energy = Money

Energy Efficiency Improvements

- Free on-site energy audit
- 0% efficiency upgrade financing (On-Bill Financing)

SDG&E Business Energy Savings Center:

1-800-644-6133

www.sdge.com/ways-save

SDGE A Sempra Energy utility™ | Center for Sustainable Energy™ | CITY OF CHULA VISTA

Solar PV Terminology

- **Photo=** light **, voltaic=** produces voltage
- **DC:** Direct Current (produced by solar panels)
- **AC:** Alternating Current (used in the home)
- **Efficiency:** Measure of how much of the sunlight is converted to electricity (%)
- **Capacity:** Total amount of power that a system produces

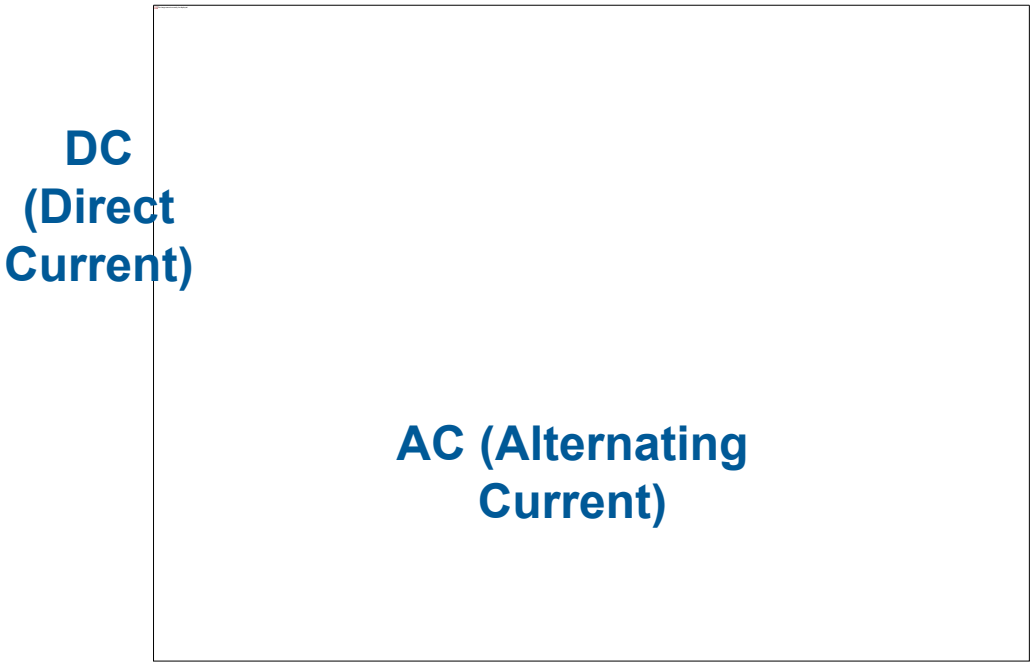
How does solar PV work?

PV Terminology

Solar is not just for rooftops

Inverters

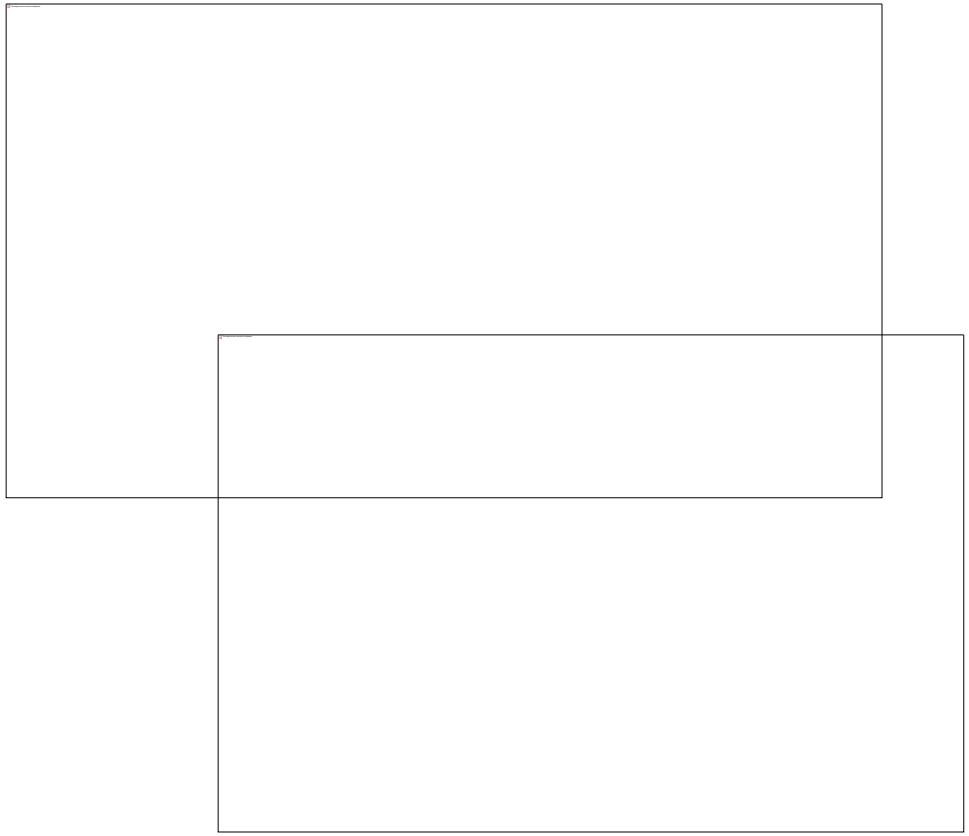
Inverters change DC electricity from panels to AC electricity for use in your business



Inverter

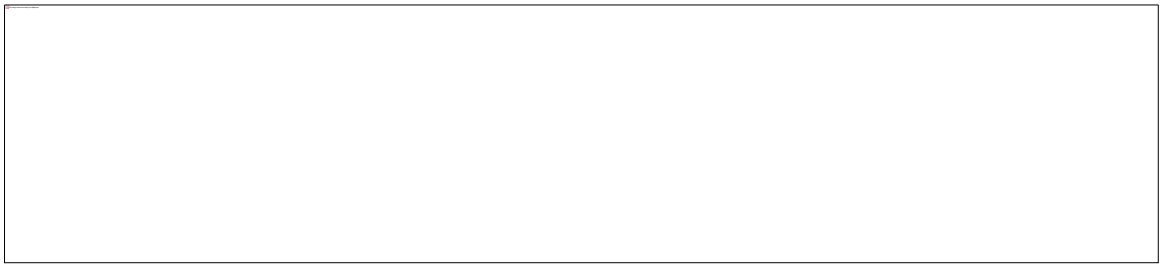
Central Inverters

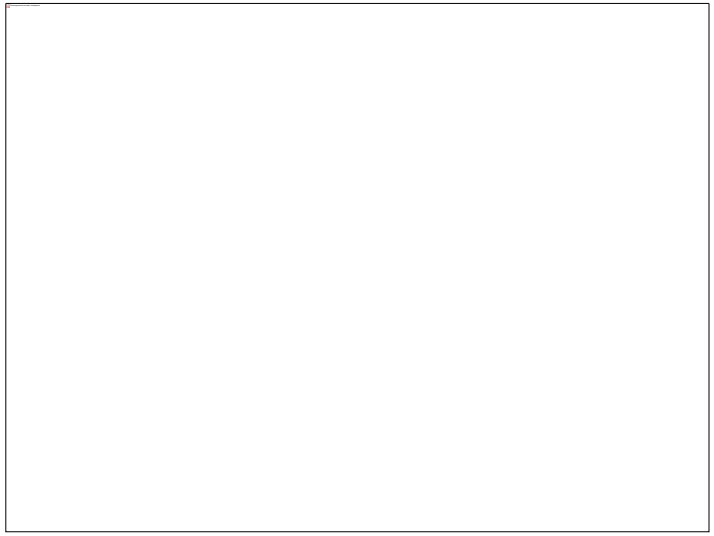
One individual inverter per array.



Micro Inverters

One individual inverter per panel.





System Performance Monitoring

Micro Inverters

Display

Monitoring &
Management

What is Net Metering?

The California Solar Surplus Act

- AB 920 requires the utility to purchase over generation by net metered utility customers.
- Purchase price is ≈$0.04/ kWh
- If you offset more then 100% of you kWh usage, you will receive a minimum charge on your SDG&E bill.

Changes to Net Energy Metering

www.SDGE.com

NEM 2.0

- 1 MW limit eliminated
  - Equipment warranty for system greater than 1kW will be processed according to Rule 21
- Interconnection fee
- Increased assessment of non-bypassable charges (NBCs)
  - Public Purpose Program Charge
  - Nuclear Decommissioning Charge
  - Competition Transition Charge
  - Department of Water Resources Bond Charges

System Sizing

12 month electricity consumption (kWh) / **1,700 kWh (average annual production of 1 kW in San Diego)** = **# of kW that would offset your energy use**

Remember: this will offset 100% of your annual energy use

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

CSE's Commercial Rate Analyzer

www.energycenter.org/california-solar-initiative/business/rate-analyzer

CSE's Commercial Rate Analyzer (continued)

www.energycenter.org/california-solar-initiative/business/rate-analyzer

CSE's Commercial Rate Analyzer (continued)

www.energycenter.org/california-solar-initiative/business/rate-analyzer

Solar and Demand Charges

- Possible to reduce Demand Charges *if* peak energy demand occurs during peak solar production

- Warning: If solar production is reduced (i.e. clouds) for more than 15-minutes than Demand Charges may spike up to pre-solar levels

Virtual Net Metering

Net Metering Aggregation

Net Metering Aggregation (NEM-AG) allows for generation from one or more systems to be shared with many meters.

- The meters and parcels must be solely owned, leased, or rented by the NEM-AG customer.
- The parcels must be the same, adjacent or contiguous.

How much does solar cost?

$3 - $5 / Watt (AC) **X** **Your system size** **=** **Approximate Cost**

(Average cost of commercial PV System)

(in kilowatts)

- Federal Tax Credit

Federal Tax Credit

- 30% of the total system cost
- One-time credit, but may be carried over
- 30% is available through December 31, 2019
- 26% in 2020, 22% in 2021, 10% 2022-

Talk to your tax professional!

Purchase Options

- Cash Purchase

- Clean Energy Financing
  - www.energycenter.org/financing

PACE Loan Program

Loans financed through your annual property tax

- Fund energy efficiency, water efficiency and renewable energy projects with little or no up-front costs.
- Residential and commercial property owners within a participating district can finance up to 100% of their project and pay it back over time as a voluntary property tax assessment through their existing property tax bill.

Third Party Options

- Lease
  - Fixed $ per Month
  - May be pre-paid or monthly
- Power Purchase Agreement (PPA)
  - Fixed $ per kWh produced by system
  - Customer buys ***all*** power produced by system

Finding Contractors

- Find solar contractors:
  - Referrals from friends, family, neighbors, other business owners
  - www.californiasolarstatistics.ca.gov*
  - www.gosolarcalifornia.ca.gov
- Contact a minimum of 3 contractors and ask for quotes

One of the following active licenses is required:

A – General Engineering Contractor

C10 – Electrical Contractor

C46 – Solar Contractor

What to Look for in a Contract

1. Installer and Host Customer Information
2. System Size-DC Rating
   - Manufacturer's rating of the module's ideal output
3. Make/Model/Quantity of Panels and Inverters
4. Warranty Language
5. Work Schedule/Description of Work
6. Price/Payment Schedule
7. Know all Parties Involved

Make/Model/Quantity of Panels and Inverters

A clear description of the system components is shown below:

12kW DC
Modules: SolarWorld 280 (43 SW 280 Mono)
Inverters: SMA America (2 SB6000US 208V)

$0 Installation Cost	14.20¢ electricity rate per kWh	20 years agreement term

Our Responsibilities

- Maintain the system and ensure smooth operation
- Provide a warranty against leaks
- Access to 24 hour information system production

Things to Consider

- Is your business as energy efficient as possible?
- Do you have space for panels? Roof, parking lot, land, etc.
- Will you have shading on your roof?
- Talk to your business insurance company before adding solar to your business.
- If you rent your building, do you have permission from your landlord or property manager?

Clean Energy Assessment

Find out which clean energy technologies may be right for your facility.

www.energycenter.org/assessment

SDGE A Sempra Energy utility™

Center for Sustainable Energy™

CITY OF CHULA VISTA

Energy Advisory Services

Integrating emerging and innovative clean energy technologies.

www.energycenter.org/consulting

Online Resources

- www.energycenter.org – CSE Website
- http://www.sdge.com/good4biz/ – SDG&E Energy Savings Solutions
- www.gosolarcalifornia.ca.gov – CPUC and CEC
- www.cslb.ca.gov – Contractor State License Board
- www.bbb.org – Better Business Bureau
- www.yelp.com - Customer Reviews
- www.californiasolarstatistics.com – CSI Program Data
- www.sdge.com/clean-energy/apply-nem/apply-nem-business - SDG&E NEM

Center for Sustainable Energy™

Laura Williams

Laura.Williams@energycenter.org

(858) 737-1586

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

Introduction to Advanced Energy Storage (AES)

Store your Power

Jonathan Hart and Andrea Woodall,
SGIP Project Associates

Center for Sustainable Energy™

Jonathan Hart

Jonathan.hart@energycenter.org

Andrea Woodall

Andrea.woodall@energycenter.org

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

Technology Overview

What is Energy Storage?

- Energy Storage is a technology that is capable of absorbing energy, storing it for a period of time, and discharging the energy at a later time

- This can be accomplished via chemical, thermal, or mechanical processes

Electrochemical Energy Storage (Batteries)

Customer-Sited Use Cases and Benefits

Primary Use Cases

- Demand Charge Reduction
  - Reduce monthly demand charges by offsetting peak demand
- Time of use energy arbitrage
  - Shift on-peak energy usage to off-peak
- Can be used in “Zero Net Energy” applications

Stand-Alone Energy Storage

Stand-Alone Energy Storage

Center for Sustainable Energy™

CITY OF CHULA VISTA

Stand-Alone Storage

Storage Integrated with Solar PV

Storage Integrated with Solar PV

Storage Integrated with Solar PV

Storage Integrated with Solar PV

Thermal Energy Storage

Thermal Energy Storage Example

- Uses electricity at night to ‘charge’ (create ice)
- Ice melts and cools air, providing cool air for buildings
- Compressor on HVAC unit turns off, saves energy

Self-Generation Incentive Program

Self-Generation Incentive Program (SGIP)

- The SGIP provides incentives to promote the installation of clean and efficient distributed generation and storage technologies installed on the customer's side of the utility meter
- Ratepayer funded and overseen by the CPUC
- Available to utility customers of SDG&E, SCE, PG&E, SoCal Gas
- Recently reauthorized with administration through 2020

SGIP Goals

GHG

reduction

RELIABILITY

improved transmission and distribution

PEAK DEMAND

reduction

MARKET

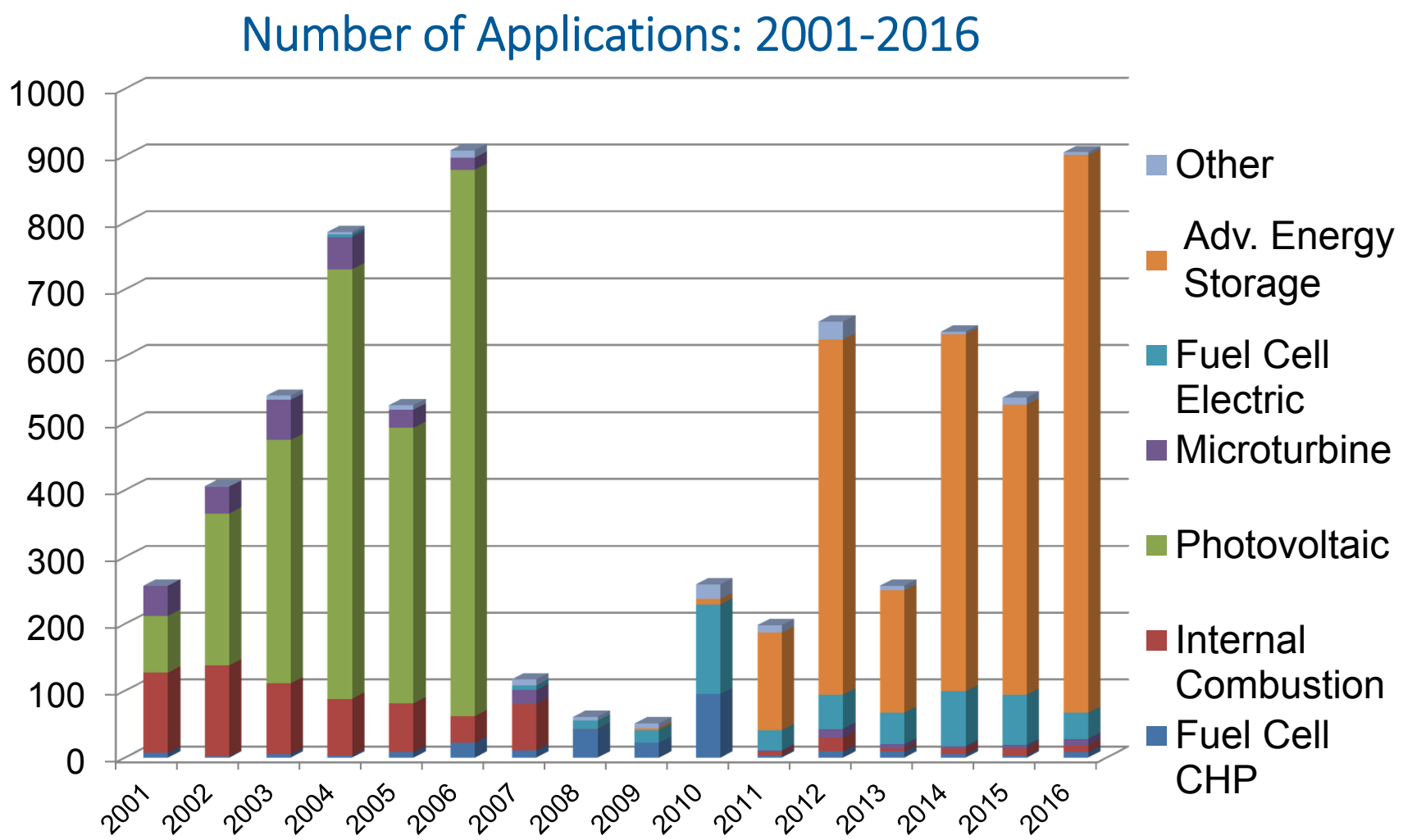
transformation

SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

SGIP has evolved over time



SDGE A Sempra Energy utility

Center for Sustainable Energy™

CITY OF CHULA VISTA

Current Program Status and Pending Modifications

- Historically, demand has far outweighed incentive availability for energy storage. The proposed modifications are intended to resolve this issue.

- The CPUC recently proposed program modifications include:
  - Incentive rates and structures
  - Budget allocation (75% storage)
  - Eligibility requirements for the different technologies

- The program will open soon!

Major Takeaways

- Energy storage can help you lower your utility bill by reducing your demand charges
- Rebates are available to help offset the cost of installing a storage system at your home or business
- More information can be found at www.energycenter.org/sgip

Center for Sustainable Energy™

CITY OF CHULA VISTA

THANK YOU!!!

Center for Sustainable Energy Expert Panel Q&A

- **Laura Williams**, California Solar Initiative Nonresidential Project Manager
- **Andrea (Andi) Woodall**, Self Generation Incentive Program Project Associate
- **Jonathan (Jon) Hart**, Self Generation Incentive Program Project Associate

SDGE A Sempra Energy utility™ | Center for Sustainable Energy™ | CITY OF CHULA VISTA