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Long-Term Energy Optimization Opportunities of California Water Systems

LGC – Statewide Energy Efficiency Forum **June 16, 2016**

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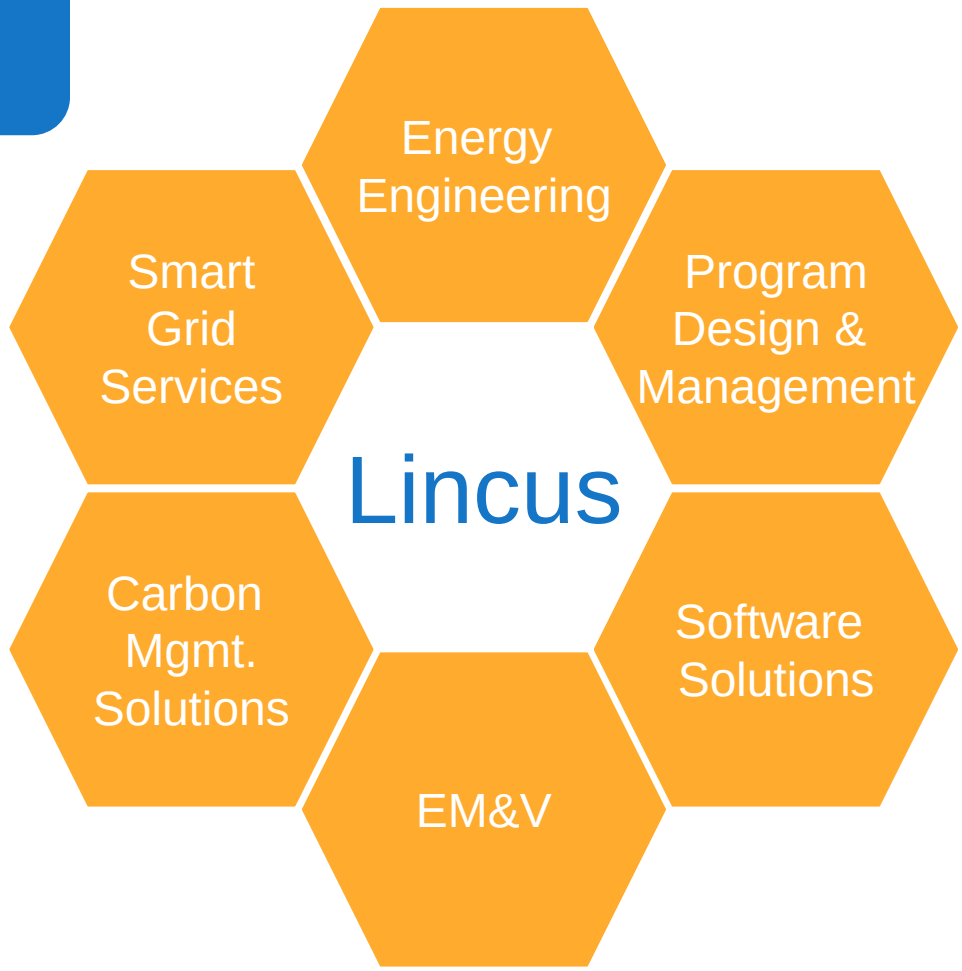
Introduction

Established in 2003

Offices:

- Tempe, AZ
- Monrovia, CA
- San Diego, CA
- Emeryville, CA



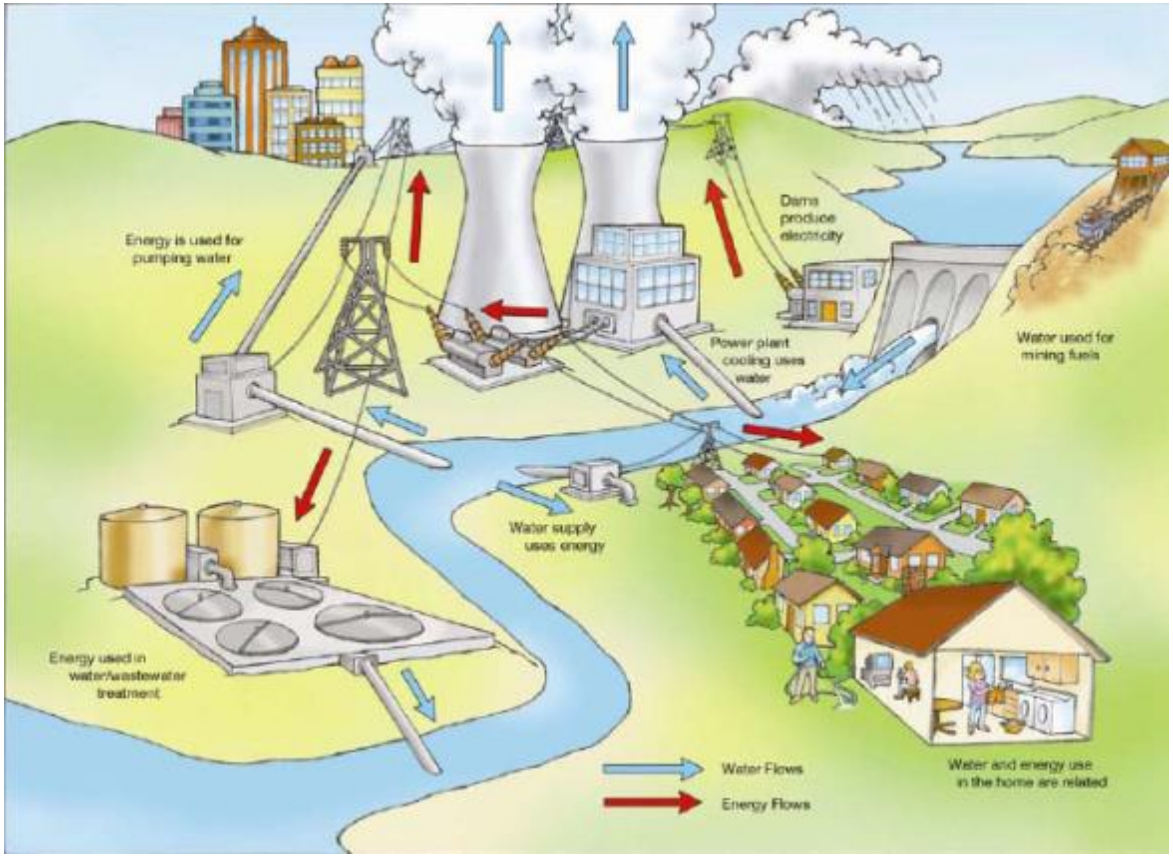
LINCUS

- We work with Electric Utilities to offer technical assistance and incentive programs to their Customers
- We provide comparative energy analyses and energy engineering
- We provide objective third-party technical reviews
- We offer full coordination with utility representatives throughout the incentive process

Agenda

- The Water-Energy Nexus
- Lincus Water Infrastructure System Efficiency (WISE) Program
- Market Potential
- Prioritizing Water Segment Opportunities
- Why Leverage WISE?

Water – Energy Nexus



- Water required to produce energy
- Energy required to distribute the water to public
- Energy required to treat the waste water

"Energy demands on Water Resources" U.S. DOE Report to Congress on the interdependency of energy and water

Water Conservation ⟷ Energy Conservation

Water-Energy Nexus

Energy for Water

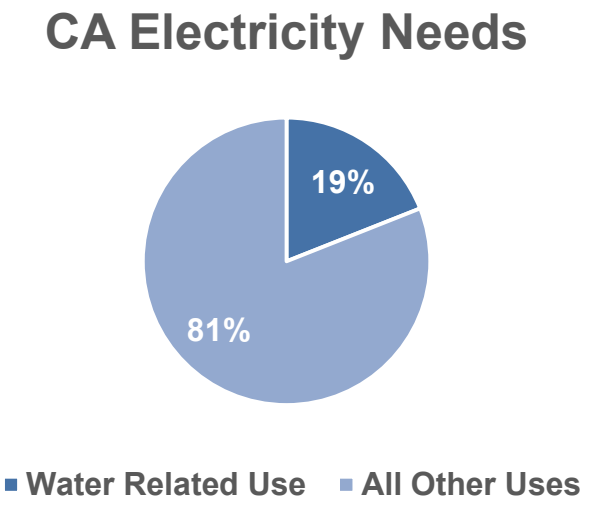
- Heating
- Pumping
- Pressurizing
- Purification
- Aeration

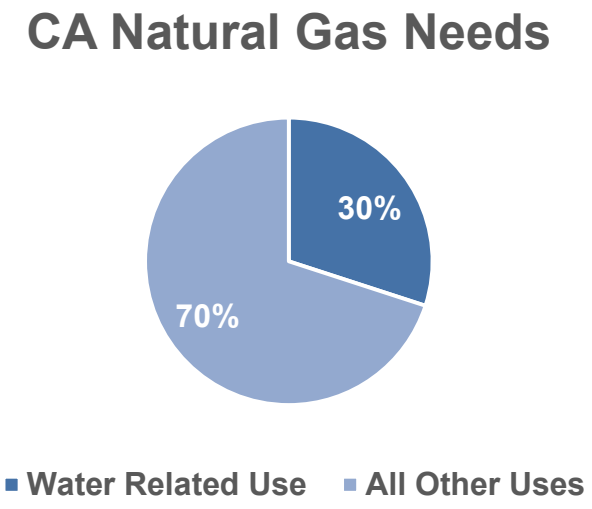
Water for Energy

- Exploration
- Extraction
- Hydraulic Fracturing
- Refining/Purification
- Steam
- Cooling

Energy Impact of Water

- In 2005, the CEC found that water-related energy consumption and demand accounted for 19% of the state's electricity requirements[1]. The 19% includes both:
  - Item #1: Energy Use by the Water Sector - the amount, timing, and location of energy needed to support water sector operations.
  - Item #2: Energy Use by Water Customers - the amount of energy used by water customers during the consumption of water, whether for pumping, heating or other purposes.





Energy Impact of Water

- In 2010, the CPUC Embedded Energy in Water studies[2] determined that the Energy Use needed to support water sector operations was 7.7%

Table ES-2. Statewide Water Sector Electric Use (GWH)

	CPUC/GEI/Navigant	
Segment of the Water Use Cycle	**Study 1**	**Study 2**
Supply	15,786	172
Conveyance		
Water Treatment		312
Water Distribution		1,000
Wastewater Treatment		2,012
Total Water Sector Electricity Use	**19,282**	
% of Total Statewide Electric Requirements	**7.7%**	

Note: Excludes estimates of electricity consumption for water end uses.

Water Impacts

- 195 billion gal/day of fresh and saline water withdrawn for thermoelectric cooling
- 48% of total withdrawals (including saline)
- 39% of freshwater withdrawals (same as irrigation)

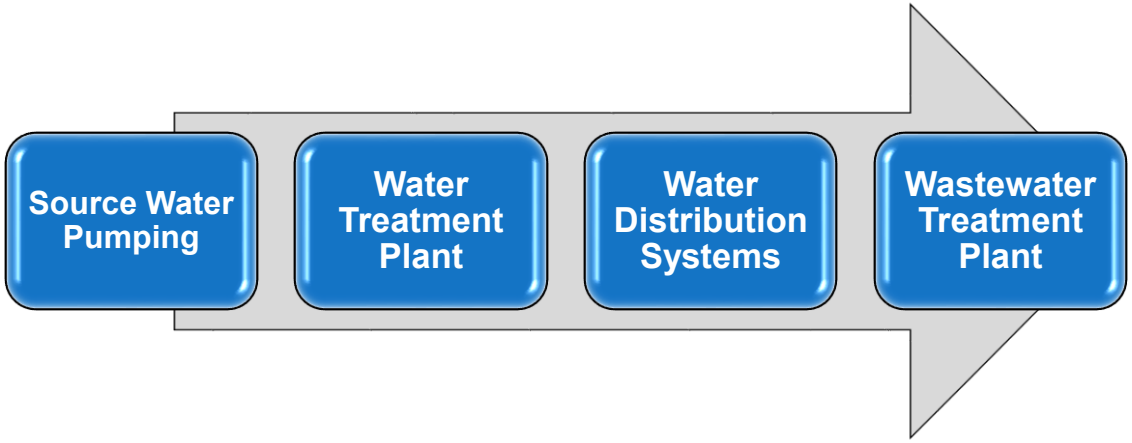
Figure 1. Total water withdrawals by category, 2000.

Water Infrastructure System Efficiency (WISE) Program

Summary

- Lincus' Water Infrastructure System Efficiency (WISE™) Program currently targets the major water-energy users in SCE's, PG&E's and SDG&E's service territory, namely Water Agencies, Special Districts, and city owned water systems.

- WISE focuses on the the major electric consumers of this segment.



Water Infrastructure System Efficiency (WISE) Program

- **Water Source Pumping**
- **Water Treatment Plant**
- **Water Distribution Systems**
- **Wastewater Treatment Plant**

- **Source Water Pumping and Water Distribution Systems (WSO)**
  - Lincus uses a holistic approach, combining existing pump tests and hydraulic modeling to evaluate how a Water Agency's pumping system can be optimized.

- **Water (WTP) and Wastewater (WWTP) Treatment Plants**
  - In Wastewater Treatment Plants, WISE focuses on aeration systems and controls to minimize the facilities' electrical consumption
  - In Water Treatment Plants, we use a similar approach to WSO to optimize a plant's operations, focusing primarily on the pumps.

Market Potential

- Looking at the 5 largest utility electric producers, this amounts to over **1.7 billion kWh in energy savings potential** at a conservative estimate of a 10% energy reduction.

		7.7%	10%
	Total Energy Use[3] kWh	Sector Electric Use	Energy Savings
SCE	82,849,000,000	6,379,373,000	637,937,300
PG&E	82,840,000,000	6,378,680,000	637,868,000
LADWP	27,628,000,000	2,127,356,000	212,735,600
SDG&E	17,670,000,000	1,360,590,000	136,059,000
SMUD	10,319,000,000	794,563,000	79,456,300
Total Energy Savings Potential (assumed 10%)			**1,704,056,200**

- From Lincus' current pipeline of projects the kWh/kW ratio is about 8,600. therefore this equates to **198 MW of coincidental peak reduction**.

Market Potential: Pumps

Energy Efficiency of Pumps –

Motor HP	Low %	Fair %	Good %	Excellent %		
				Well Pump	Booster	Submersible
3 – 5	≤ 41.9	42.0 – 49.9	50 - 54.9	≥ 55.0	≥ 55.0	≥ 52.0
7.5 – 10	≤ 44.9	45.0 – 52.9	53 - 57.9	≥ 58.0	≥ 60.0	≥ 55.0
15 – 30	≤ 47.9	48.0 – 55.9	56 - 60.9	≥ 61.0	≥ 65.0	≥ 58.0
40 – 60	≤ 52.9	53.0 – 59.9	60 - 64.9	≥ 65.0	≥ 70.0	≥ 62.0
75 – up	≤ 55.9	56.0 – 62.9	63 - 68.9	≥ 69.0	≥ 72.0	≥ 66.0

Research indicates that the OPE averages of pumping plants in California range between 53-57.5% for well pumps and 52-55% for non-well pumps.

Market Potential: Sample Customer

Although pump efficiency improvements are cost effective, operators will typically not work on a pump until efficiencies drop below 40%.

Pump Name	Test Eff. %	Impr. Eff. %	Estimated Savings (kWh/yr)	Estimated Peak kW Savings	Simple Payback Period (yrs)
Pump A	52.8	67.0	115,829	10.4	1.2
Pump B	45.1	67.0	77,697	10.3	2.2
Pump C	57.6	67.0	77,877	6.5	2.2
Pump D	52.2	69.0	106,801	18.0	2.4
Pump E	56.4	67.0	70,965	7.8	2.5
Pump F	49.7	66.0	48,269	9.0	2.8
Pump G	43.1	66.0	34,565	8.0	3.2
Pump H	58.0	70.0	47,793	9.5	4.1

Market Potential: Distribution Systems

Energy Efficiency of Distribution Systems –

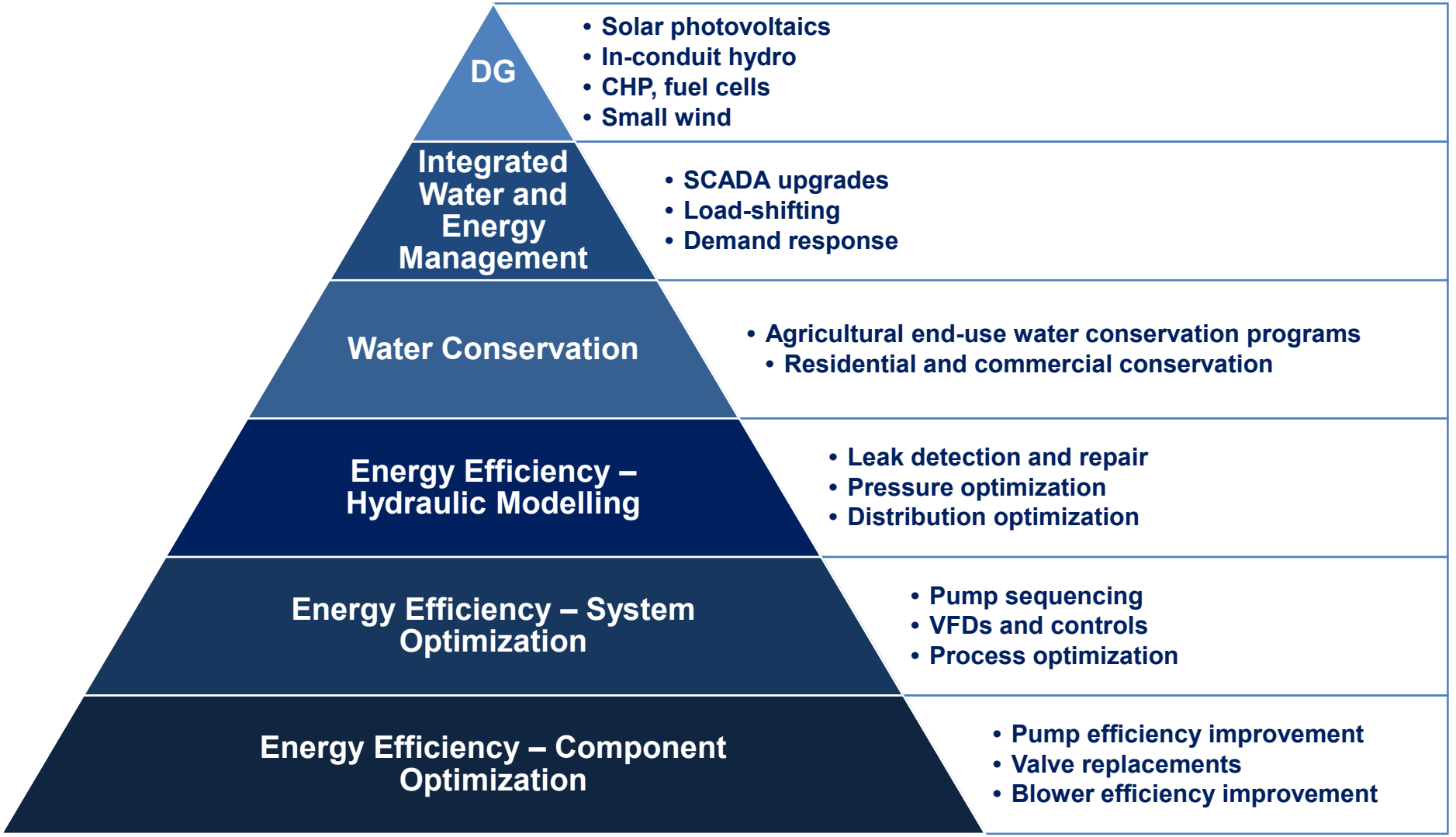
	Energy Intensity (kWh/MG)	
Water-Use Cycle Segments	**Low**	**High**
Water Supply & Conveyance	0	14,000
Water Treatment	100	16,000
Water Distribution	700	1,200
Water Collection	1,100	4,600
Wastewater Discharge	0	400
Recycled Water Treatment & Distribution	400	1,200

Optimized Energy Intensity metrics will vary widely between various water systems and must be developed at a system level.

Market Potential: Sample Customer

	Project Total	EEM1	EEM2	EEM3
		Sys. Opt. of Well Pumps	Sys. Opt. of Booster Pumps	Pump Efficiency Improvement
kWh/yr Savings	4,434,322	3,049,878	787,022	597,422
kW Savings	575.2	436.3	56.2	82.6
Measure Cost	1,755,050	$1,312,575	$153,725	$288,750
Utility Savings	620,211	$431,499	$106,159	$82,554
PG&E Incentive	464,921	$309,442	$71,394	$84,085
Net Cost	1,290,129	$1,003,133	$82,331	$204,665
Simple Payback	2.1	2.3	0.8	2.5

Prioritizing Water Segment Opportunities



Why leverage WISE?

- Lincus has thorough understanding of PG&E, SCE, & SDG&E-qualified measures and will evaluate cost-effective EE opportunities
- Lincus manages the utility incentive process directly
- Lincus will develop energy savings calculations as part of the program
- Lincus will maximize utility incentives and associated energy savings
- Lincus can process applications for On-Bill Financing (OBF) 0% loans
- If you are an eligible IOU Customer, the PROGRAM SERVICES ARE AT **NO COST** TO YOU!

Contact

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http://www.LincusEnergy.com

Sources

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2. http://www.waterenergyinnovations.com/publication/view/cpuc-embedded-energy-in-water-studies-1-statewide-and-regional-water-energy-relationship/
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