Presentation 5: Roadmap to a Sustainable San Diego

Presented By

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What solutions can be implemented that will lead San Diego and Northern Baja to be 100% reliant on renewable energy and sustainably consume water?

Current State

Preferred State

Dreamstime; Colourtime

Roadmap to Renewable Energy

Large-Scale Solutions for *San Diego County* & *Northern Baja*

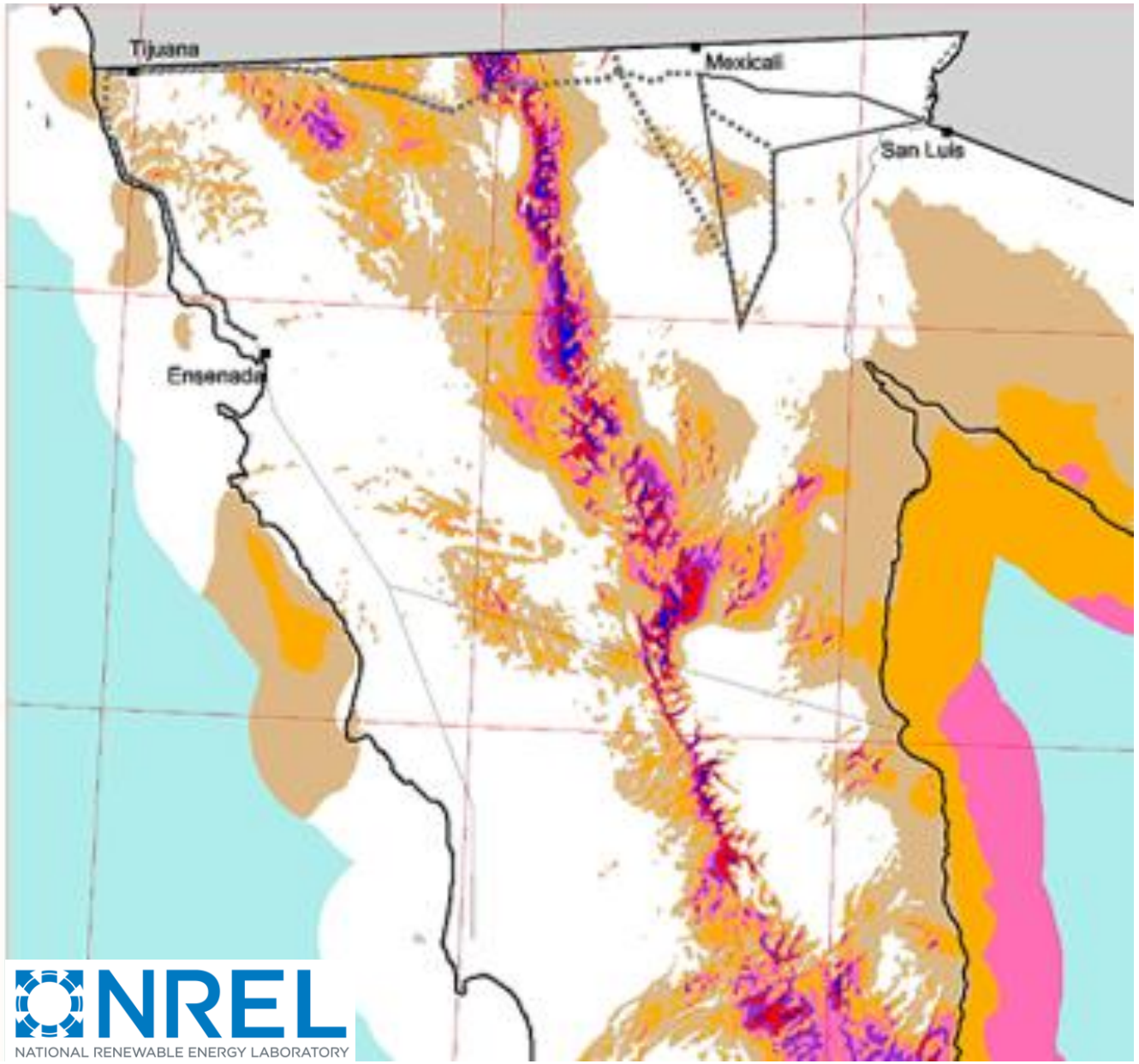
Wind Farm Development

- Companies have already begun to capitalize on areas in San Diego County and Northern Baja with significant wind potential.

- *Cannon Power Group* and *Gamesa Technology Corp.* have announced the development of major wind farms near La Rumorosa.

- This *Aubanel Wind Project* is expected to be **one of the biggest wind farms in North America** with up to 1,000 MW of power capacity.

Cannon Power Group, Inc.



Map of Northern Baja California with wind potential according to wind speed. (see legend)

Poor 0 - 5.6 m/s

Marginal 5.6 – 6.4 m/s

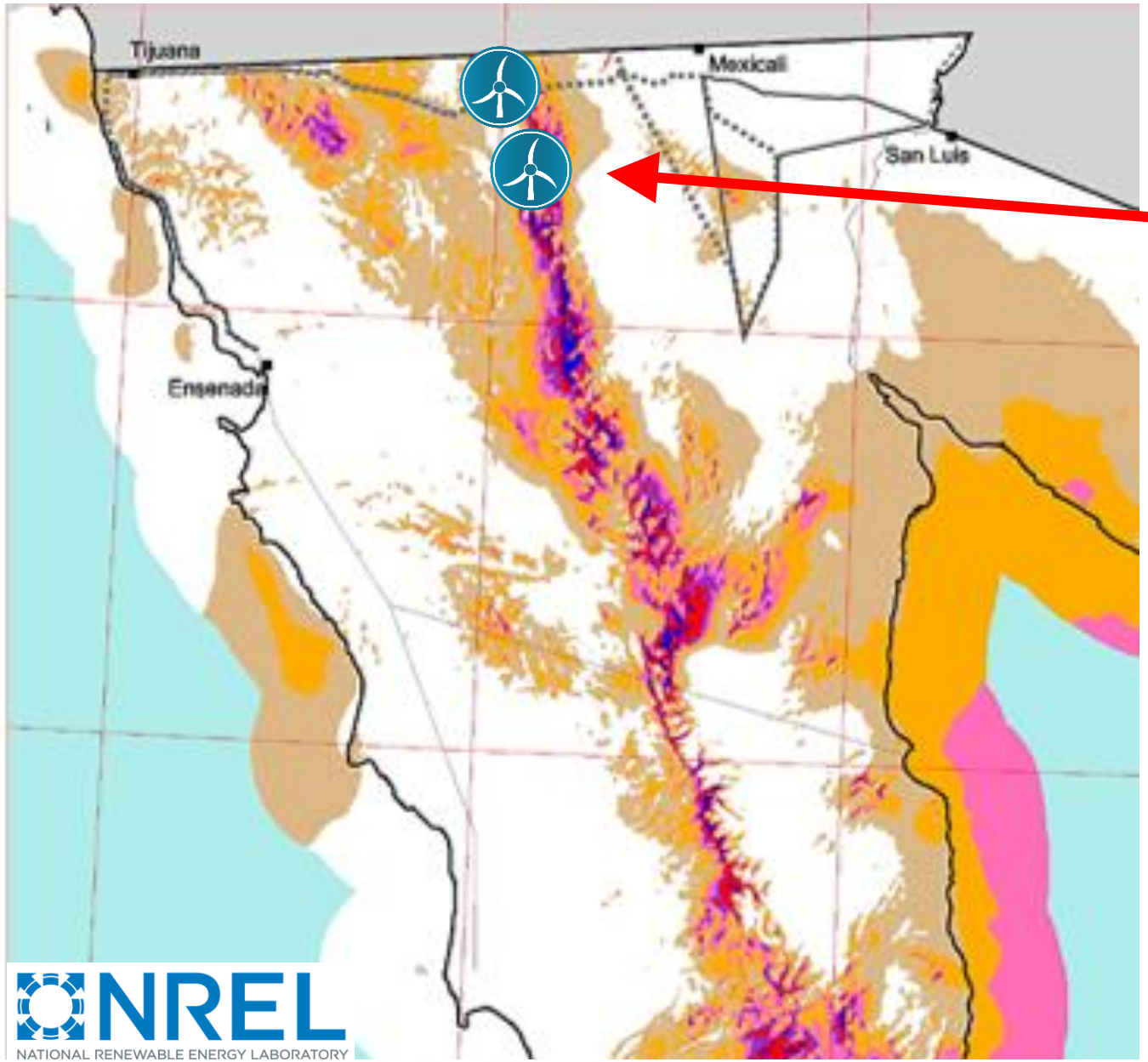
Fair 6.4 – 7.0 m/s

Good 7.0 – 7.5 m/s

Excellent 7.5 – 8.0 m/s

Outstanding 8.0 – 8.8 m/s

Superb < 8.8 m/s



Aubanel Wind Project
(~ 1,000 MW)

- **Poor** 0 - 5.6 m/s
- **Marginal** 5.6 – 6.4 m/s
- **Fair** 6.4 – 7.0 m/s
- **Good** 7.0 – 7.5 m/s
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- **Superb** < 8.8 m/s

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Wind Farm Development

- The Sierra California Mountain Range also has huge potential for wind power where there would be little development.
- **It's time for us as a community to install more of these wind farms to further invest in renewable energy for our future.**

University of Oregon

Solar PV/Solar Thermal Power

- A massive part of CA's growing renewable energy sector can be attributed to Solar Power.
- 200% increase in large-scale installments compared to 2012.

The Desert Sun

Solar PV/Solar Thermal Power

- Much of Southern CA's solar potential is in the east towards the desert.
- However, San Diego County and Northern Baja still have vast untouched regions to expand the solar energy sector.
- These regions alone have enough potential to power all of Southern CA and Northern Mexico.

Ivanpah Solar Thermal Station

PV Solar/Solar Thermal Power

- One Solar PV plant just opened up this past February that covers roughly 4,000 acres, from Riverside County up to Joshua Tree. It supplies enough energy for 160,000 homes.

- U.S. Interior Secretary Sally Jewell attended the opening ceremony, saying **“This is truly the beginning to a renewable energy future.”**

LA Times

PV Solar/Solar Thermal Power

Ivanpah Solar Thermal Station

Solar Energy Generating Systems (SEGS)

- These companies are essentially avoiding high initial costs through the government while they can. The time is now.
- The potential for profit is substantial as the only other expenditures deal with maintenance; **sunlight is free!**

Nationwide Incentives

- The Federal Government will offer up to 30% cost reduction to both residential and commercial solar installations.
- The Obama Administration recently reserved some **22 million acres** in CA alone for renewable projects, primarily for solar.

Independence Renewable Energy

Statewide Incentives

California's Emerging Renewables Program

- Introduced in 1997/1998, this program incentivized people to **adopt cleaner energy** by providing rebates to lessen initial costs of switching to renewables.

- They mostly offer significant discounts for small wind turbines or PV solar panels for buildings, including houses.

Statewide Incentives

Lead By Example

CALIFORNIA ENERGY COMMISSION

- The program was effectively closed in mid-2012 as the renewable energy sector began to gain significant foothold in CA.
- This is an example of a policy that facilitates the **introduction of the renewable energy market.**

Energy Digital

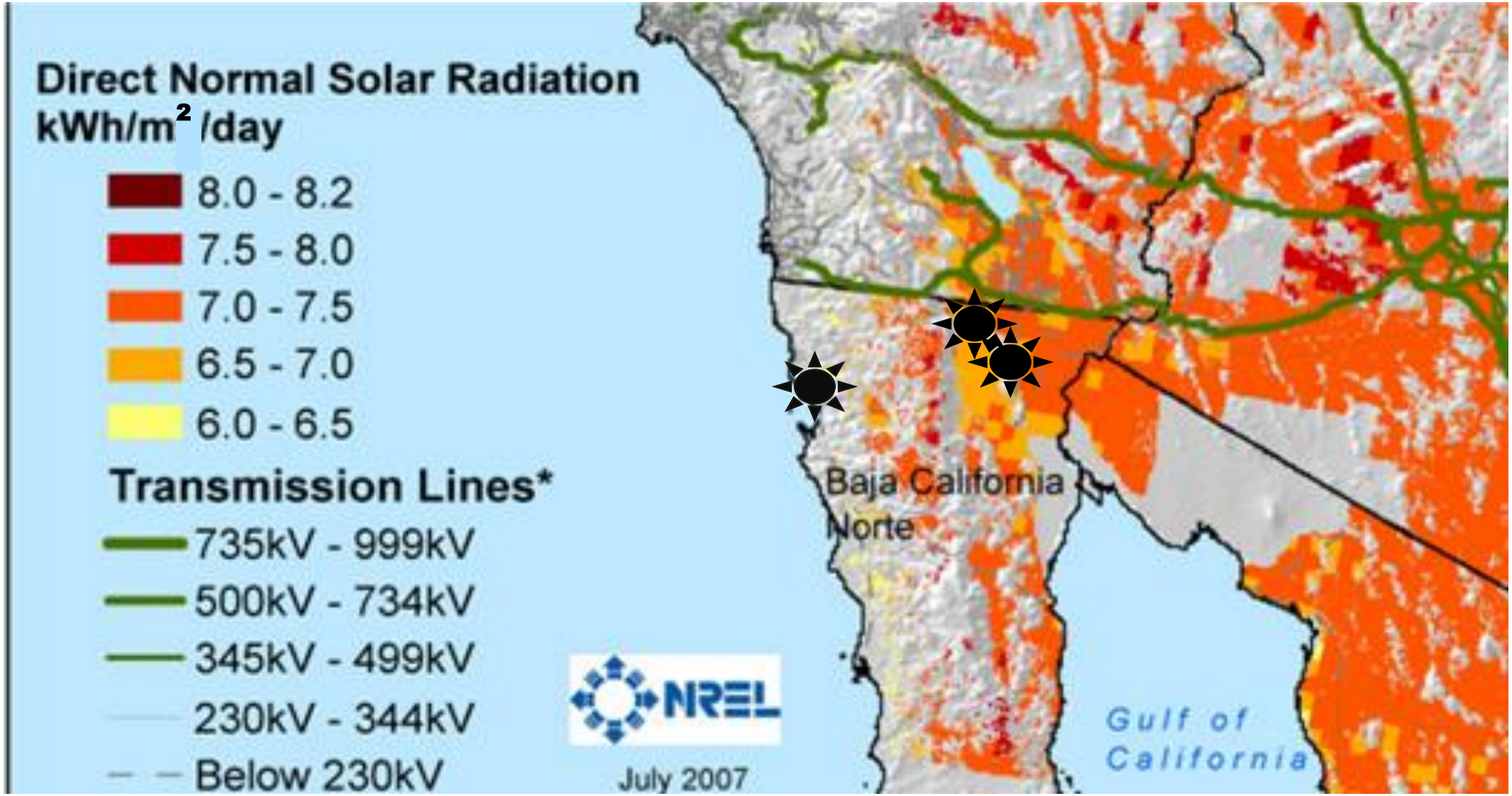
Statewide Incentives

California's Emerging Renewables Program

- This is **not** a policy that would be effective on an already existing market.

- Though, developing regions like Northern Baja could initiate the introduction of a renewable energy sector if they modelled policies much like CA has.

CALIFORNIA ENERGY COMMISSION



Existing Cross-Border Solar Farms

International Cooperation

•Cooperation is a KEY COMPONENT to developing renewables in this region.

•Companies from countries like Spain, South Korea and Israel have played a major part in CA's renewable sector by manufacturing turbines, solar cells, etc.

• Additionally, the lack of regulatory delays in Mexico mean these farms can potentially be constructed much more quickly in Mexico than in CA.

US News

Roadmap to Renewable Energy

Small-Scale Solutions for *San Diego County* & *Northern Baja*

Rooftop Solar

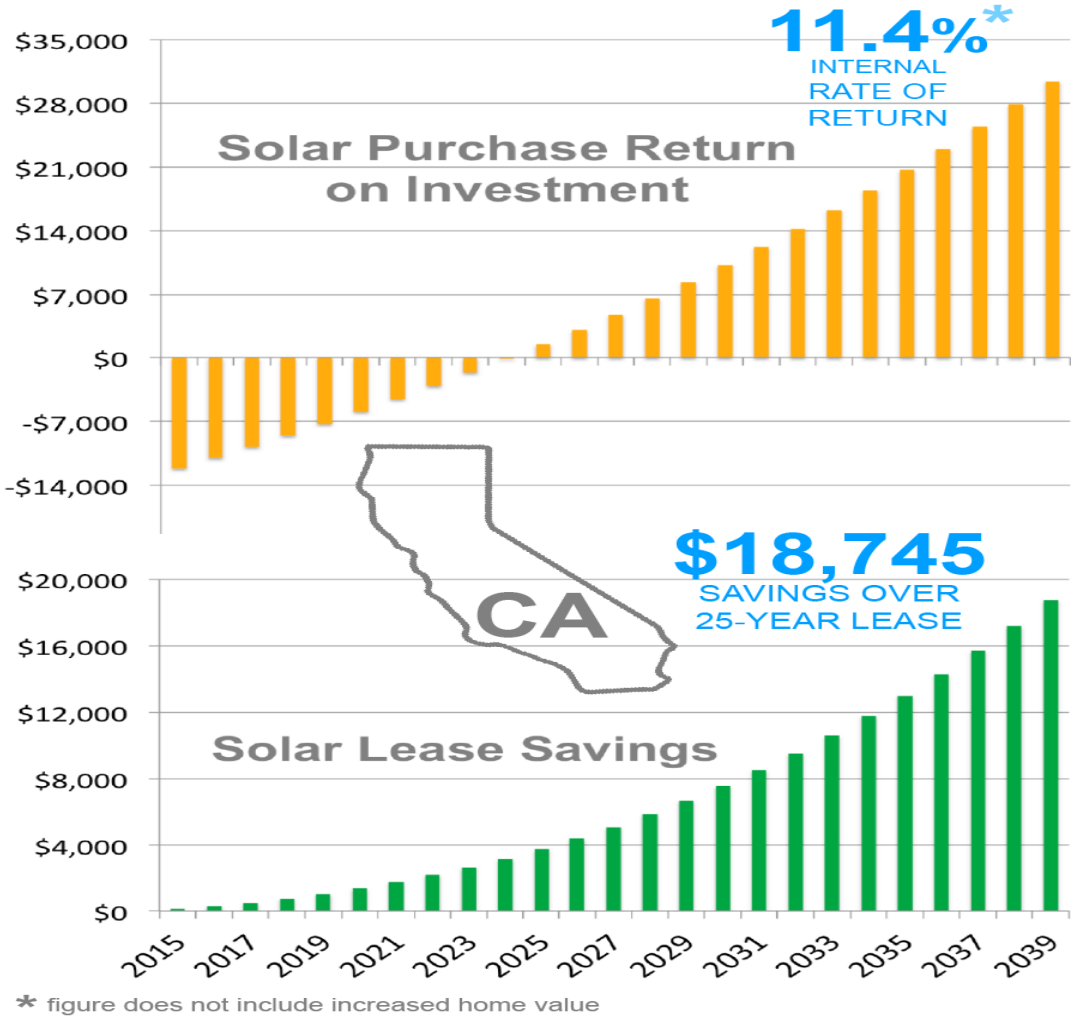
Solution for San Diego

- 6,000 kWh per year on average per 3 person household
- 5 kW system costs on average - $20,000 without incentives and rebates
  - Automatic 30% federal tax credit
  - Other incentives such as LADWP Solar Incentive Program
  - Increased home value
- San Diego averages 5.7 peak-equivalent hours per day
- Payback in 6 - 8 years

UCSD Department of Physics & SDG&E

Ways to spark the installation of rooftop solar

- Many homeowners are complacent and do not research rooftop solar systems
- Data must be made more readily available and easier to understand for an average homeowner



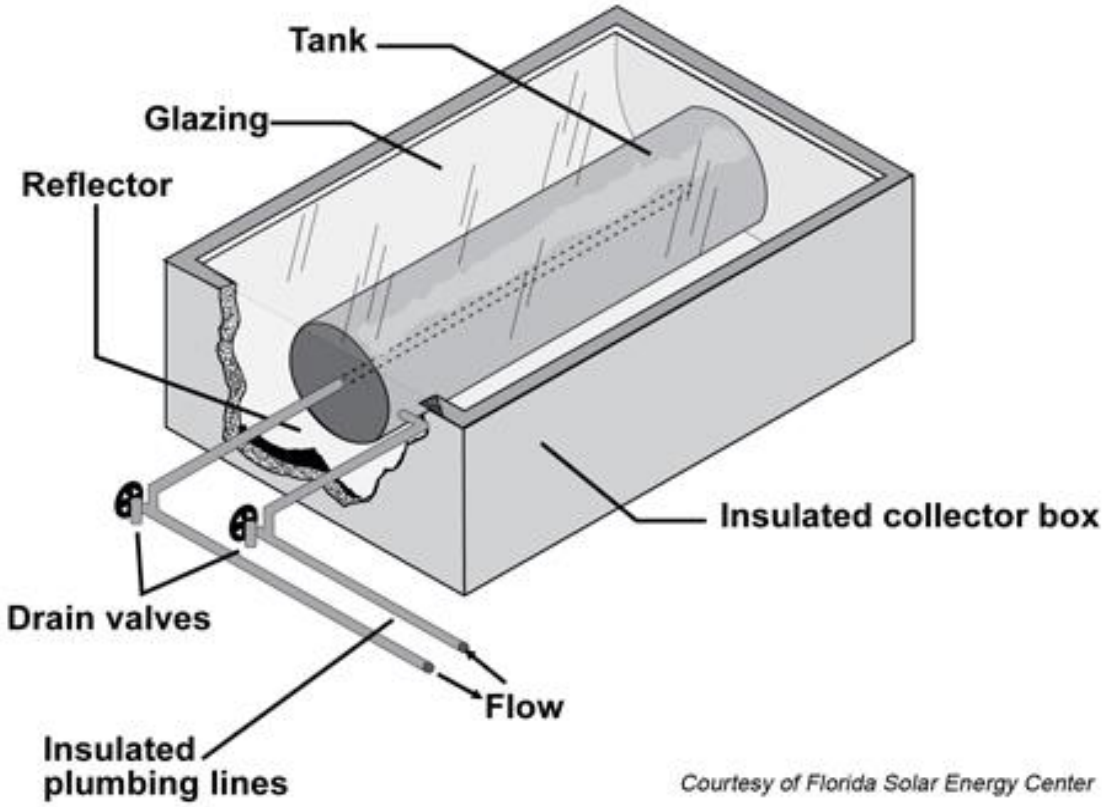
Education

Solar Companies and Government must educate public on reasons to install rooftop solar

- Focus on economic benefits
- Solar companies increase funding toward advertising
- Cooperation between the government, utilities, and solar companies to help fund education programs
- Place importance on capitalizing on policies that are in place now before they change

Simple Rooftop Solar Thermal

Solution for Northern Baja



Courtesy of Florida Solar Energy Center

- Simple Systems cost from $300 to $400 and can often be self-installed
- Educate public on the benefits of cheap solar thermal systems
- Volunteer groups will help start action in Mexico

Household Practices

A large portion of the population does not attend the workshops and conventions available

- Commercials
- Flyers

Increase LED lighting popularity through continued financial incentives for upgrading to LED Lighting

PG&E

	Lighting Type	Lighting Requirement	Available Incentives
LED Lighting	LED MR16 Lamp	Up to 6 Watt	$6 / lamp
		7 to 10 Watt	$11 / lamp
	LED PAR Lamp	Up to 16 Watt	$14 / lamp
		16 to 25 Watt	$20 / lamp
	LED Wet Location Rated Par	17 to 23 Watt	$20 / PAR lamp

Household Practices

Advertise upgrading insulation

- Can save up to 50% on heating and cooling bills for old homes and can cost as little as $600 if self-installed

Educate the public on energy saving tricks

- ✓ Use energy during off-peak hours
- ✓ Heat/cool during nighttime
- ✓ Install smart thermostats
- ✓ Repair leaky ducts
- ✓ Cover bare floors
- ✓ Install window shades
- ✓ Keep freezer full
- ✓ Put water heater on a timer
- ✓ Wash full loads of laundry and dishes

EPA

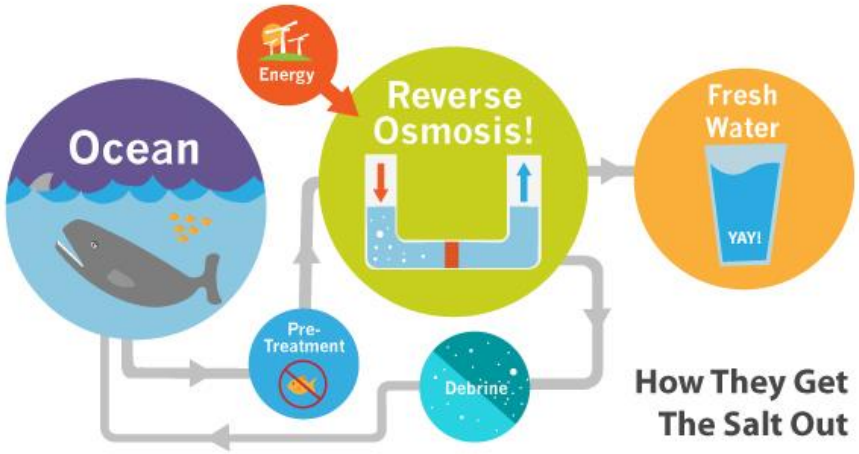
ENERGY STAR

Roadmap to Sustainable Water Consumption

large-scale Solutions for *San Diego County & Northern Baja*

Pivotal Practices

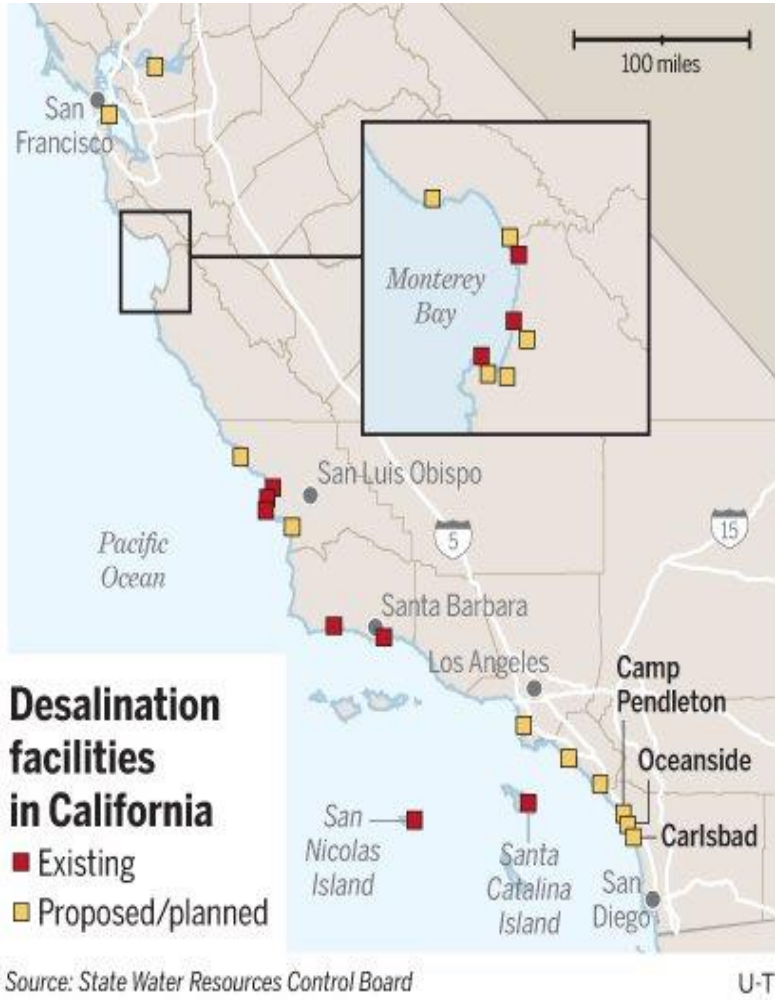
Desalination



Water Recycling

New Innovations

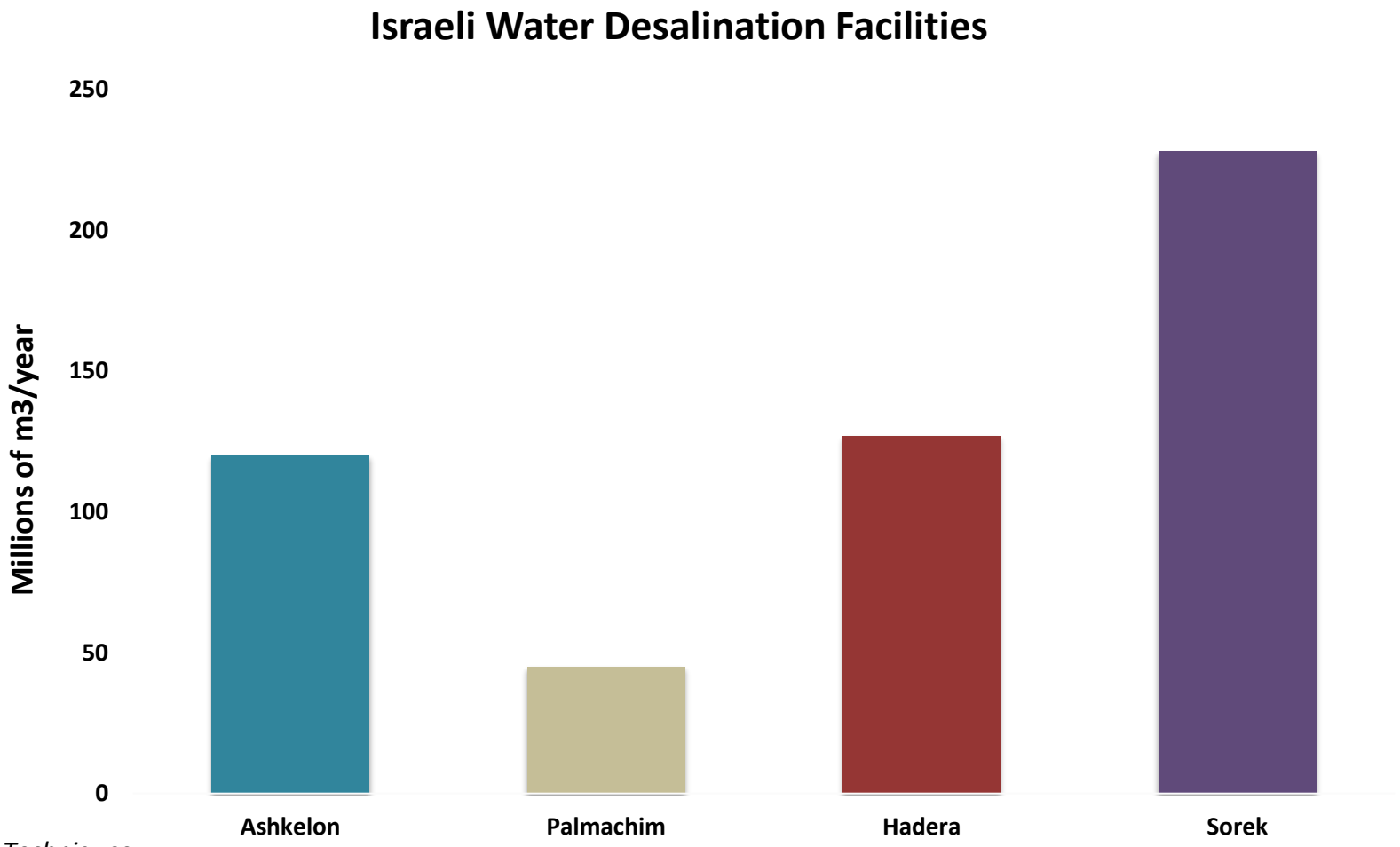
Desalination



- Desalination proven in middle eastern states
- Similarities between climates allow Southern California to model off Israel.
- Carlsbad plant to demonstrate feasibility in California
- Many sites have been proposed

Colombia University

Desalination – On a Large-Scale

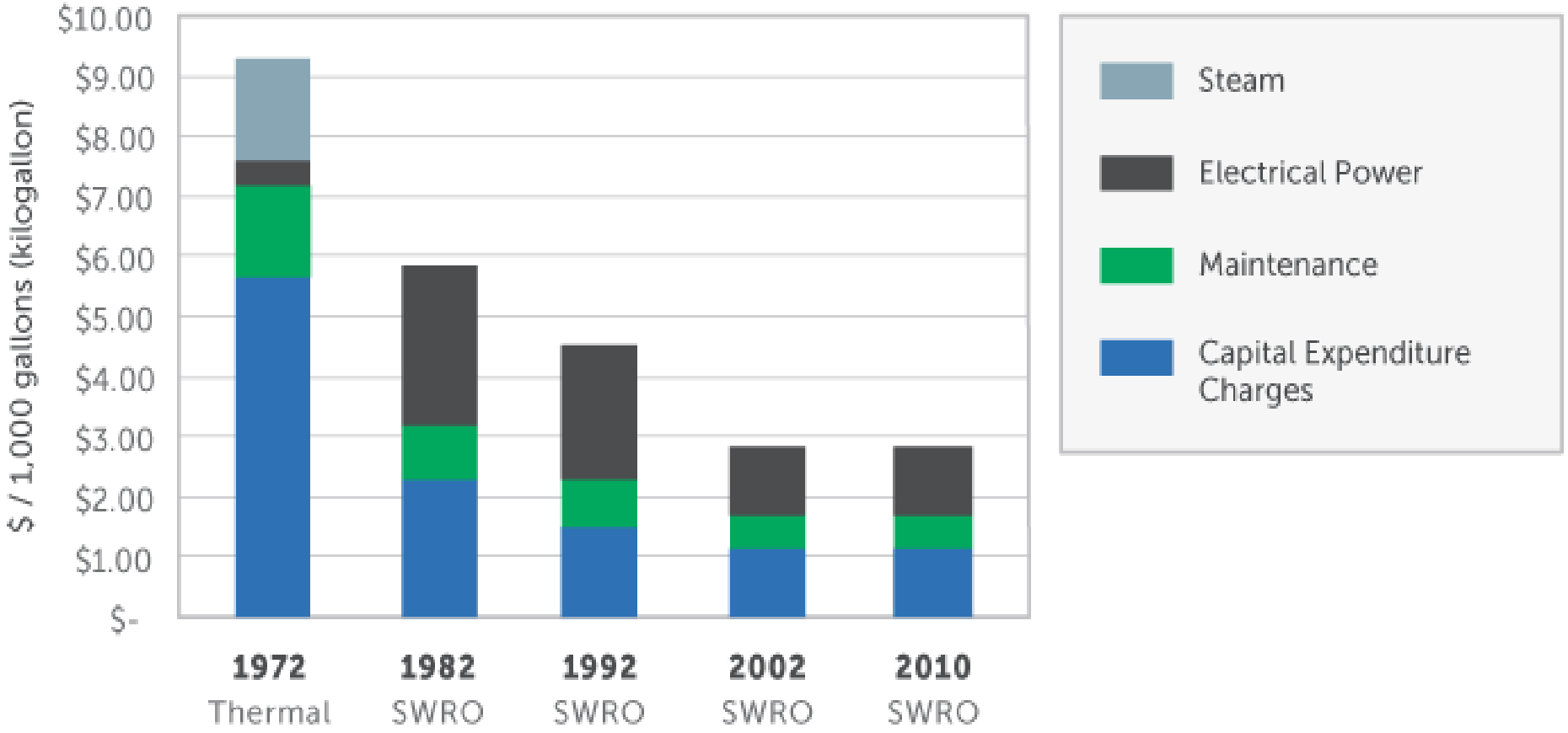


- Desalination currently provides Israel with ~50% of its freshwater
- Plans to reach 70% by 2050

IDE Techniques

Desalination Costs

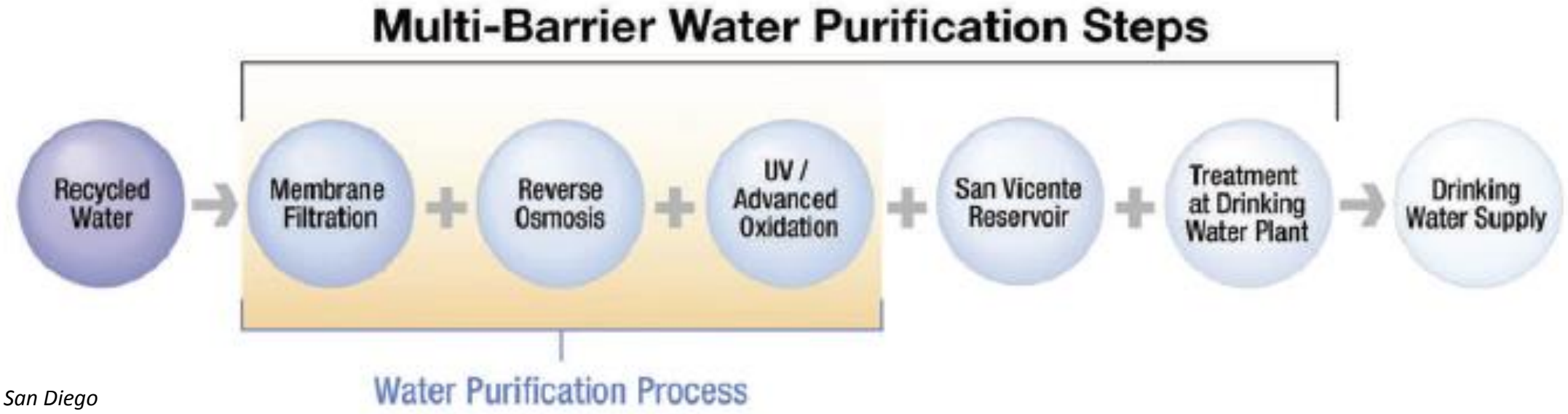
- Prices between 1972 and 2010 dropped by $6 per 1,000 gallons
- Desalination technology is now a mature technology which is well established



Poseidon Water

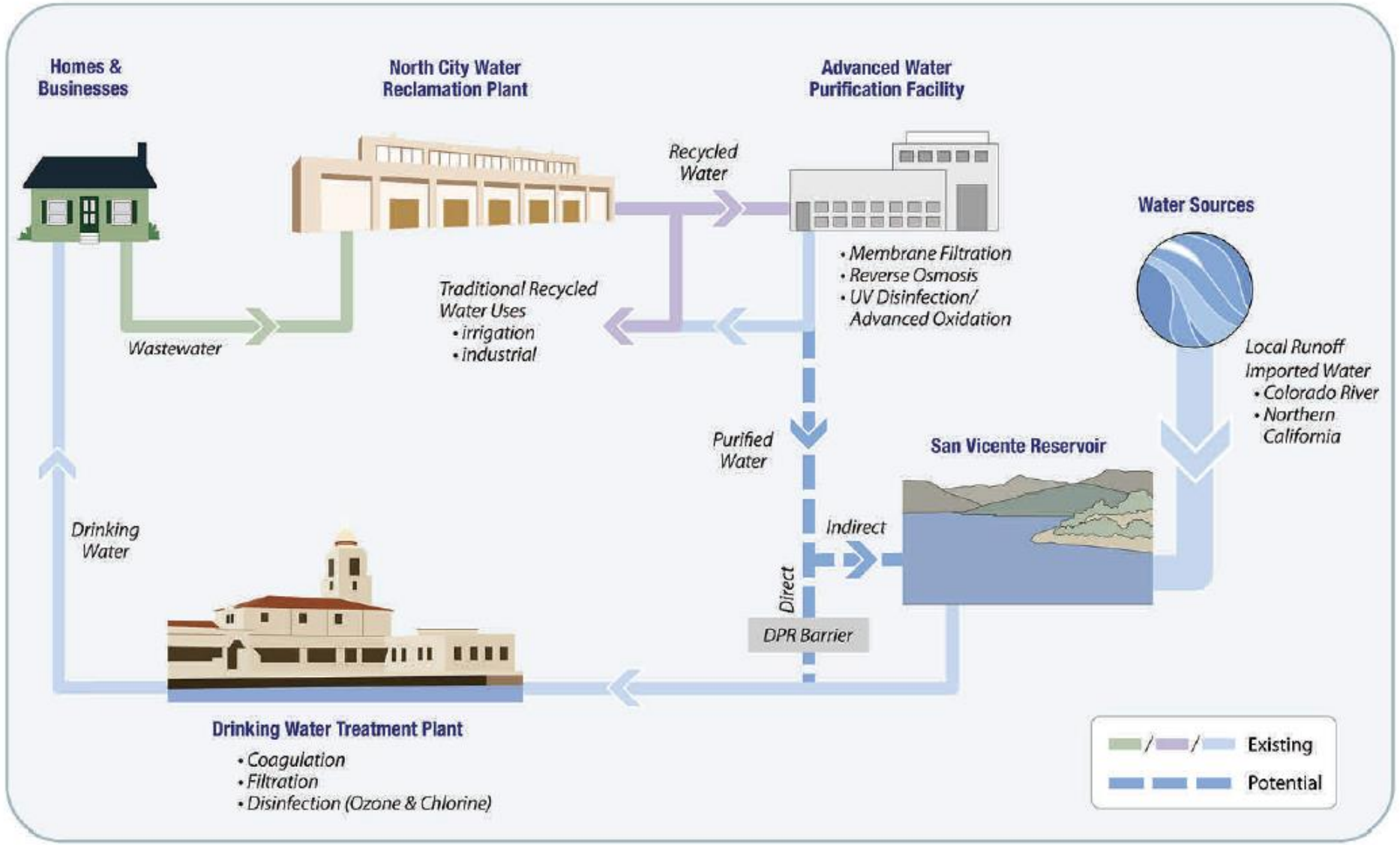
Recycled Water

- Recycled water exceeds potable water standards



Pure Water San Diego

Water Purification Process



Pure Water San Diego

Current Plans Regarding Water Recycling

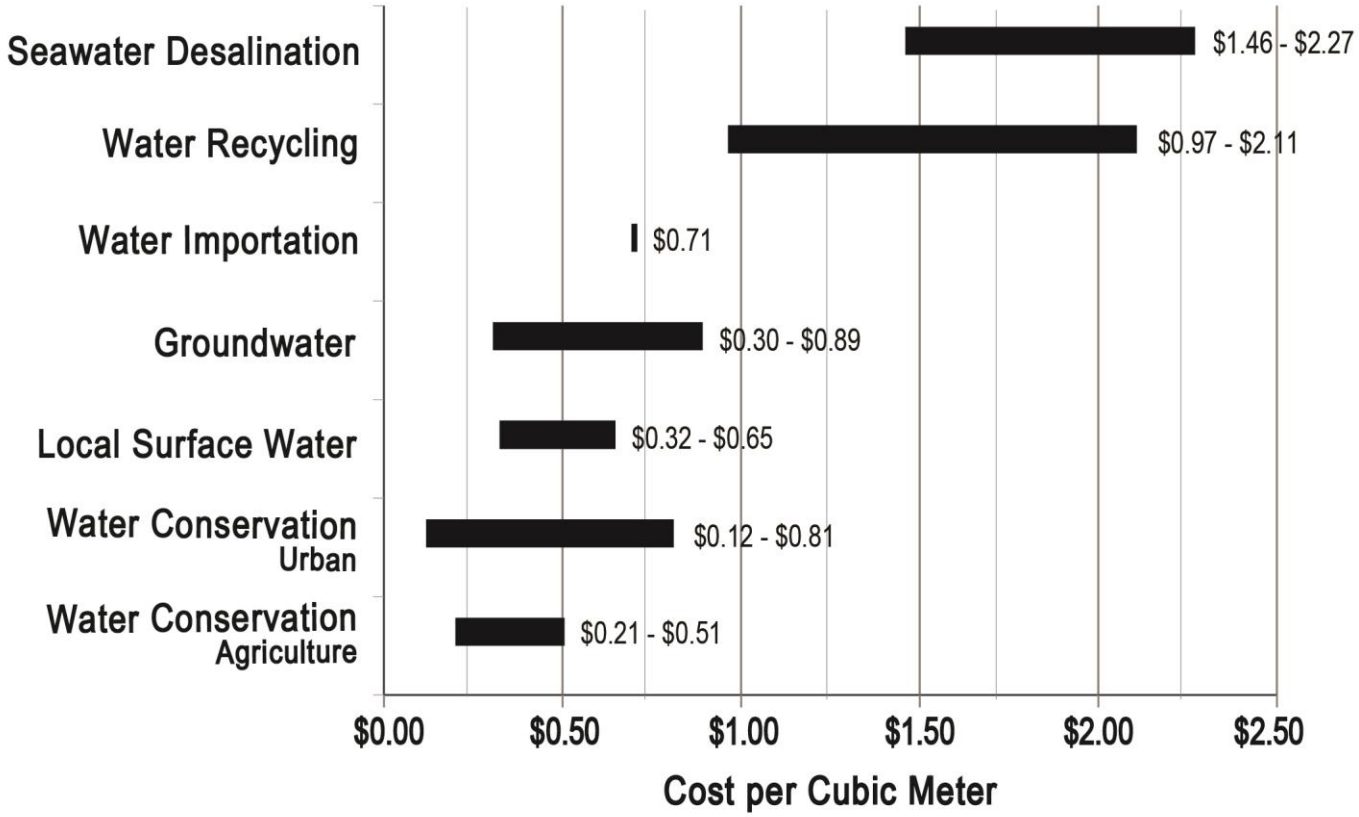
- San Diego recently invested 3.5 billion USD into waste water recycling with plans to provide 1/3 of the cities daily needs using recycled water by 2035. (pure water)
- Saves money on waste water treatment costs and water transportation costs
- It would be efficient to invest money into Pure Water systems which could reduce the need to invest more money into Point Loma which is estimated to require over $2 billion to upgrade

Pure Water San Diego

Water Costs and Energy Use

Recycling is the most economical solution

Methods	Price per acre foot
Metropolitan Water District	~ $900
Recycling	~ $1700
Desalination	~ $2200

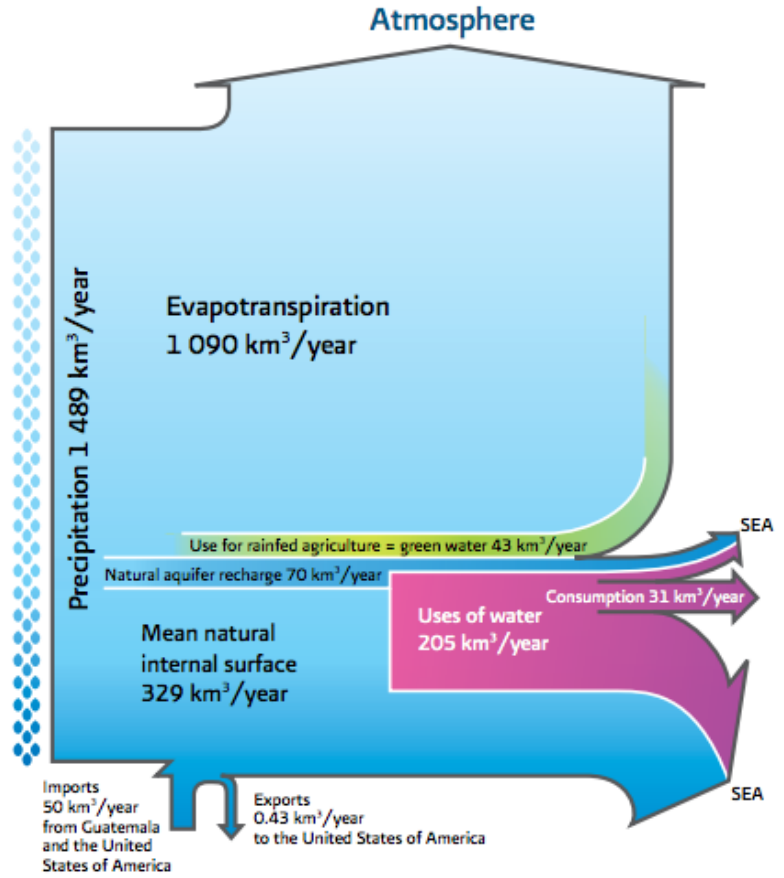


National Geographic

New Innovations

- Natural processes cause massive strains on water supply. Evaporation alone takes up 70% of the water.
- 96 million black plastic balls reduce evaporation by up to 90% in reservoirs.
- Cut costs from initial $300 million to only $34.5 million

G2.1 Mean annual values of the components of the hydrologic cycle in Mexico (billions of cubic meters, km³)



Rain Water Reservoir Storage

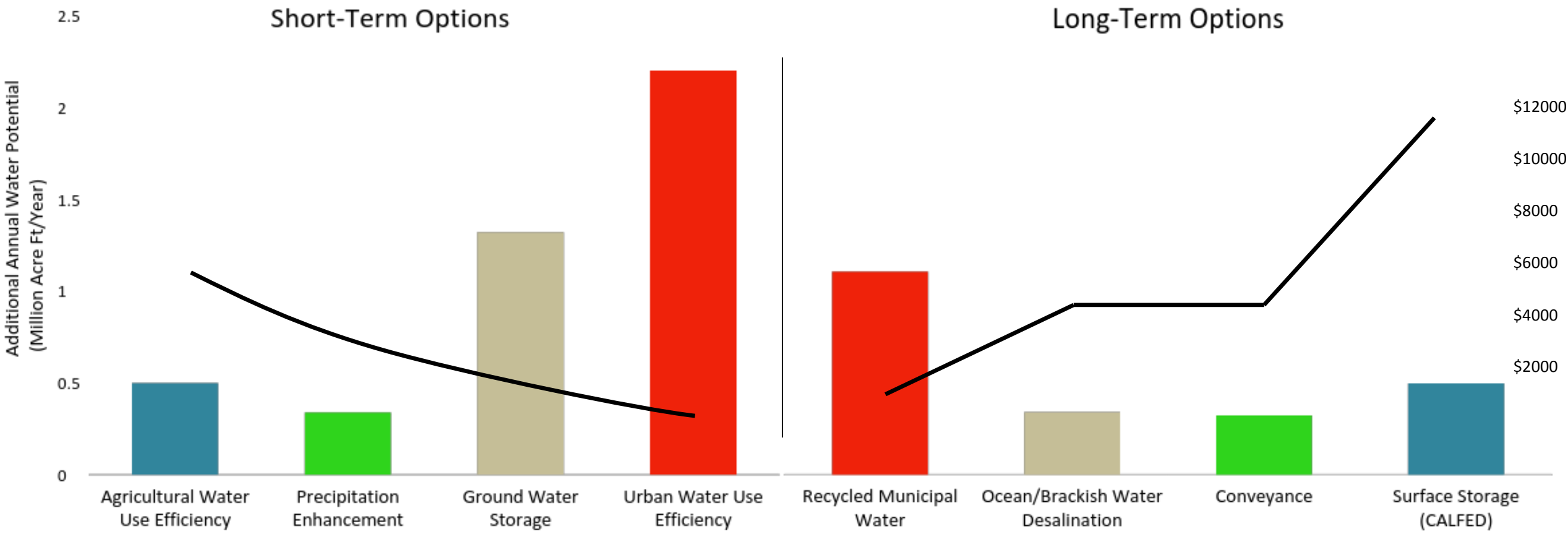
- Rain water will inevitably seep back in to the ocean by flowing down stream
- It is possible to utilize rain water capture pits with an impermeable layer to capture rainfall before it can seep back into the ground.
- If used in conjunction with the black orbs there could be a significant amount of potable water obtainable from rainfall in Baja and SD.

GENI Map using ArcGIS

Roadmap to Sustainable Water Consumption

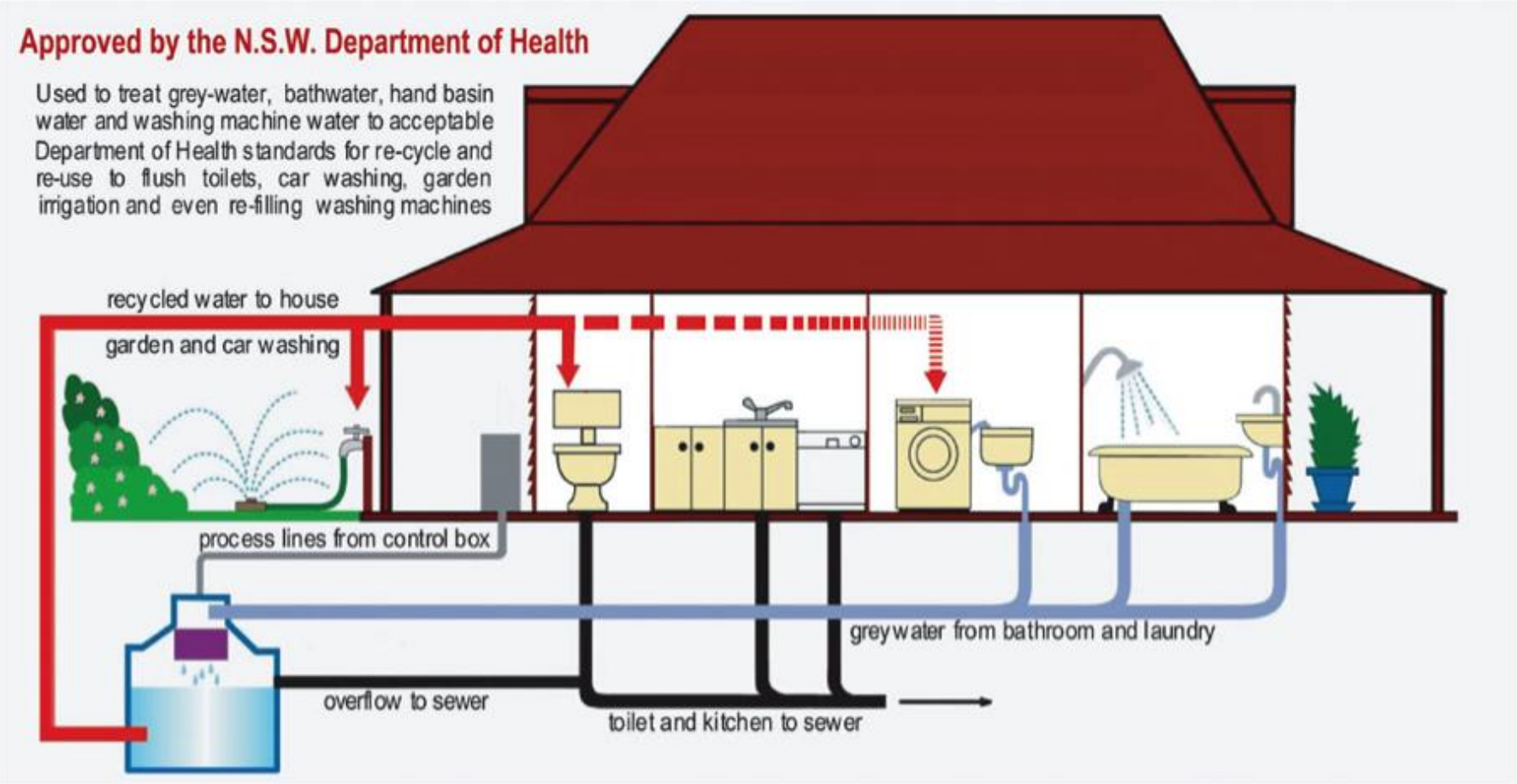
Small-Scale Solutions for *San Diego County & Northern Baja*

Water Solutions



California Coast Keeper Alliance 2009

Household Grey Water System

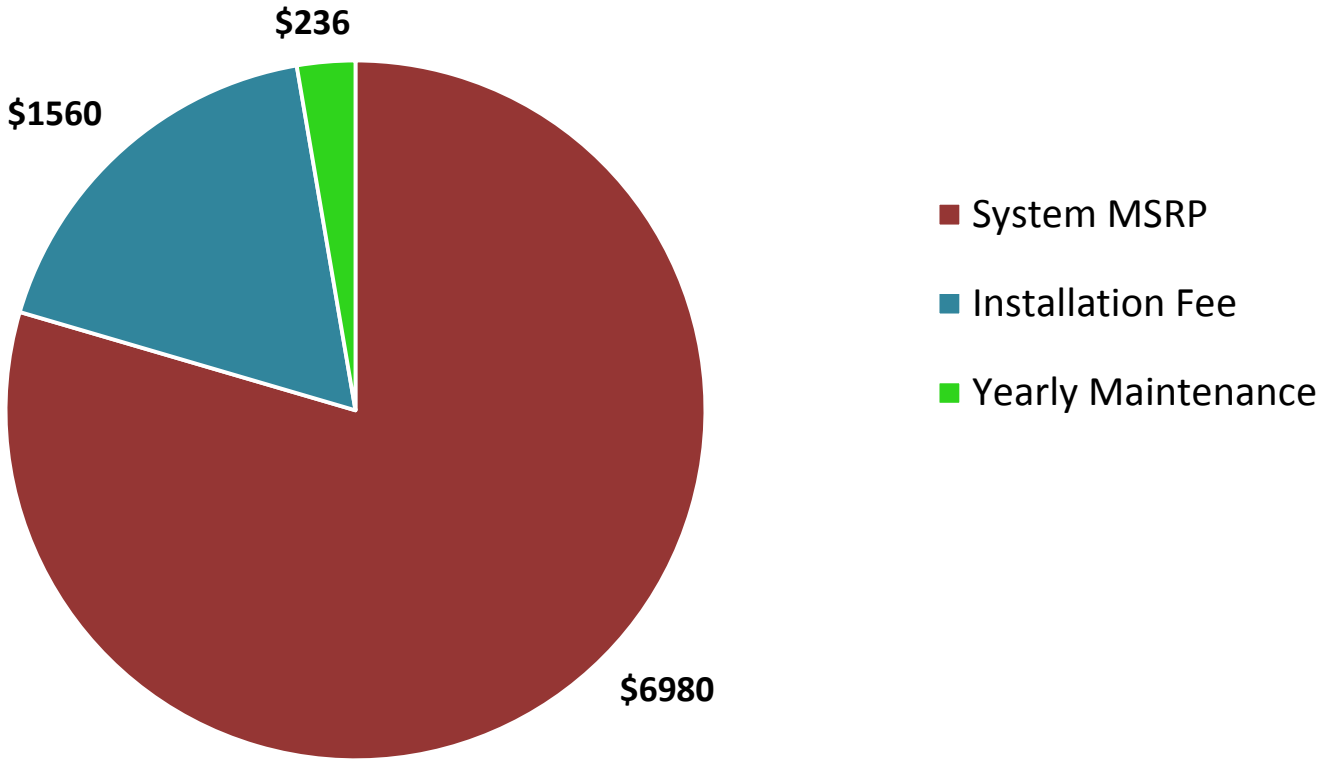


Note: Only lightly polluted water from the shower, bathroom sinks, and laundry machines can be recycled as grey water

Immediate Cost of Grey Water Systems

Drawbacks

- High installation cost
- Construction for individual buildings and homes are not cost effective.
- Long construction and clean up

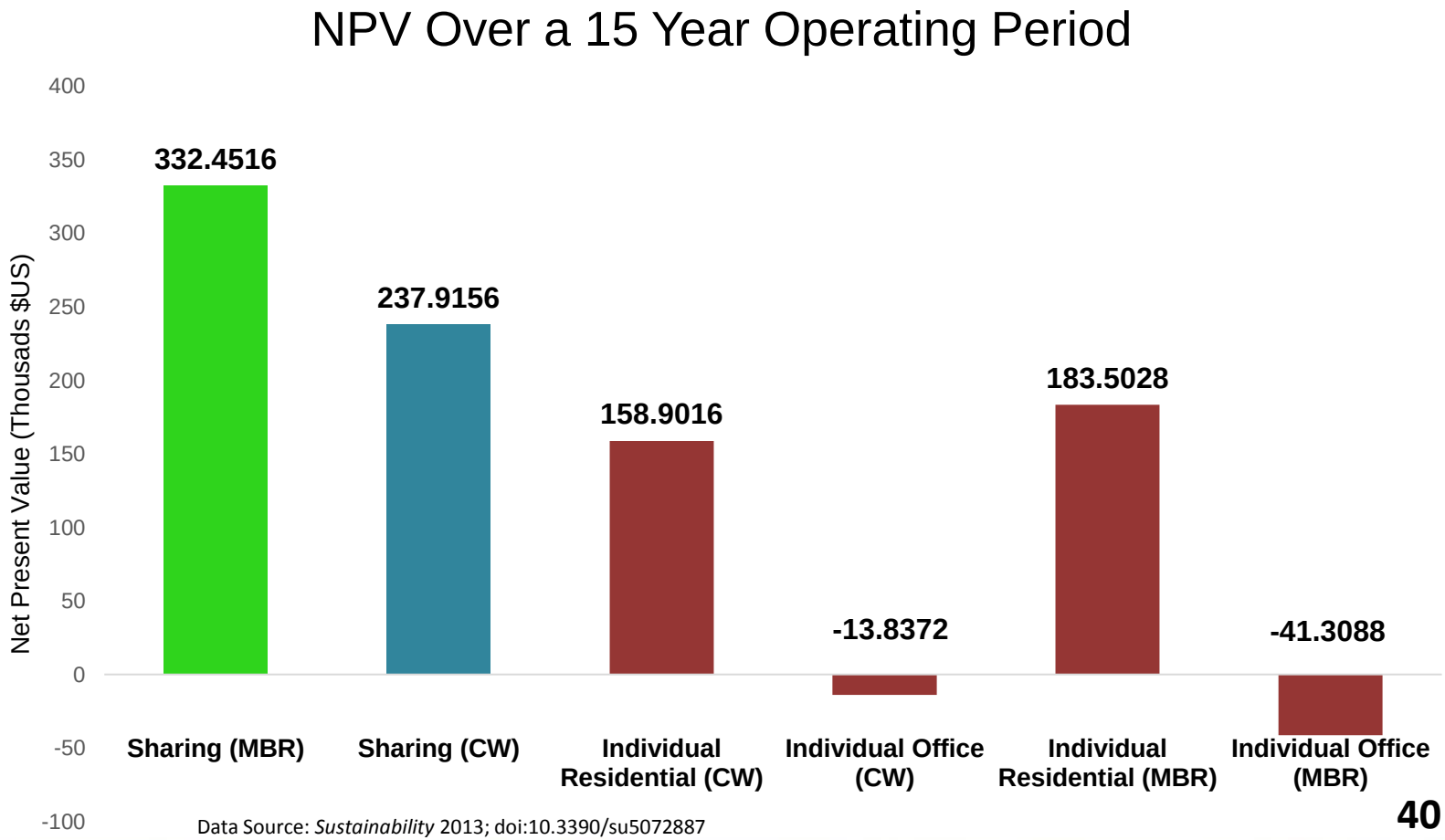


Data Source: *The Guardian* 2014

Overcoming the Cost of Grey Water

The Take Away

- Membrane bio reactors (MBR) are superior to constructed wetlands (CW)
- Water savings potential and net present value are highest in shared MBR systems



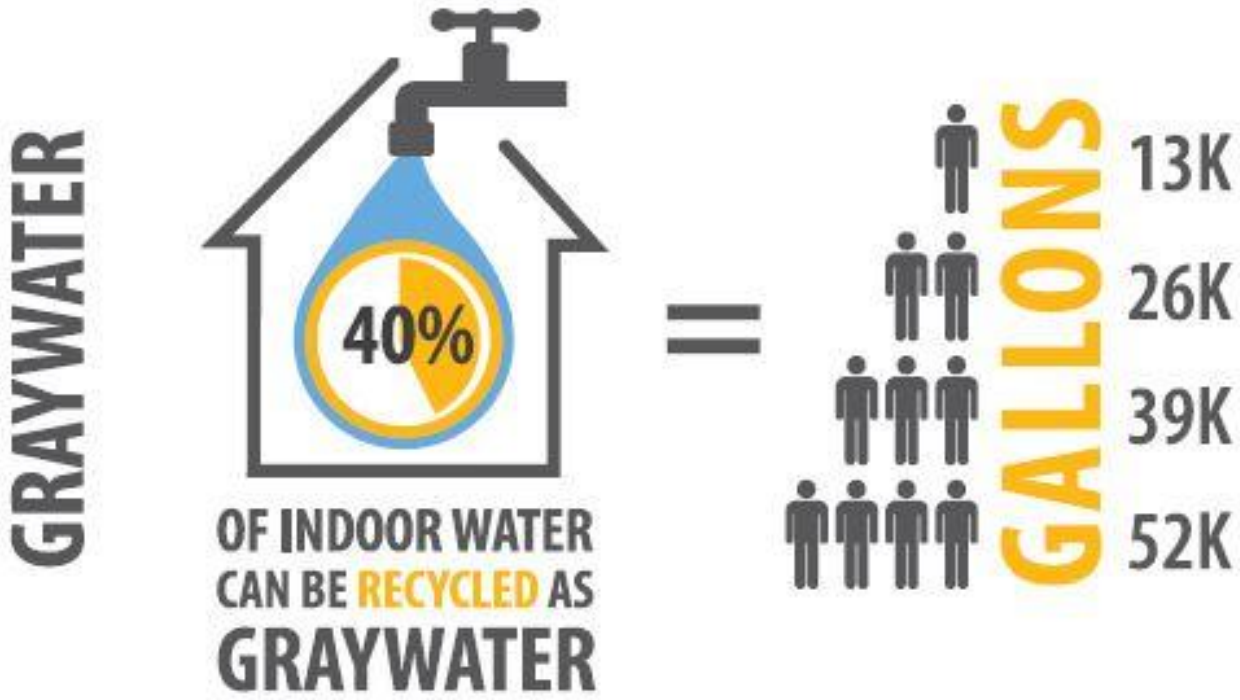
Data Source: *Sustainability* 2013; doi:10.3390/su5072887

Achieving Broad Adoption of Grey Water Systems - Incentives

- Incentivize builders to install large capacity grey water systems

and

- Combine appropriate plumbing lines of other structures



Achieving Broad Adoption of Grey Water Systems – Regulation Change

Public Health

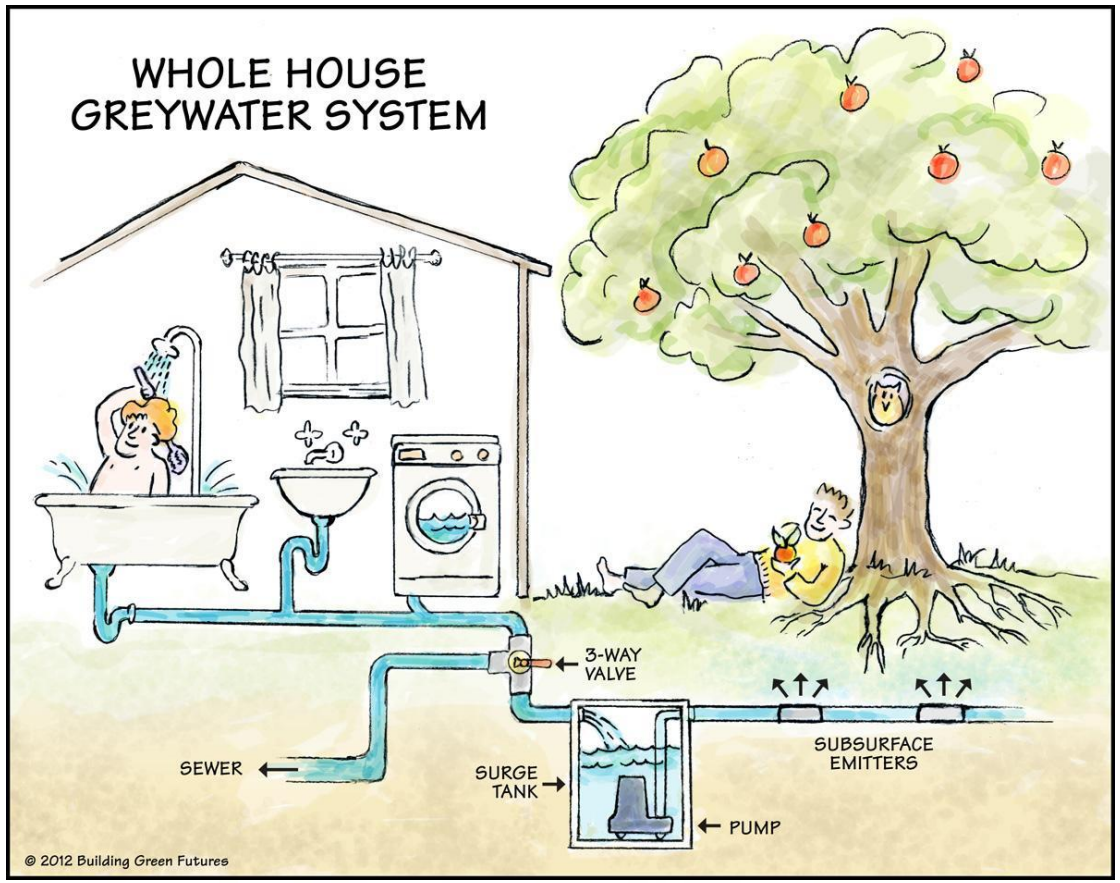
- Ease fears of mixing potable and grey water

Municipal Governing

- Refine process to obtain a permit

Plumbing Code

- Written by the 'traditional' plumbing industry
- Allow supply and waste water to share certain plumbing



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