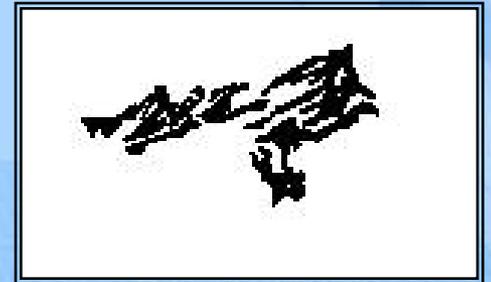


# City of Boulder Wastewater Treatment Facility –

*A case study of a large WWTF and energy use / management*



By Chris Douville  
Coordinator of Wastewater Treatment

ASME Conference -- November 16, 2011

# Case Study Overview

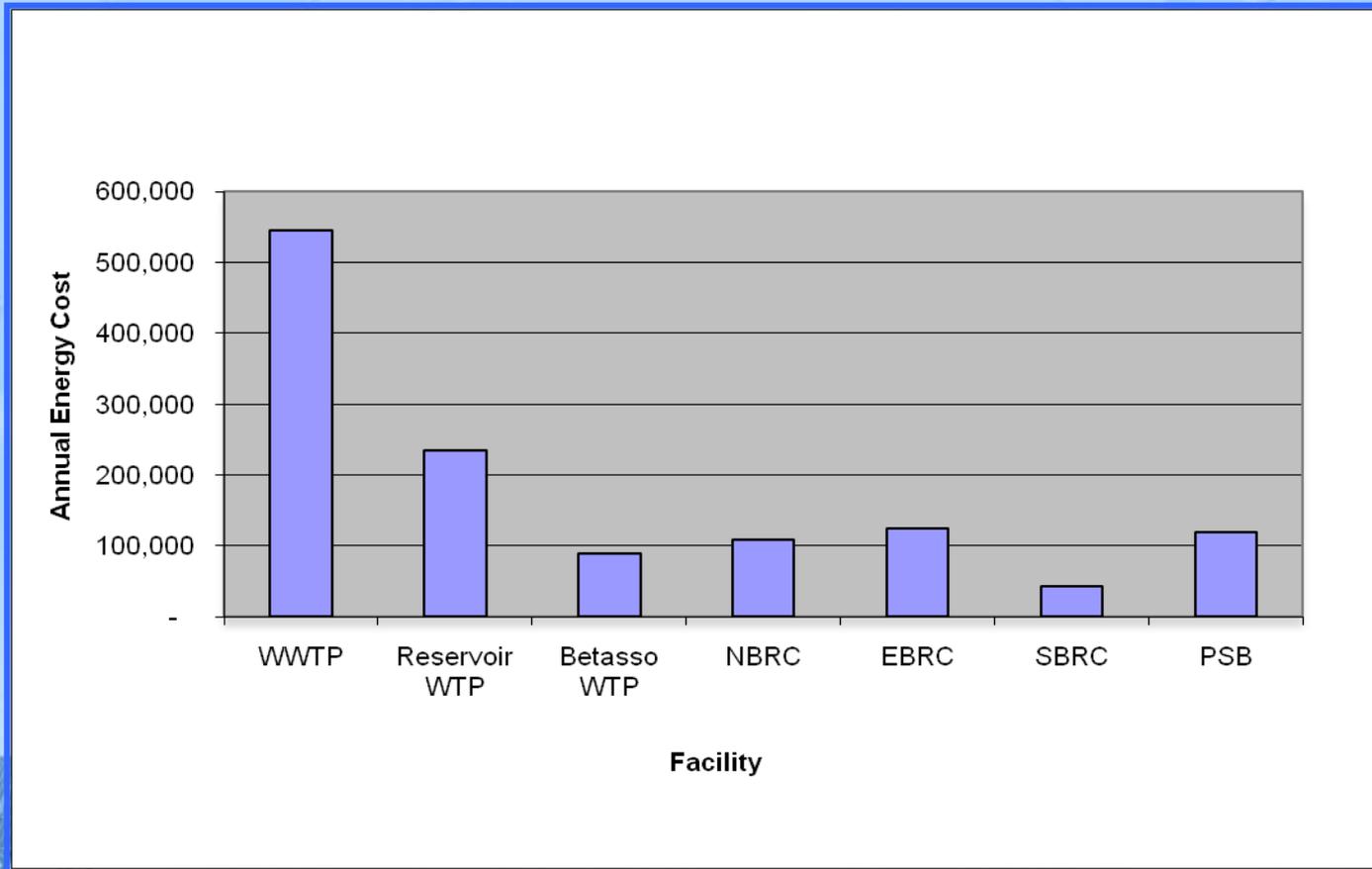
- WWTF Summary
- Source Power Summary
- Demands
- Energy Management
- Future Goals

# WWTF Summary



- Physical (mechanical) facility with microbiological and chemical treatment
- Secondary treatment with BNR activated sludge (nitrification and partial denitrification) and onsite solids treatment and dewatering
- 25 MGD capacity
- 1968 original facility – modified 2008 to activated sludge

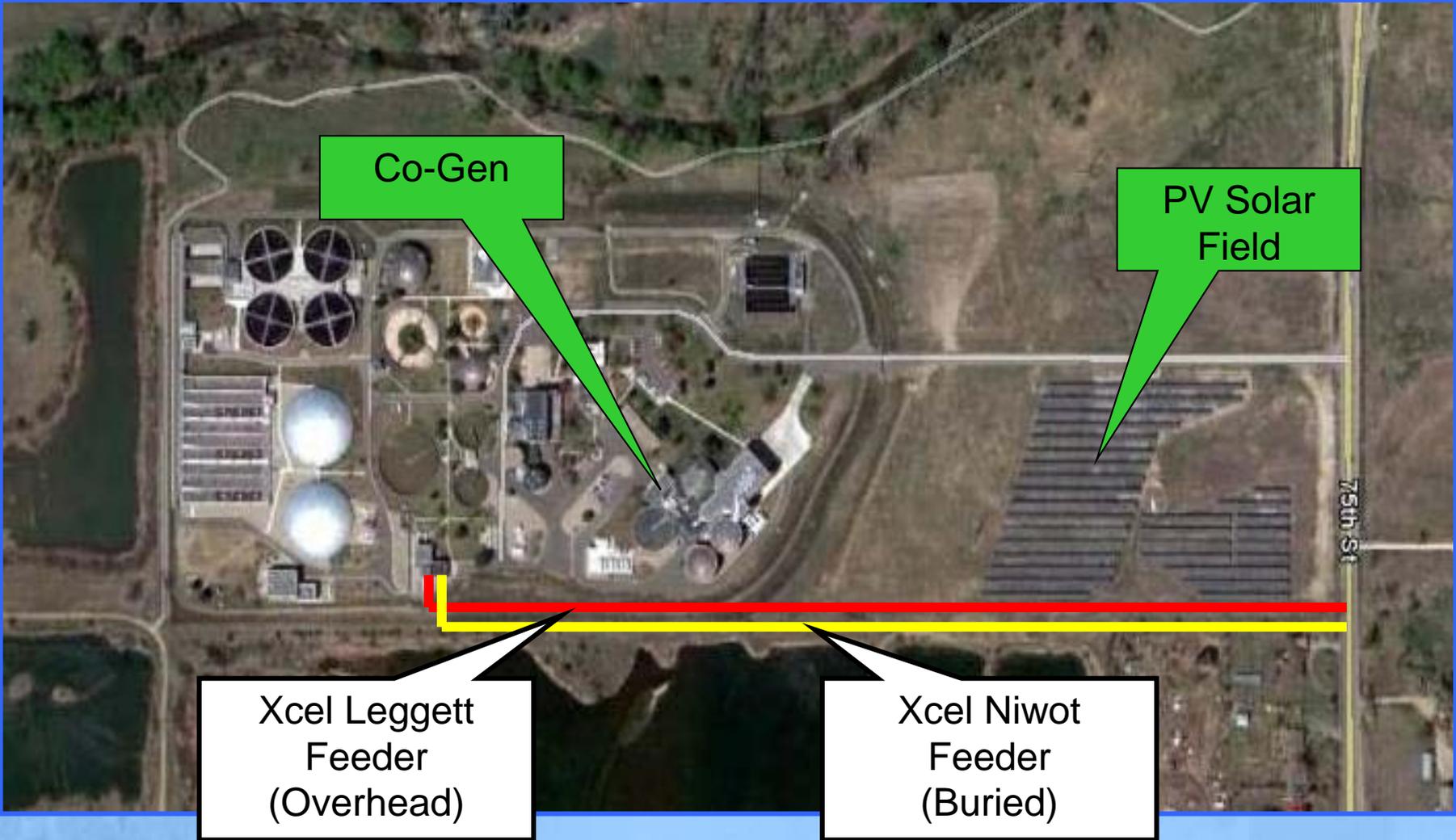
# City of Boulder Largest Facilities' Power Use



# Energy Use

- Approximately 30,000 kWh per day
- ~ 11,000,000 kWh annually
- Grid electricity expenditures of \$600,000 annually
  - → 10-15% of operating budget
- August 2011 – 13.2 MGD average
  - → 2,270 kWh / MG
  - → 0.002 kWh / gal

# Sources of Power



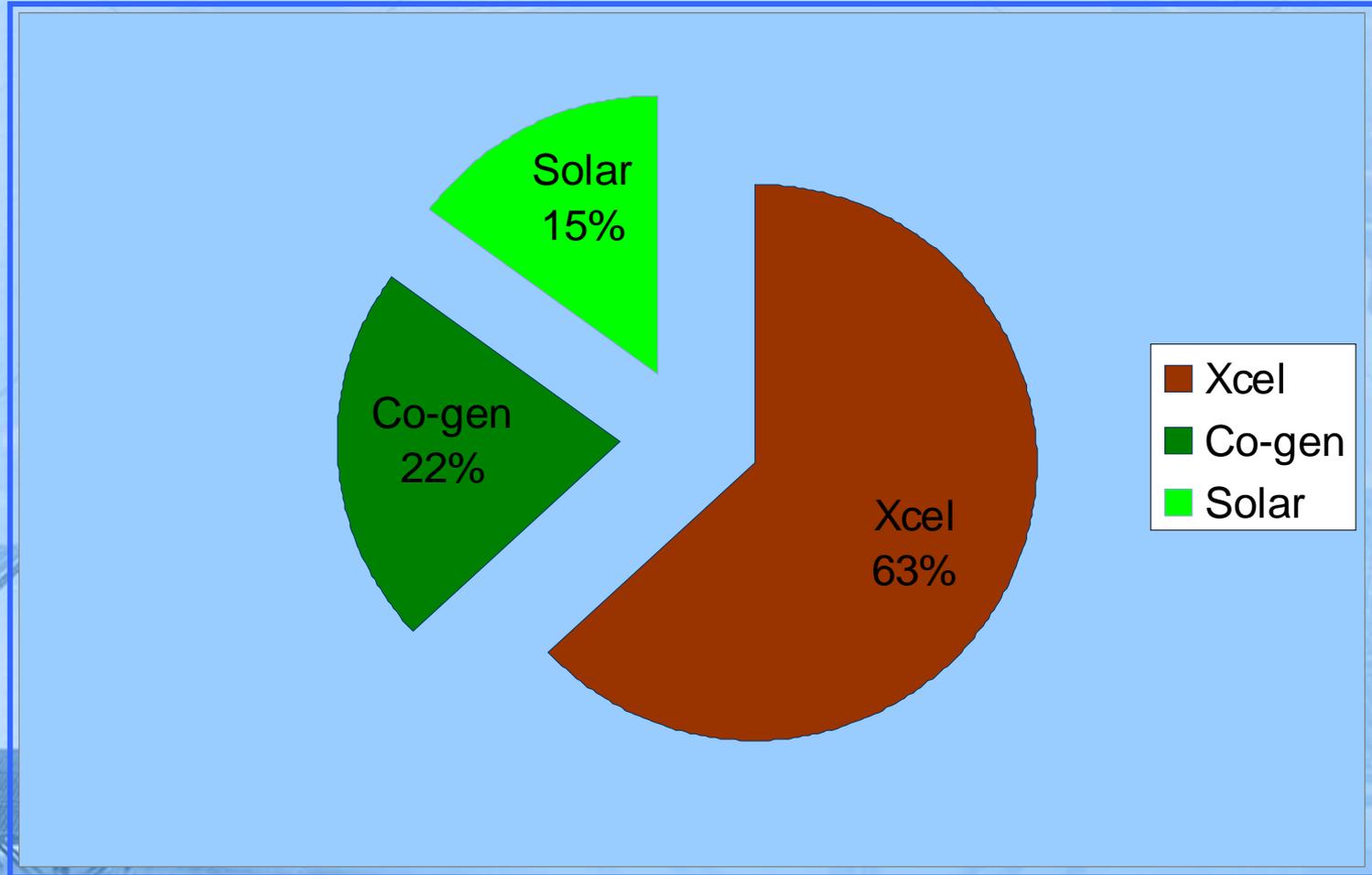
Co-Gen

PV Solar Field

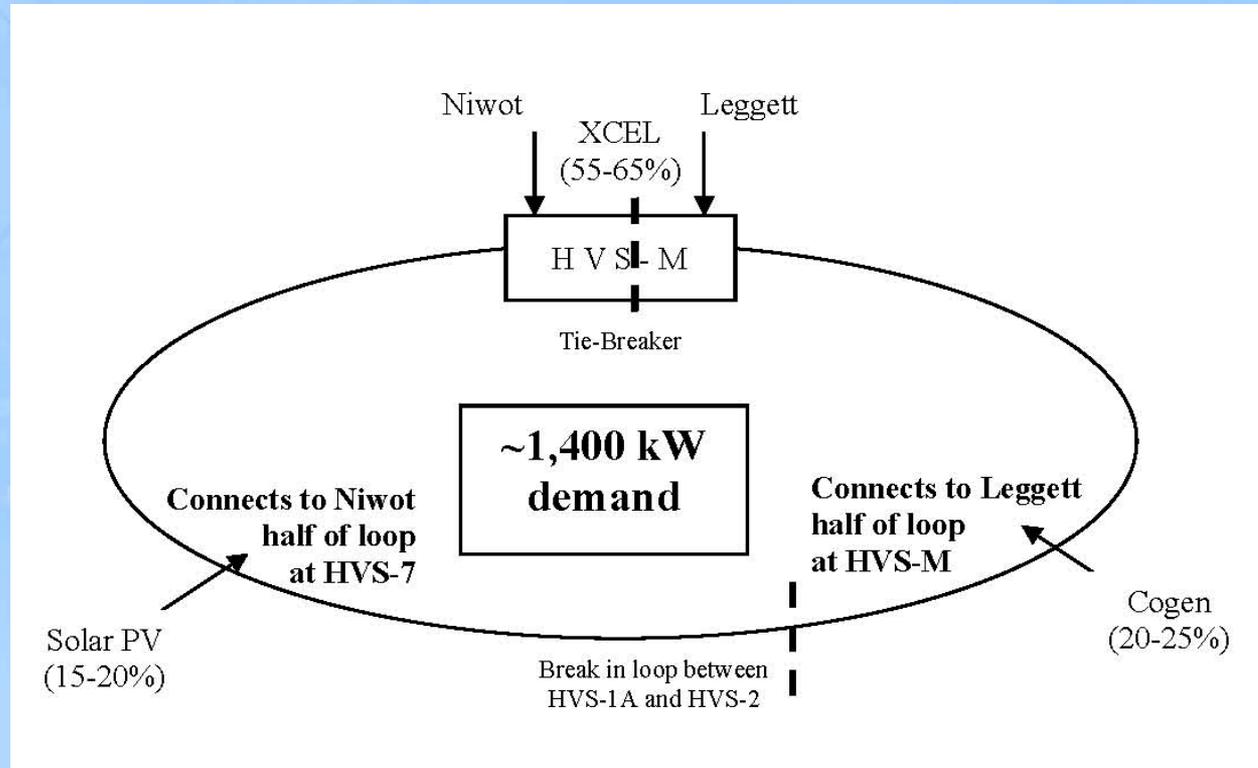
Xcel Leggett Feeder (Overhead)

Xcel Niwot Feeder (Buried)

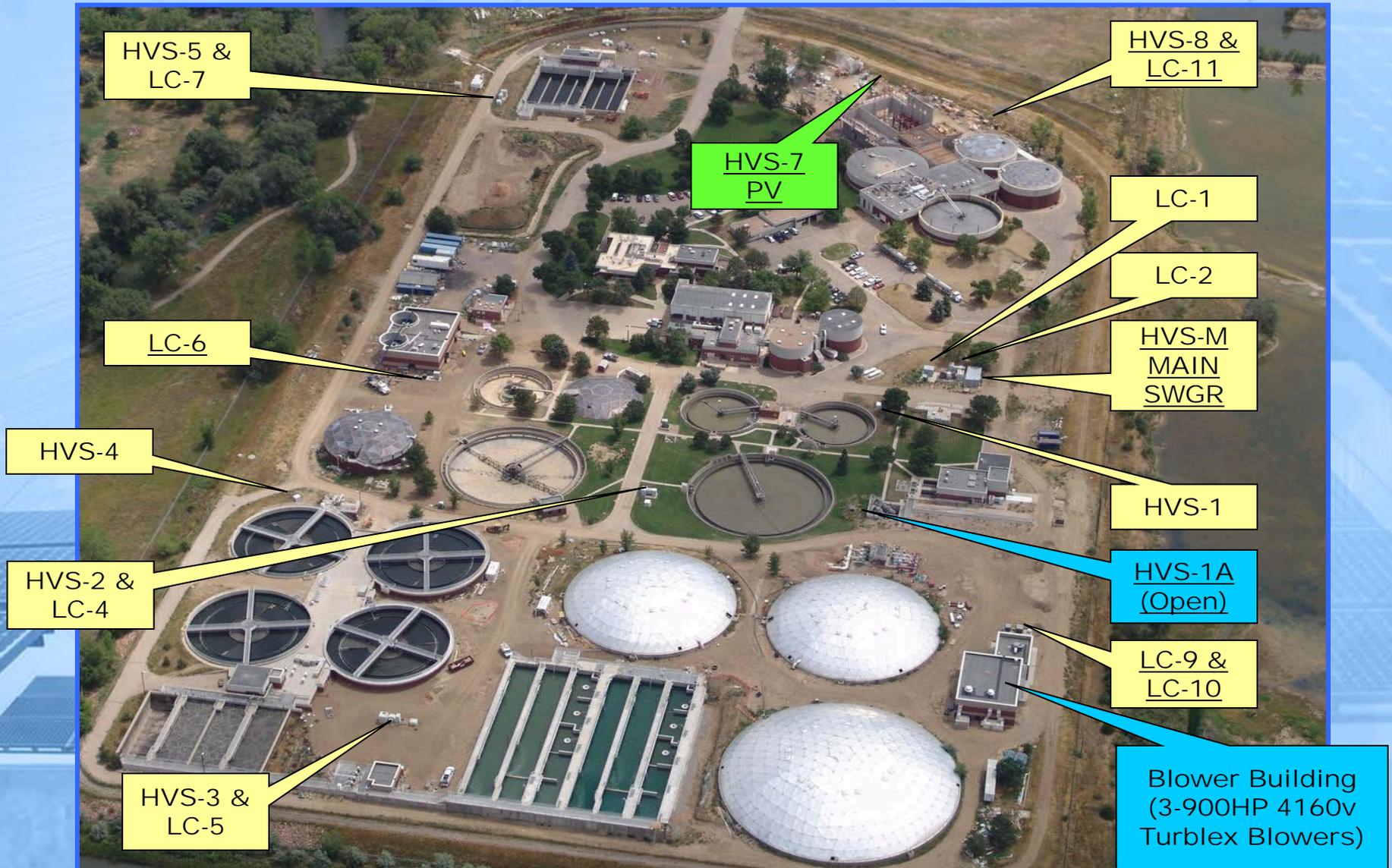
# Plant Power by Source



# Power Source Schematic



# 75<sup>th</sup> Plant Power Loop/Details



# Solar PV Facility



# Solar PV Facility Key Stats

- One Megawatt (DC rated) PV facility
- Ground mounted fixed angle (40 degrees) system
- 5 acres
- Operational in July 2010
- 1,500,000 kWh annually
- 15% of WWTF's annual power
- 2/3 of instantaneous power (~910 kW)
- DC / AC Derating factors



# Cogeneration Facility

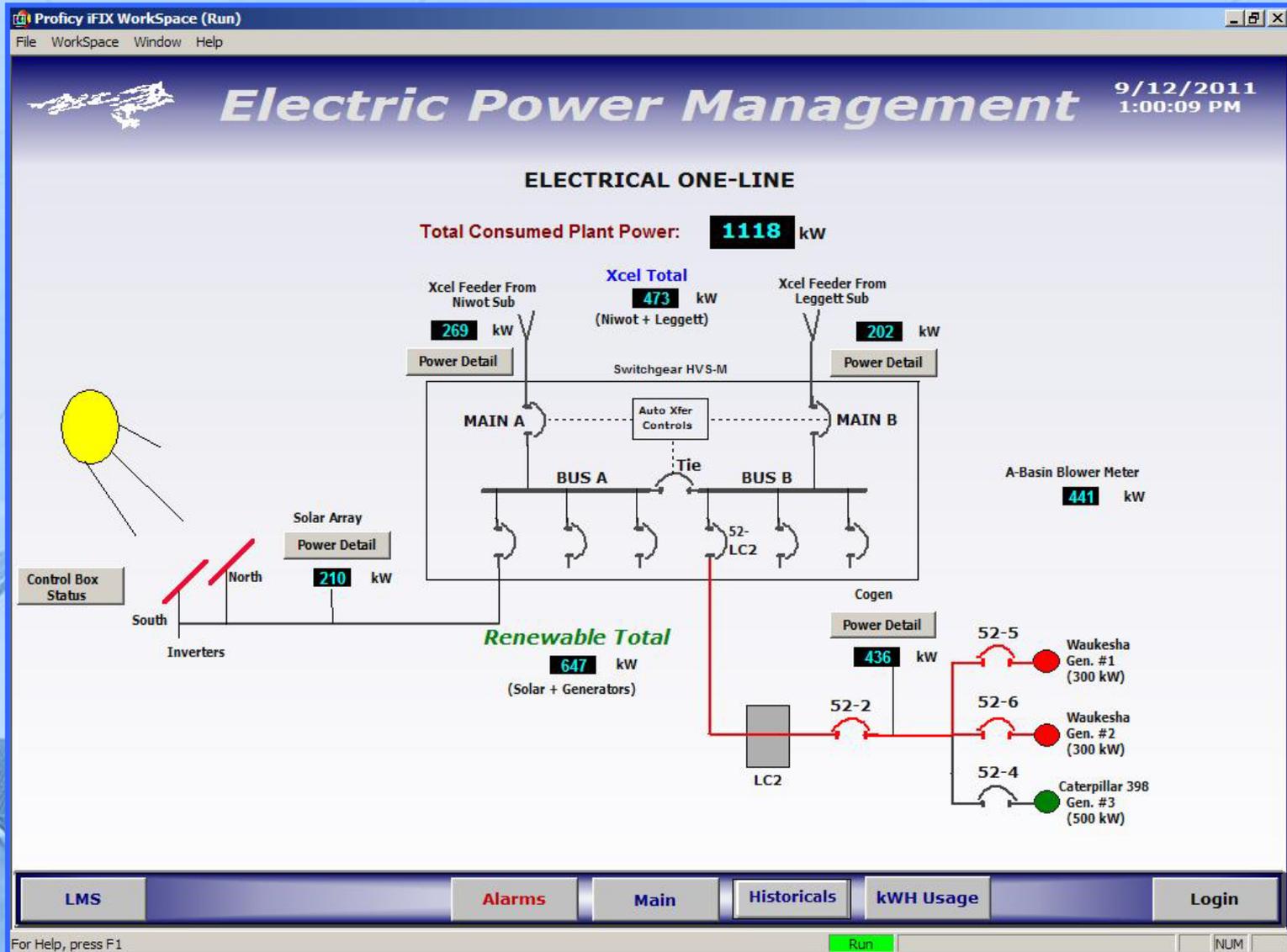
- Combined heat and power system (CHP)
- Operational in December 1986
- Two (2) 300kW engine generators
- One 500kW propane fired emergency generator (1968)
- 22% of WWTF's annual power
- Waste heat recovery for digester process heating and heating of 4 buildings



# Demands

1. Aeration Blowers – 900 hp motors  
*Energy efficiencies gained by  
turndown (~450 hp equivalent)*
2. Pumps – 150 hp and down  
*Install VFDs and automated  
control where possible*
3. Dewatering Process – only about 20-  
24 hours per week (1/7 of the time)
4. HVAC / lighting / computers / etc.  
minor in a relative scale

# Facility Power SCADA Screen

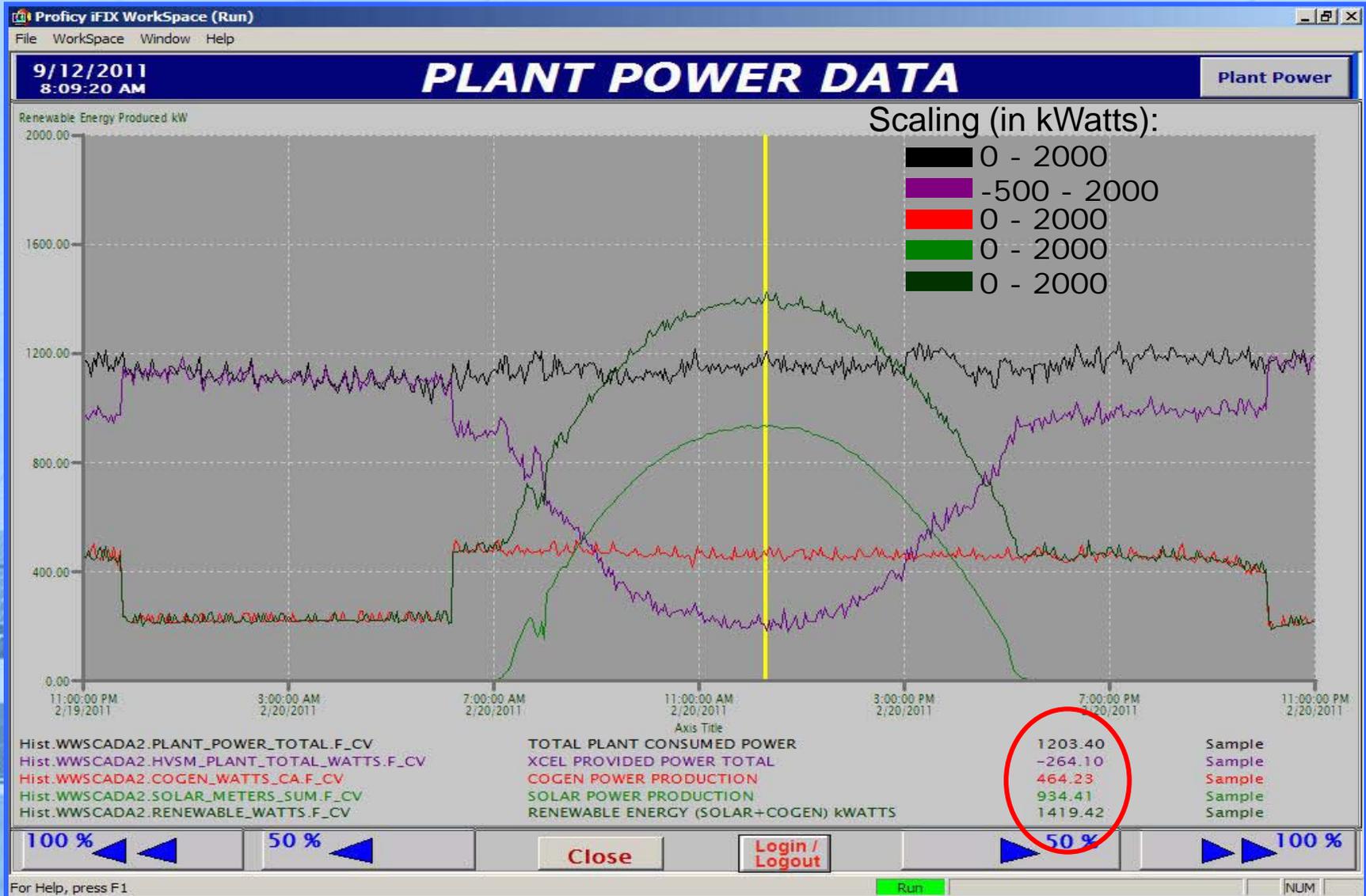


# Electric Power Usage Summary

## ***PLANT POWER kWH USAGE***

	Solar PV	CoGen	Niwot	Leggett	Total
<b>Today</b>	<b>1888</b>	<b>4082</b>	<b>6319</b>	<b>2919</b>	<b>15208</b>
<b>Sun. 3/6</b>	<b>2642</b>	<b>7593</b>	<b>11495</b>	<b>5560</b>	<b>27290</b>
<b>Mon. 3/7</b>	<b>551</b>	<b>5600</b>	<b>14452</b>	<b>7456</b>	<b>28059</b>
<b>Tue. 3/8</b>	<b>2516</b>	<b>6775</b>	<b>14540</b>	<b>6563</b>	<b>30394</b>
<b>Wed. 3/9</b>	<b>6574</b>	<b>7256</b>	<b>8888</b>	<b>6539</b>	<b>29257</b>
<b>Thu. 3/10</b>	<b>6418</b>	<b>7924</b>	<b>7368</b>	<b>6335</b>	<b>28045</b>
<b>Fri. 3/4</b>	<b>3306</b>	<b>7697</b>	<b>12537</b>	<b>5810</b>	<b>29350</b>
<b>Sat. 3/5</b>	<b>2714</b>	<b>6720</b>	<b>11554</b>	<b>6434</b>	<b>27422</b>

# “Text Book” Solar Production Day



# Future Energy Management Goals

- Expand Solar PV?
- Modify/upgrade cogeneration?
- Other renewables? Wind, low-head hydro?
- Demand management through shift in equipment runtimes
- Expand use metering at MCCs and process areas
- Load management system through SCADA, automated with alarms and/or load shed features
- Explore chemical and heat energy potential from raw wastewater? Fuel cells??

# Questions and Discussion

- Short, clarifying questions now...
- More in depth discussion at end...
- Thanks for listening!