

Natural Gas Water Heating Demand Response Demonstration

Andrew Nih

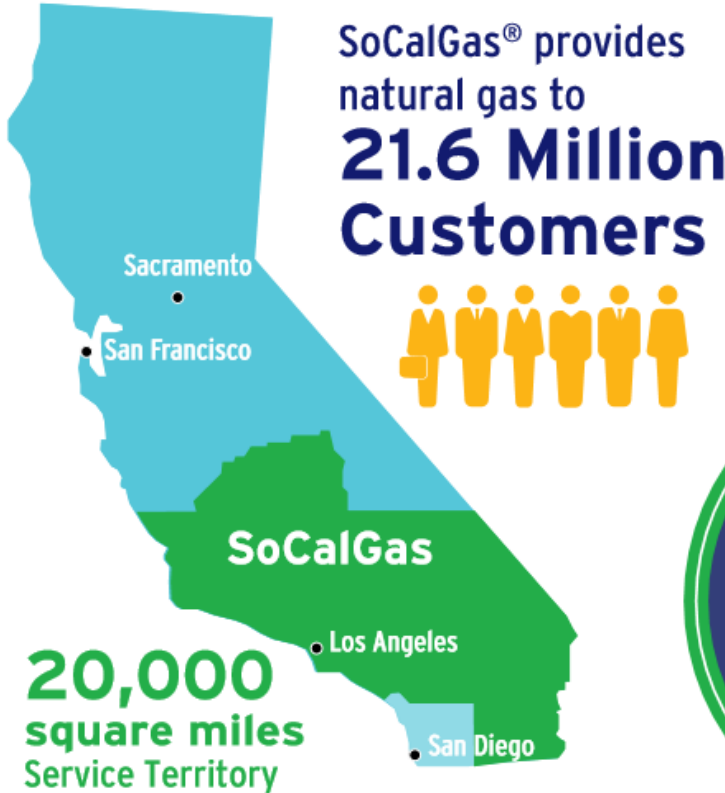
Presented at the 2019 ACEEE Hot Water Forum

3/13/2019



A  Sempra Energy utility®

SoCalGas Background

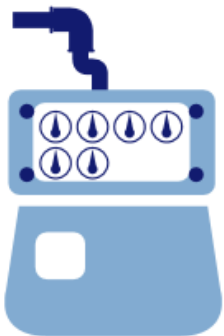


1 Trillion
cubic feet (Tcf)
of natural gas
delivered
annually

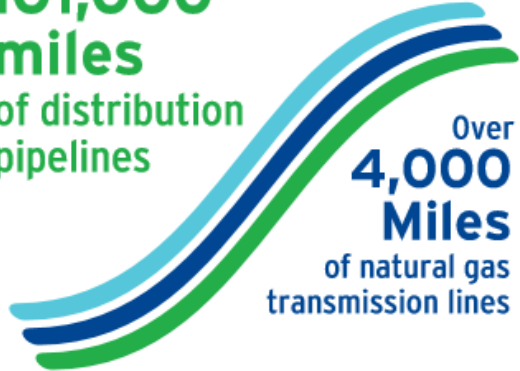
5%
of US gas
deliveries

Serving customers for **150 Years**

5.9
million
meters



More than **101,000 miles** of distribution pipelines



Over **4,000 Miles** of natural gas transmission lines

Winter DR Programs

» 2016-2017 Winter Season:

- SoCalGas Advisory: Mass market notification campaign to core and non-core customers
- Smart thermostat load control program:

» 2017-2018 Winter Season:

- Continued the smart thermostat load control program.
- Demonstration project on DR capabilities of gas water heaters

» 2018-2019 Winter Season:

- Continued smart thermostat load control program.
- Mass market media campaign

Water Heating DR Overview

» Objective:

- Functionality testing of residential water heating connectivity and control
- Understand effects and impacts of DR event



» Demonstration utilized Rheem Econet Wifi Module

» DR event scenarios:

- 1-3 hour events
- Lower temperature to 120°F, 110°F, and vacation mode

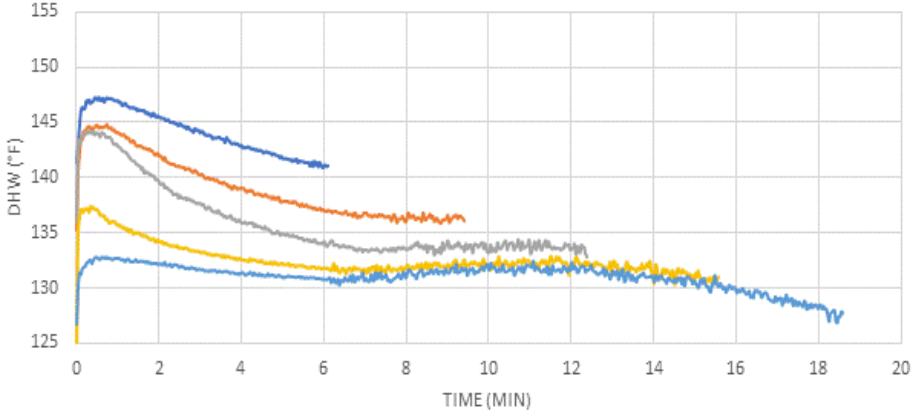
DR Event Scenarios

	1-Hour DR Event				2-Hour DR Event				3-Hour DR Event			
	110 °F	120 °F	130 °F	Vacation	110 °F	120 °F	130 °F	Vacation	110 °F	120 °F	130 °F	Vacation
12 GAL	X	X	X	X	X	X	X	X	X	X	X	X
18 GAL	X	X	X	X	X	X	X	X	X	X	X	X
24 GAL	X	X	X	X	X	X	X	X	X	X	X	X
30 GAL	X	X	X	X	X	X	X	X	X	X	X	X
36 GAL	X	X	X	X	X	X	X	X	X	X	X	X

Results: Water Temperature

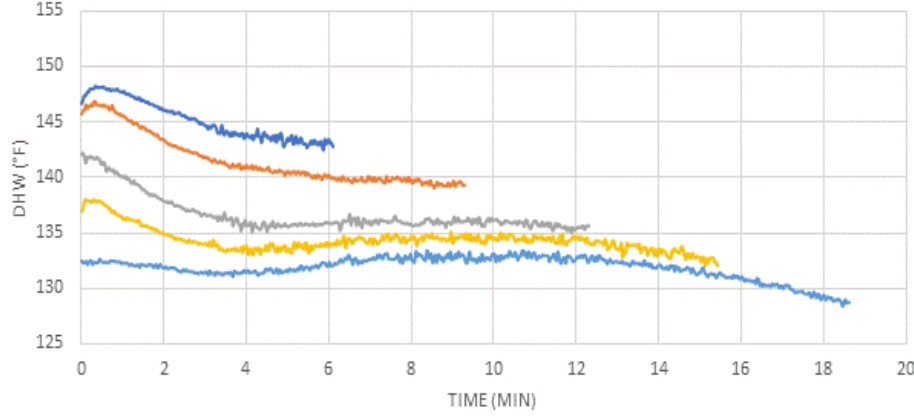
RHEEM ECONET 3 HOUR 110°F DEMAND RESPONSE EVENT
DHW VS TIME

— 12 GAL — 18 GAL — 24 GAL — 30 GAL — 36 GAL



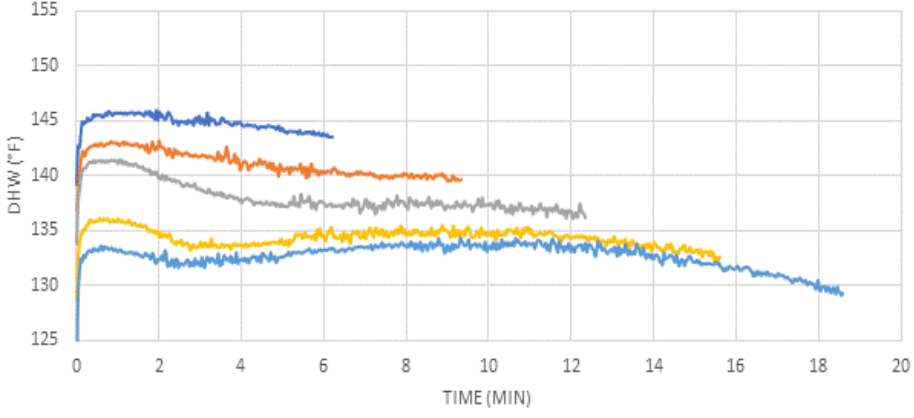
RHEEM ECONET 3 HOUR 120°F DEMAND RESPONSE EVENT
DHW VS TIME

— 12 GAL — 18 GAL — 24 GAL — 30 GAL — 36 GAL



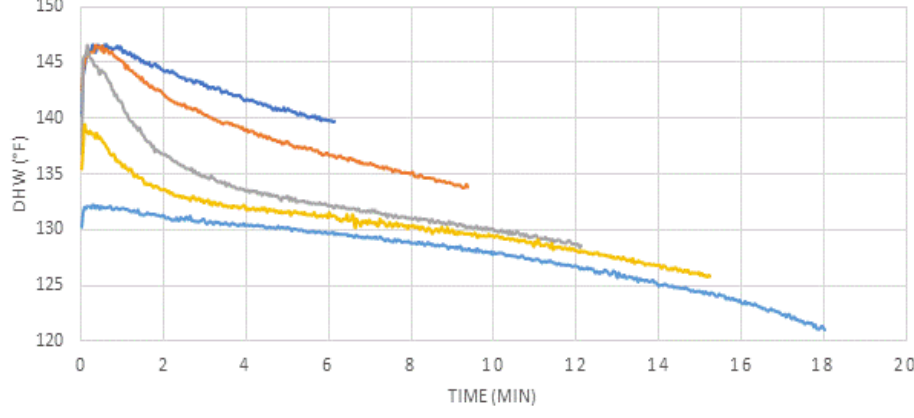
RHEEM ECONET 3 HOUR 130°F DEMAND RESPONSE EVENT
DHW VS TIME

— 12 GAL — 18 GAL — 24 GAL — 30 GAL — 36 GAL



RHEEM ECONET 3 HOUR VACATION MODE DEMAND
RESPONSE EVENT DHW VS TIME

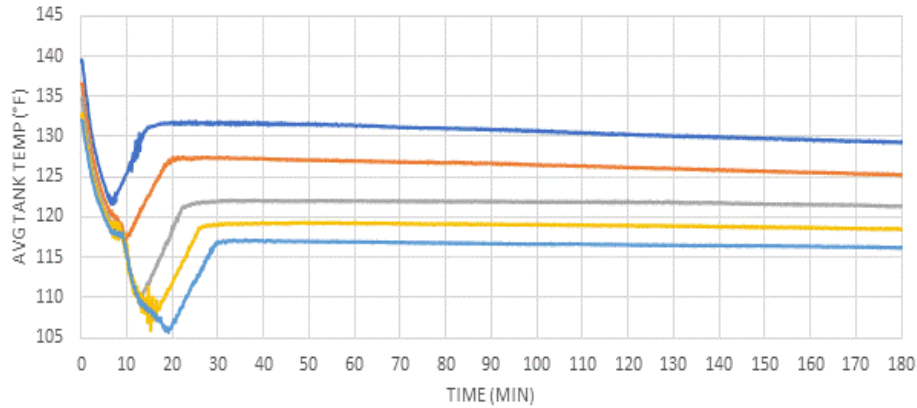
— 12 GAL — 18 GAL — 24 GAL — 30 GAL — 36 GAL



Results: Tank Temperature

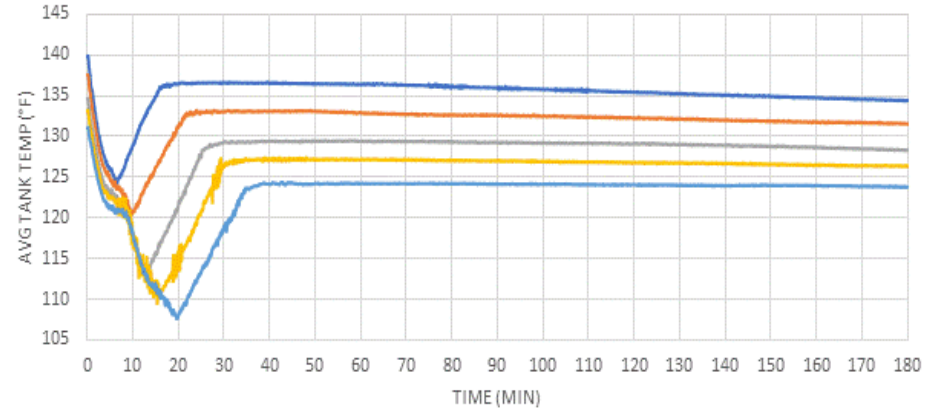
RHEEM ECONET 3 HOUR 110 °F DEMAND RESPONSE EVENT
AVG TANK TEMP VS TIME

— 12 GAL — 18 GAL — 24 GAL — 30 GAL — 36 GAL



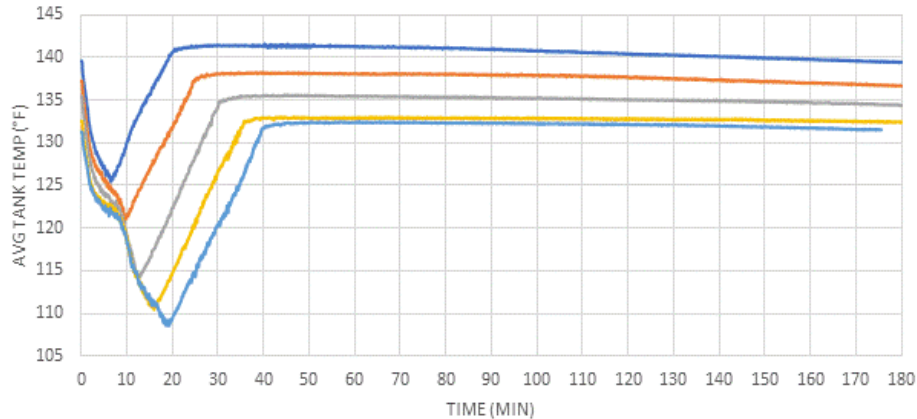
RHEEM ECONET 3 HOUR 120 °F DEMAND RESPONSE EVENT
AVG TANK TEMP VS TIME

— 12 GAL — 18 GAL — 24 GAL — 30 GAL — 36 GAL



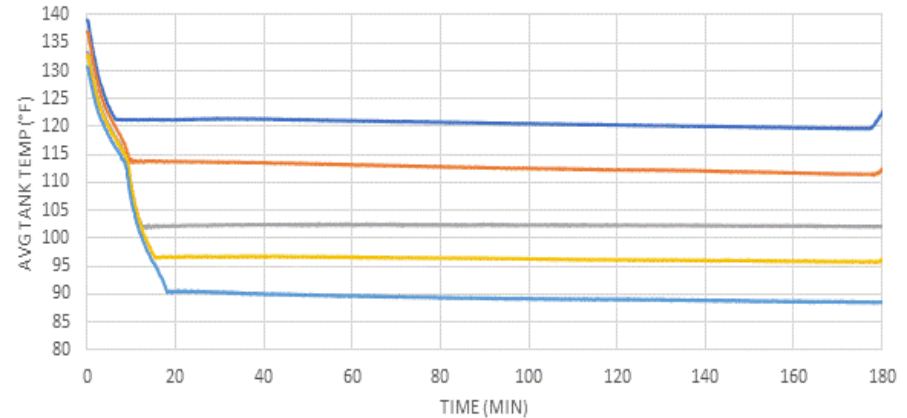
RHEEM ECONET 3 HOUR 130 °F BASELINE AVG TANK TEMP VS
TIME

— 12 GAL — 18 GAL — 24 GAL — 30 GAL — 36 GAL



RHEEM ECONET 3 HOUR VACATION MODE DEMAND
RESPONSE EVENT AVG TANK TEMP VS TIME

— 12 GAL — 18 GAL — 24 GAL — 30 GAL — 36 GAL



Results Continued

110°F WATER HEATER TEMPERATURE SETPOINT			VACATION MODE WATER HEATER SETTING		
	DHW ΔT (°F)	Avg Tank Temp ΔT (°F)		DHW ΔT (°F)	Avg Tank Temp ΔT (°F)
12GAL	4.4	10.0	12GAL	5.3	16.4
18GAL	6.3	11.4	18GAL	11.3	24.5
24GAL	9.5	13.3	24GAL	15.9	31.1
30GAL	4.7	14.1	30GAL	12.3	36.5
36GAL	-1.0	15.8	36GAL	10.6	42.1
120°F WATER HEATER TEMPERATURE SETPOINT			130°F WATER HEATER TEMPERATURE SETPOINT		
	DHW ΔT (°F)	Avg Tank Temp ΔT (°F)		DHW ΔT (°F)	Avg Tank Temp ΔT (°F)
12GAL	4.5	5.4	12GAL	0.2	0.1
18GAL	6.9	6.1	18GAL	1.3	0.5
24GAL	6.4	6.3	24GAL	2.9	0.9
30GAL	5.2	6.7	30GAL	1.5	0.1
36GAL	3.7	7.2	36GAL	1.6	-0.2

Therm Savings

Water Drawn	3-hour 110°F DR Event Potential Therms Saved	3H 110°F Event + Recovery Potential Therms Saved
12 GAL	0.060	0.002
18 GAL	0.067	0.001
24 GAL	0.080	0.010
30 GAL	0.091	0.011
36 GAL	0.093	0.003

Water Drawn	Vacation Mode DR Event Potential Therms Saved	Vacation Mode Event + Recovery Potential Therms Saved
12 GAL	0.110	0.003
18 GAL	0.114	0.002
24 GAL	0.178	0.006
30 GAL	0.209	0.002
36 GAL	0.235	-0.010

Conclusions

- » Functionality testing verified module's ability to perform as intended
- » Module successful in controlling WH temperature during DR simulations
- » Location of WH temperature sensor can cause premature burner cut-in
- » Potential therm savings results conclude shift in time of gas usage rather than a reduction

Potential DR Hot Water Pilot

- » Provide incentives for customers to purchase, install, and sign-up for pilot
- » Direct install WiFi module to select customers
- » Participants penalized for over-riding events?
- » Event time periods? Similar to smart thermostat load control program (5-9am, 6-10pm)

Path Forward for Natural Gas DR

» 2018-19 Winter

- Continuation of Smart Thermostat Load Control Program
- 29 events called through 3/13
- 43,000 thermostats enrolled in program

» Winter DR Application

- Residential water heater pilot
- Behavioral pilot
- Commercial space heating pilot
- Commercial water heating pilot
- Large C&I load reduction pilot

Contact

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