At the Nexus of Water and Energy:

New Innovative Projects that Store and Manage Energy

Ray Bennett, PE, Irvine Ranch Water District

Southern California Water Dialogue

April 25, 2018

Presentation Agenda (DRAFT)

- Irvine Ranch Water District
- Water - Energy Projects
- Results
- Questions

IRWD Overview

A California Special District Serving Central Orange County

Drinking Water
Sewage Collection
Recycled Water and
Urban Runoff Treatment

IRWD Service Area

181 Square Miles

20% of Orange County

530,000

Daytime Population

390,000

Residential Customers

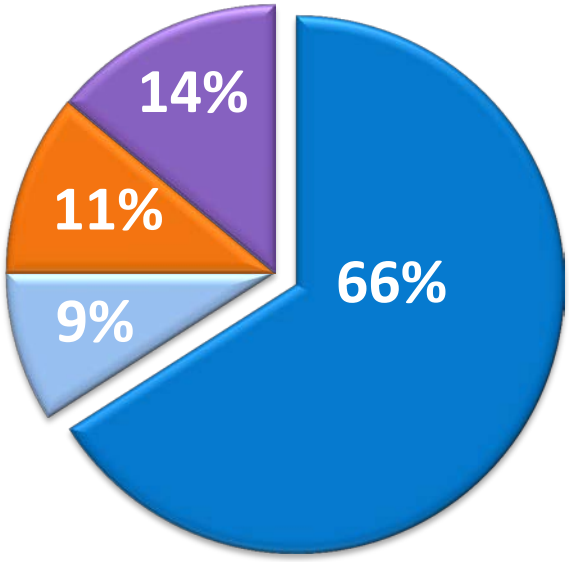
6 Cities Served

Irvine
Lake Forest
Newport Beach
Tustin
Costa Mesa, Orange
Unincorporated Orange County

IRWD Water Supply Reliability

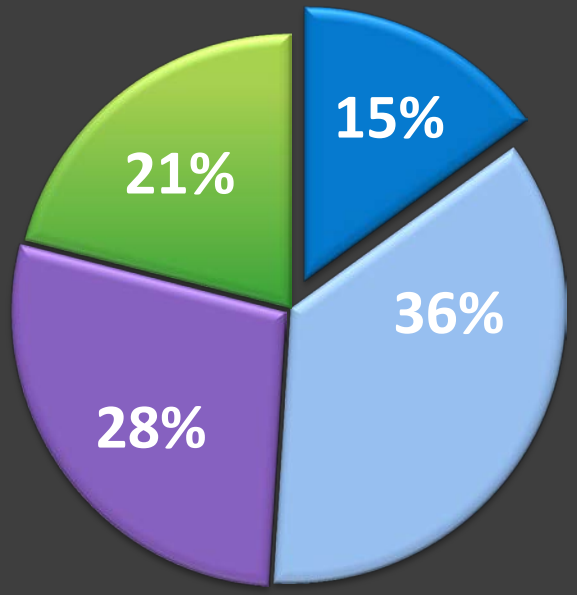
1990

Population Served: **114,000**
Total Water Provided**:** **~70,000 AF**



2017

Population Served: **390,000**
Total Water Provided**:** **~82,000 AF**

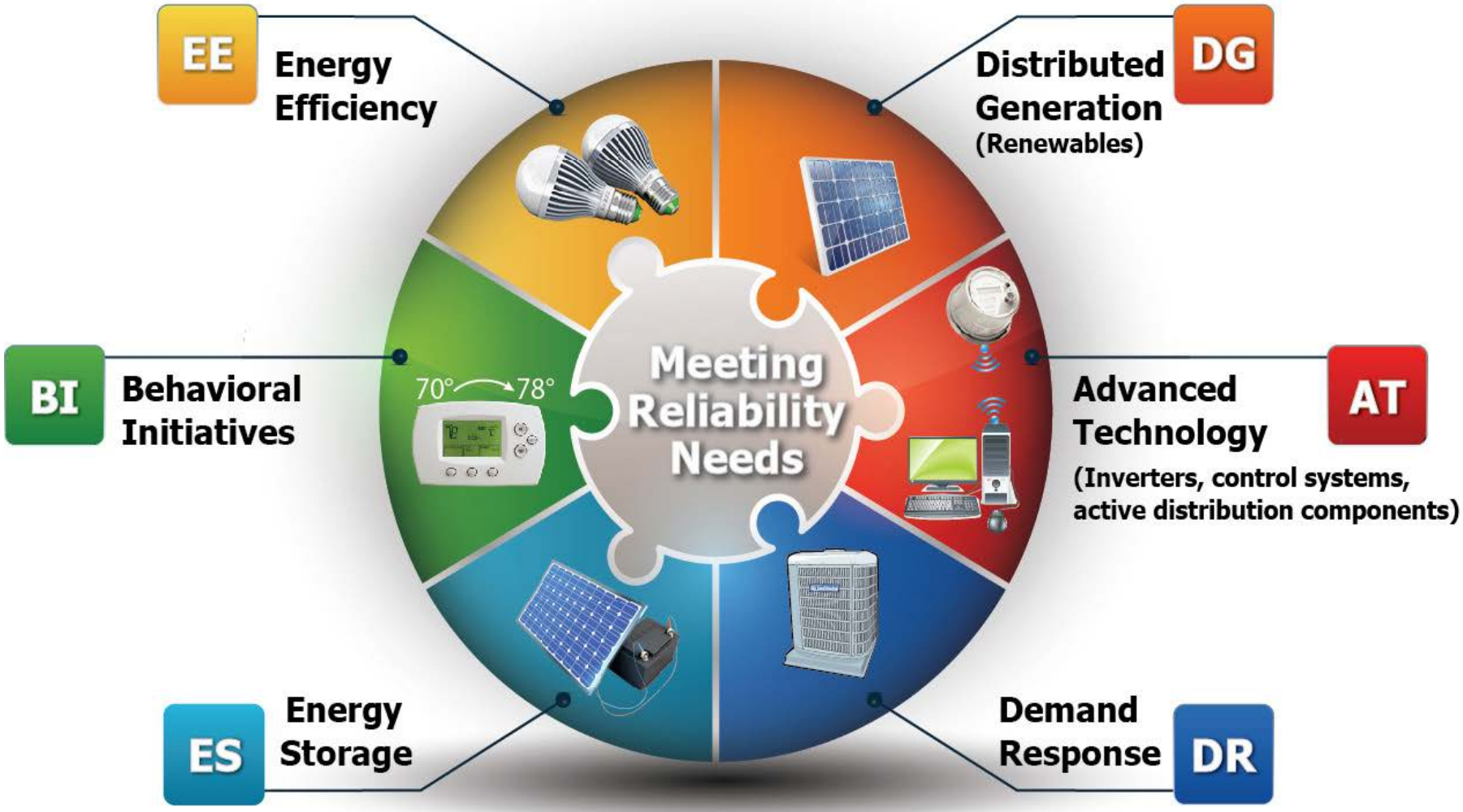


Water- Energy Projects

Motivation

- New & expanding facilities
  - MWRP expansion,
  - Baker WTP,
  - Biosolids
- State GHG goals
- Regional supply
- Win – Win
  - Good for IRWD
  - Good for Environment

Multiple Options

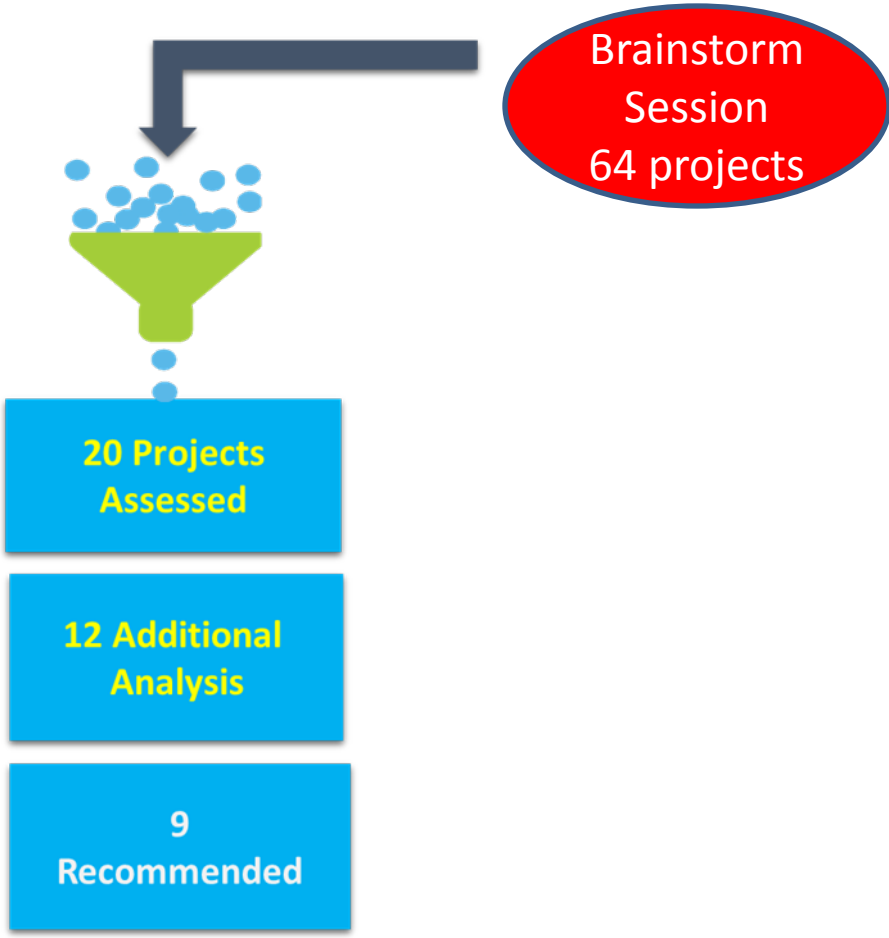


1 - Energy and Green House Gas Master Plan

Energy and GHG Master Plan

Objective:

- *"To Identify a portfolio of cost-effect projects*
- *Reduce IRWD's existing and future energy costs and,*
- *Reduce GHG Emissions *."*



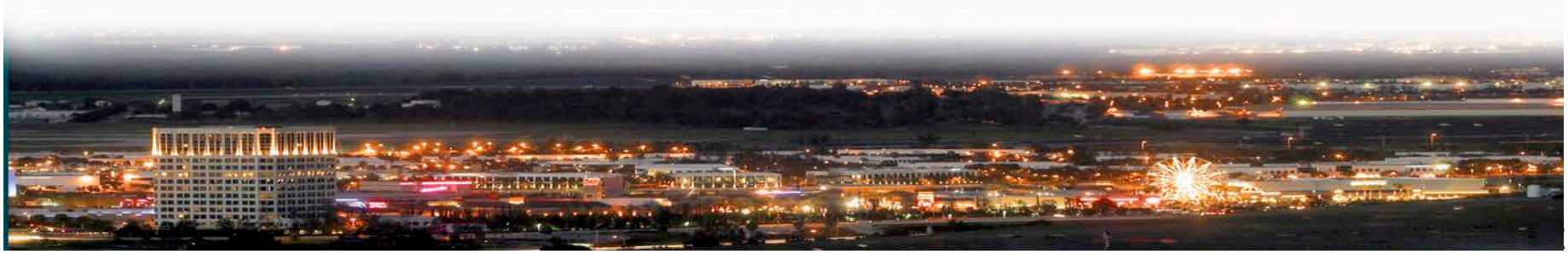
* As required for current and future regulations

Recommended Future Programs

#	Project Description
1	Additional Water **Conservation** Activities (Ongoing)
2	Accelerated **Pump Efficiency** Improvement Program (Ongoing)
3	Implement **Building Energy** Efficiency Measures (Complete)
4	**Solar PV Lease** Program on property outside service area (Not Feasible)
5	Further **optimize recycled water** production (Ongoing)
6	Implement a **Process Energy Audit** (Ongoing)
7	Optimize the San Joaquin **Marsh winter time pumping** (Complete)
8	Install **Automated Dissolved Oxygen Control** at LAWRP (Future)
9	Implement a Processed **Food Waste-to-Energy** Program (Construction)

Energy & GHG Master Plan Summary

- Economics
  - Capital Cost = $7.0 million
  - Annual savings = $1.4 million
  - Payback period = 5 years
- Annual electricity savings = 9,200,000 KWh
  - 10 percent of current use
- Annual GHG reductions = 3,650 metric tons
  - 6 percent of current emissions

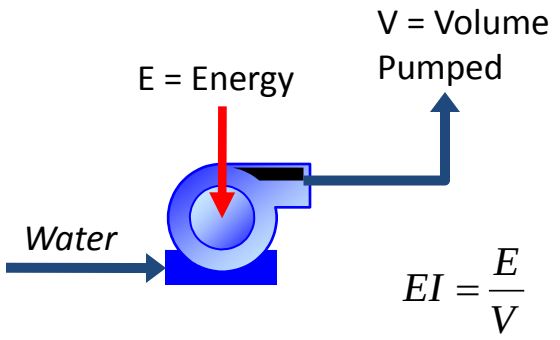


2 - Embedded Energy Plan

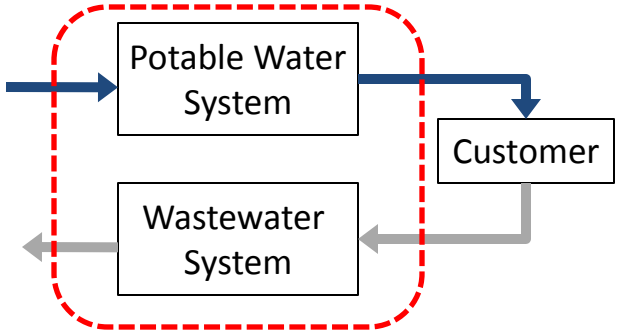
Energy Intensity and Embedded Energy

- **Energy Intensity (EI) – kWh/AF**
  - Average amount of energy needed to transport or treat water or wastewater on a per unit basis (kWh/AF).
- **Energy Embedded in Water – kWh**
  - Useful in quantifying energy savings as a result of water savings (water saved x EI = embedded energy saved)

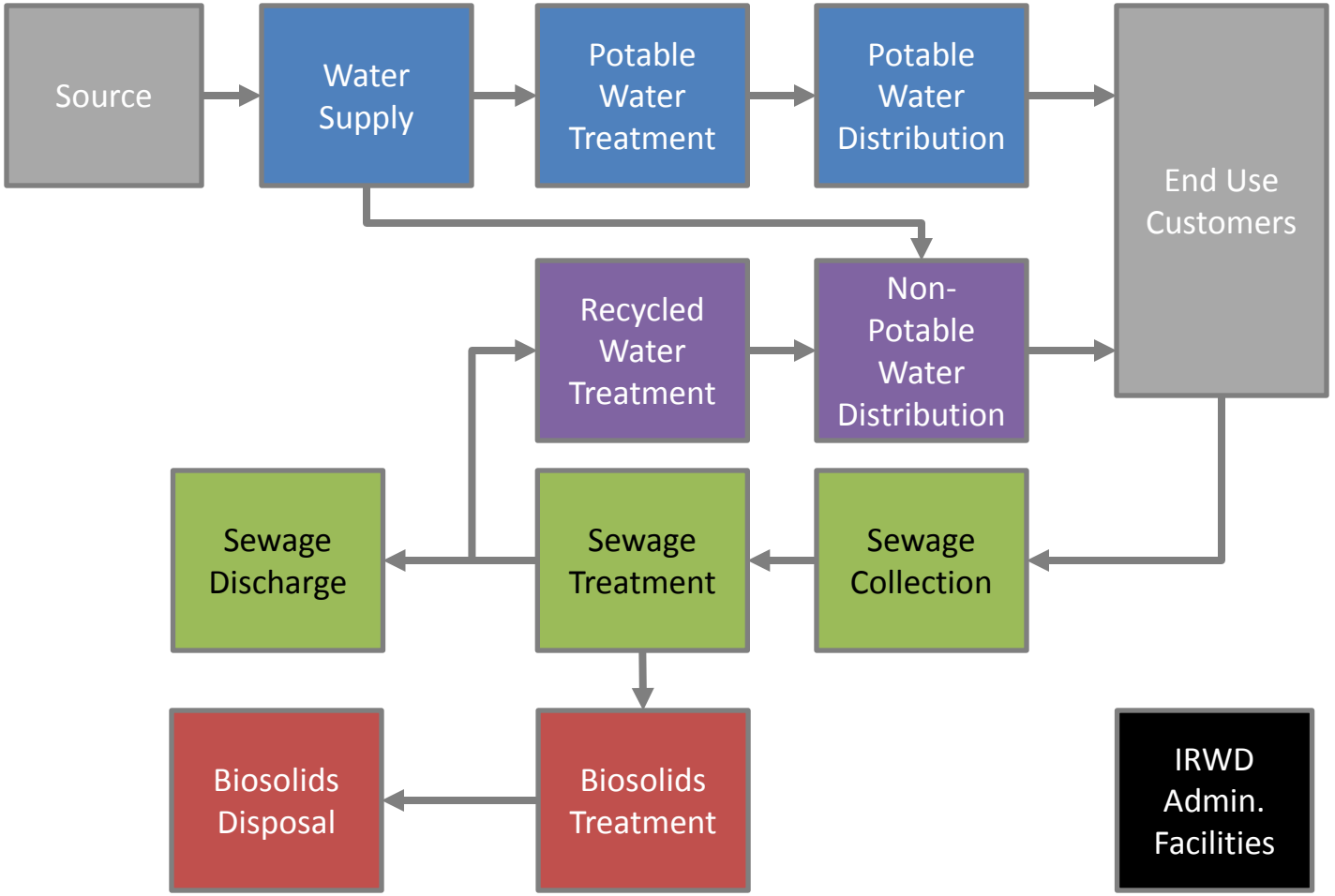
Illustrative Energy Intensity Calculation for a Pump



Embedded Energy

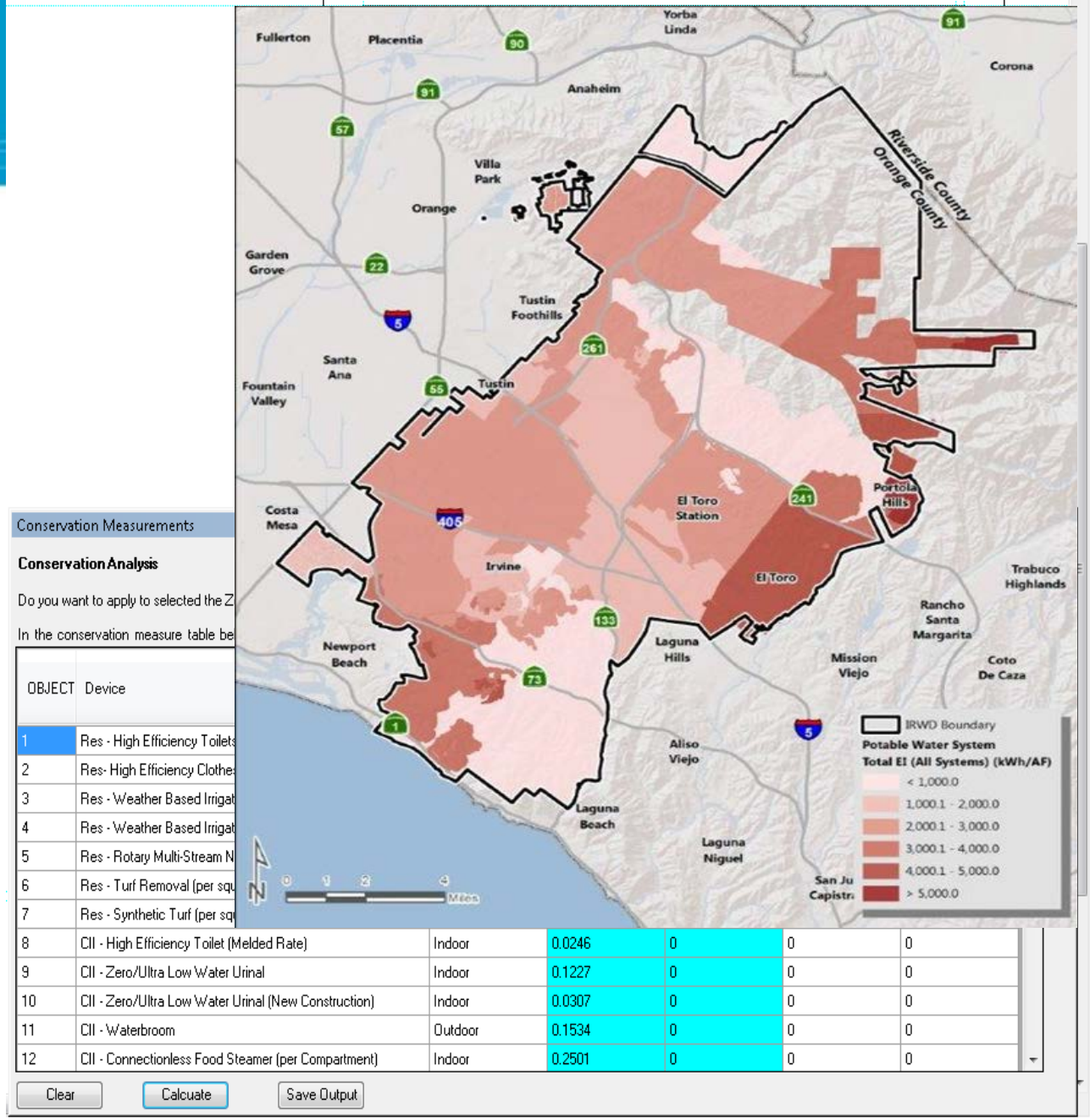


Methodology



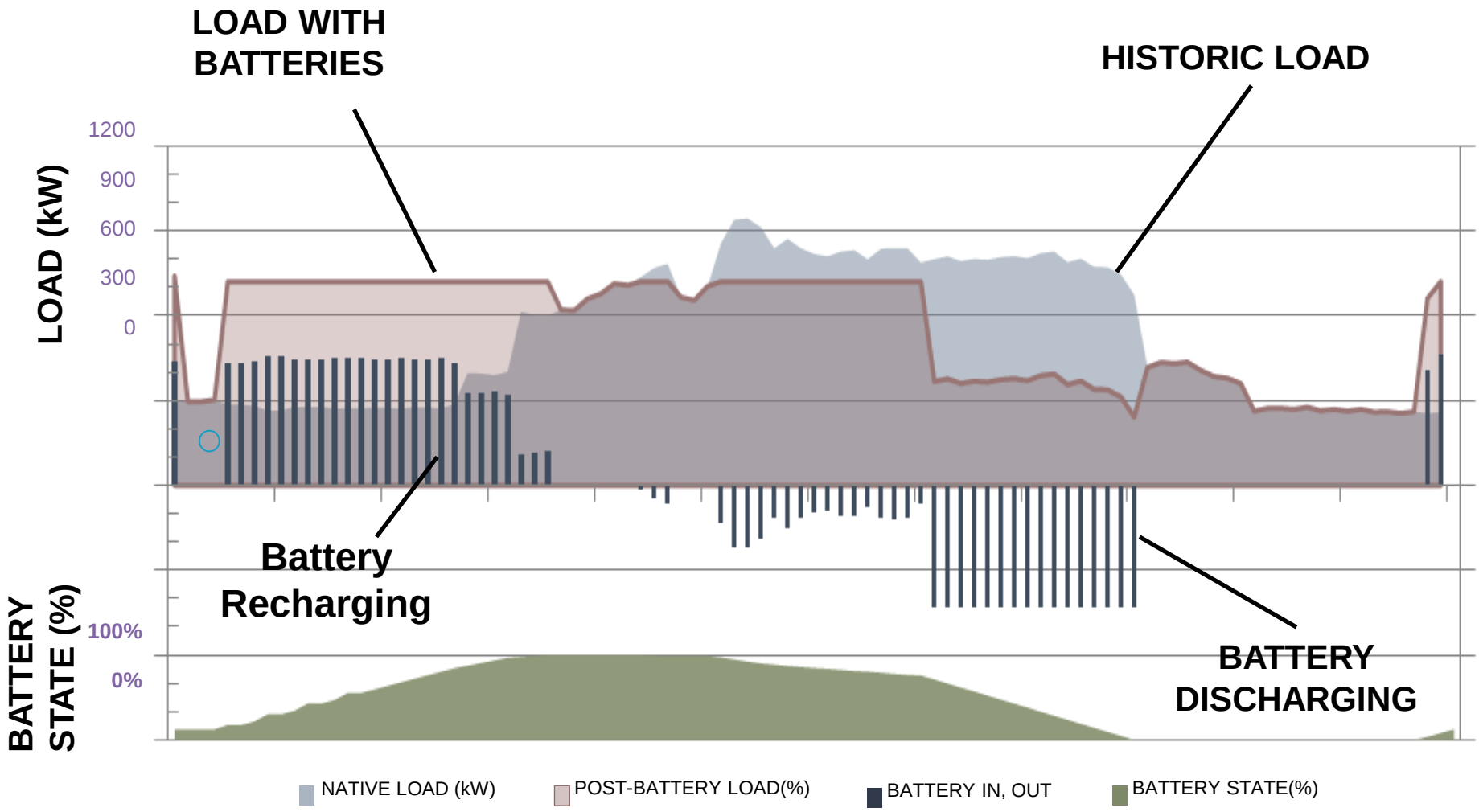
GIS Tool

- Conservation Analysis
- Select high use regions
- Estimate water and energy savings from targeted conservation in selected region



3 - Batteries

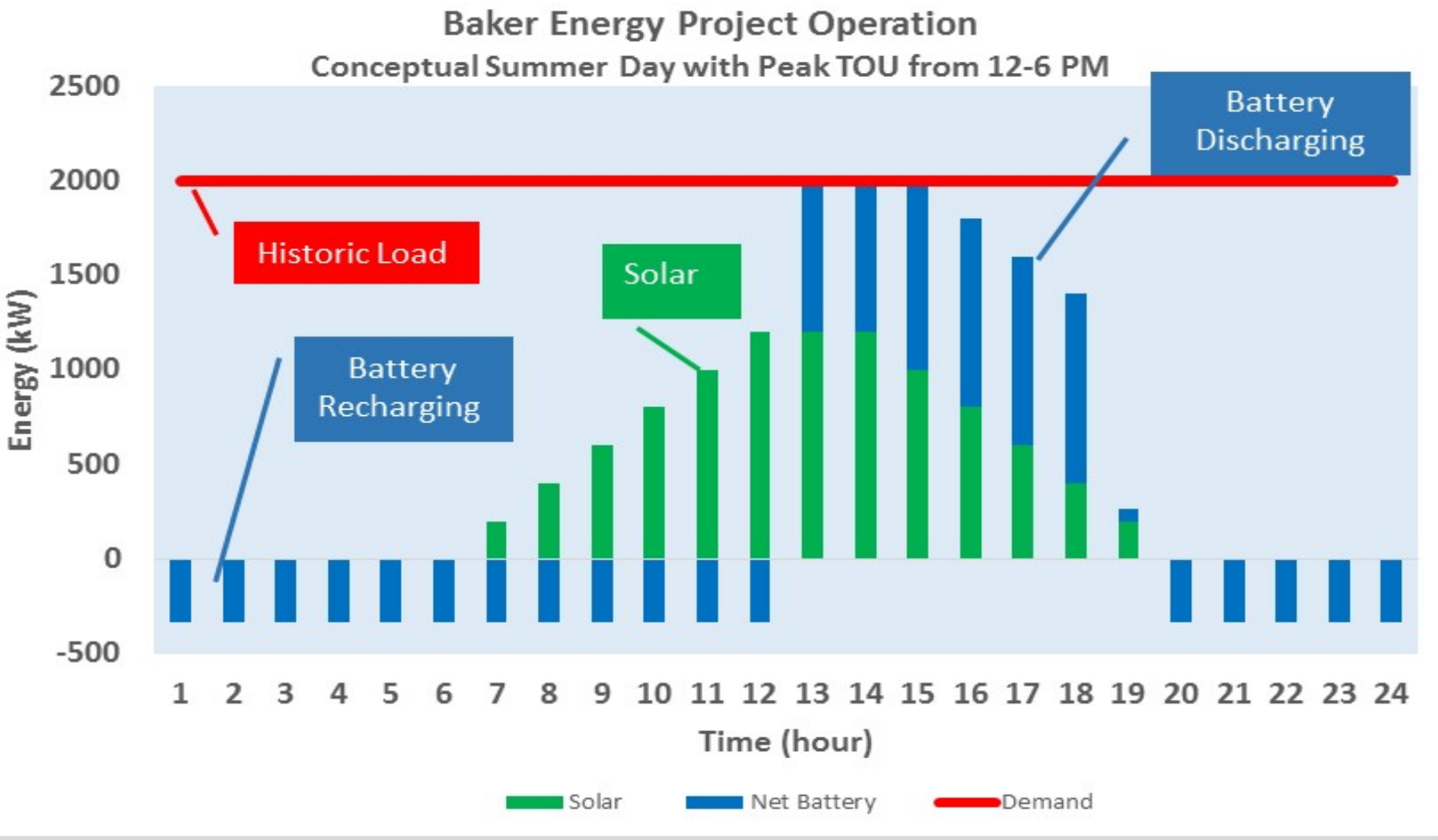
Battery operation



Batteries

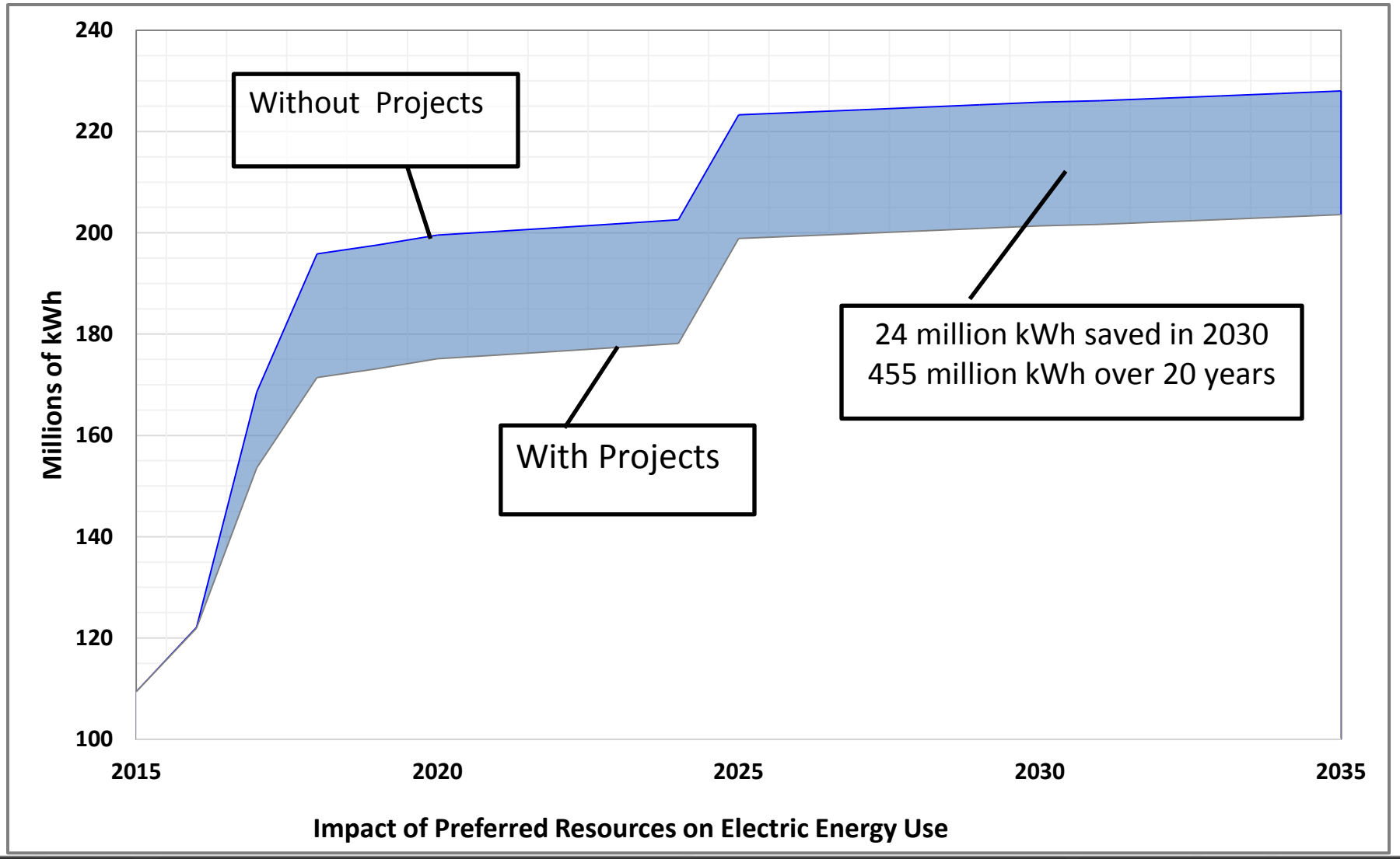
- IRWD, AMS and SCE
  - Developing 11 sites
  - 7,000 kW
- 6 demand response systems
  - 6 hour capacity
  - Cost savings to IRWD
  - Grid relief for SCE
  - 5,500 kW
- 5 demand management sites
  - 2 hour capability
  - Cost savings to IRWD
  - 1,500 kW

Batteries with Solar

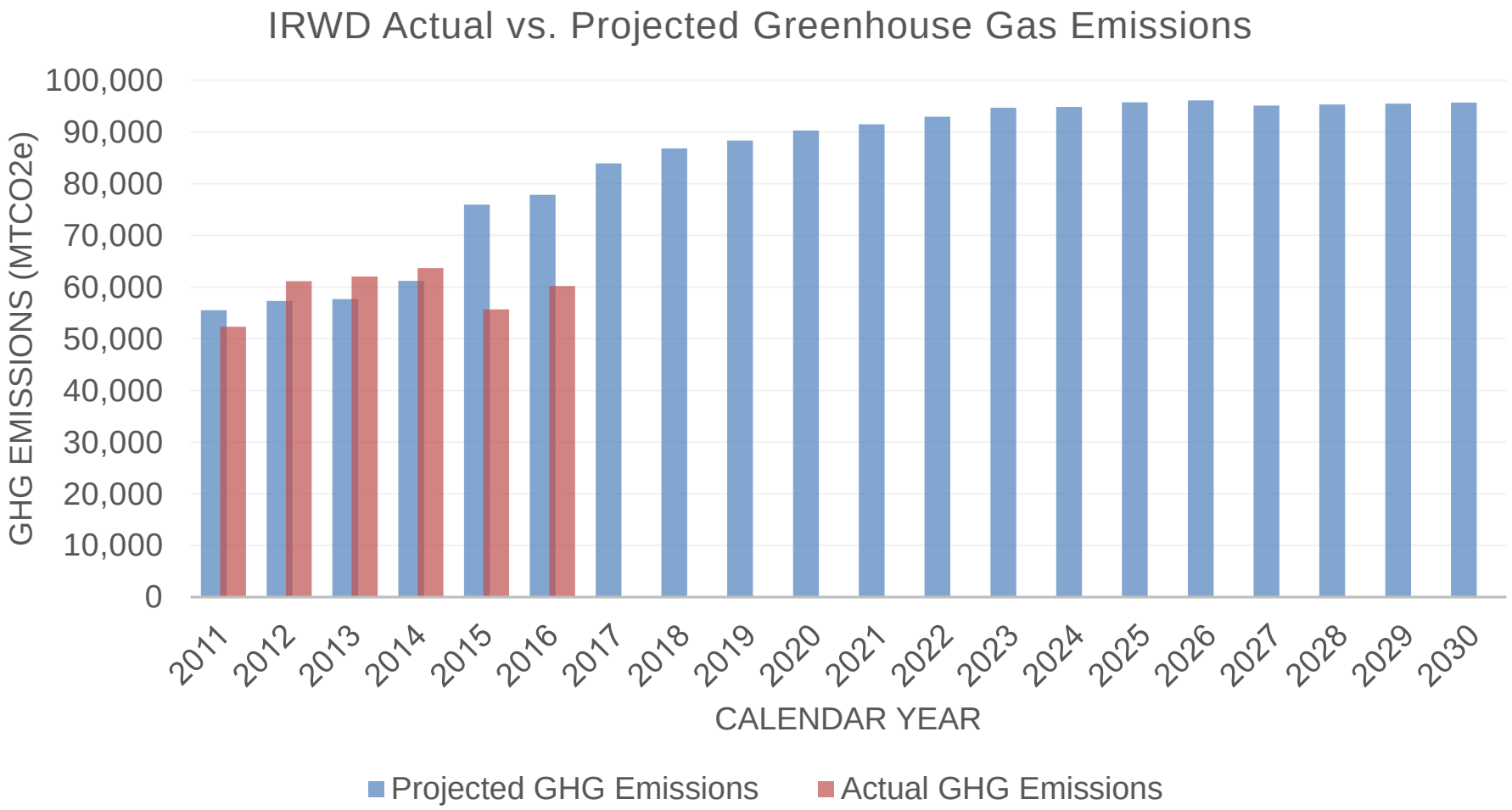


Results

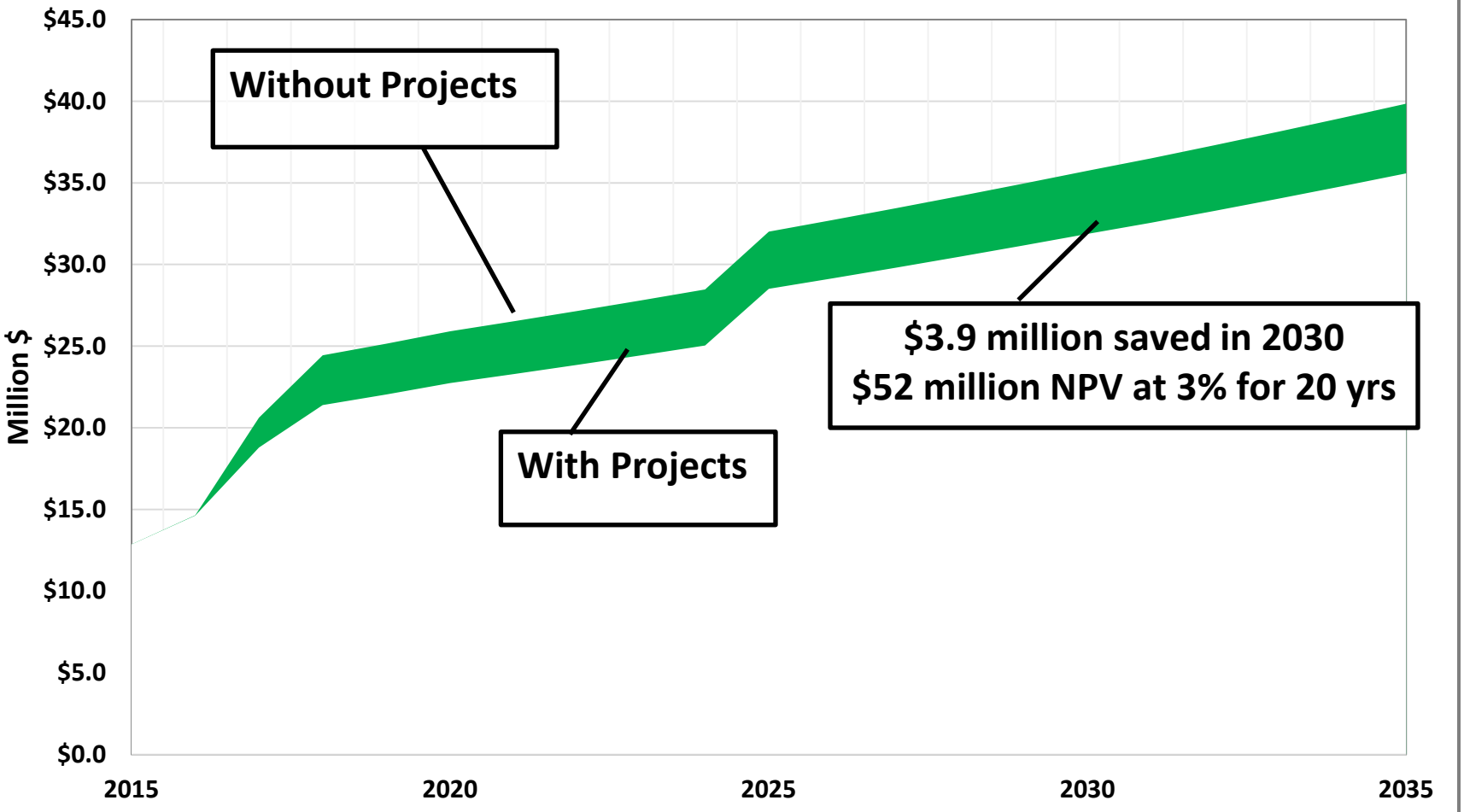
Projected Energy Requirements with and without Energy Projects



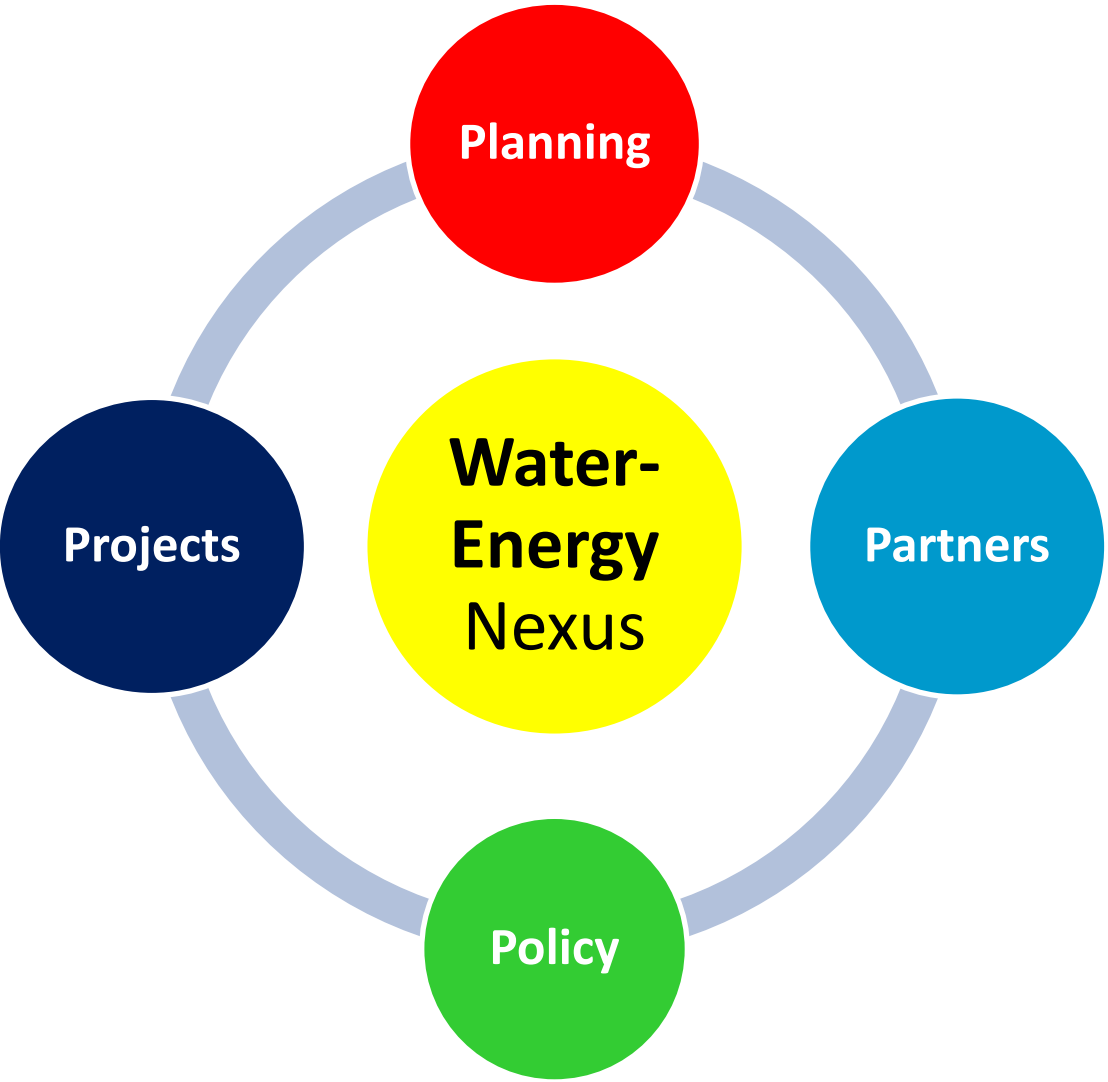
Historic vs Forecasted GHG Emissions



Historical and Forecasted Energy Costs



Summary



Questions

IRWD Contact Information

Ray R. Bennett
Engineer
(949) 453-5608
Bennett@irwd.com