

Agricultural Pumping Efficiency Program

A Multi-Purpose
Resource Management Program

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- ❑ M.S. Irrigation and Drainage
- ❑ Registered Agricultural Engineer in California
- ❑ 30 Years in Ag Water and Energy Management
 - Teaching at Cal Poly-San Luis Obispo & CSU Fresno
 - 10 yrs in Ag energy efficiency programs for PG & E
 - Irrigation scheduling and system design software
 - Non point source pollution reduction/control programs
 - Water conservation program design and implementation
 - Consultant to San Diego – IID-SDCWA water transfer
 - NSW, Australia – on-farm and irrigation district-level water management improvements
 - Program Manager – Ag Peak Load Reduction Program
 - Program Manager – Ag Pumping Efficiency Program

Center for Irrigation Technology...

- ❑ Hydraulic Laboratory Testing
- ❑ Applied Research
- ❑ Special Projects
- ❑ Education
- ❑ A part of:
College of Agricultural Sciences and Technology,
California State University at Fresno

Today's discussion...

1. What is the Ag Pumping Efficiency Program?
 - Funding and Administration
 - Goal and Objectives
 - Program Design (philosophical and analytical)
 - Components
 - Achievements

2. How people participate

Agricultural Pumping Efficiency Program...

A multi-purpose resource management program for:

1. Energy conservation
2. Water conservation
3. Air quality (as we expand to diesel-powered pumping plants)

Agricultural Pumping Efficiency Program...

- ❑ Funding through the Public Goods Charge under auspices of California Public Utilities Commission
- ❑ Operating in all four Investor Owned Utility areas in California – PG&E, SCE, SCG, SDG&E (electric or natural gas accounts)
- ❑ Total funding of about \$9.1 million since first award in June, 2002

Agricultural Pumping Efficiency Program...

- ❑ Overall Goal is ENERGY conservation

- ❑ Objectives are:
 1. Get efficient pumping plants in the field

 2. Make sure that all plants are managed correctly
(maintain efficiency and minimize WATER use)

- ❑ Target audience is ag and large turf irrigation, potable water, and tertiary-treated wastewater pumps

APEP Program Design...

Two concepts underlying APEP design:

1. Ag energy use is a non point source “type” of problem – (philosophical basis)
2. $\text{kwh/year} = \text{kwh/AcFt} \times \text{AcFt/Year}$
(analytical basis)

Ag energy use as a NPS-type...

- Diffuse – 86,000+ accounts in one utility (1997)
- Legal operation – yes
- Any one pump causing the problem - no
- Cumulative effect:
 - Electricity use for ag water pumping for one California utility in 1997 was in the range of 3 billion kWh/year (81% of total for ag sector).
 - Improve efficiency by 3% - save in the range of 90 million kWh/year for that utility alone. All things being equal (???)
 - Significant load-shifting/load-reduction will help avoid blackouts

NPS Slow to Evolve...

Generally not catastrophic, but predictable (most times)...

- ❑ The activities causing the problem are “entrenched” with large investments in:
 - Hardware
 - Management training/experience
 - Infrastructure
- ❑ Cultural environments may be established
- ❑ Certain benefit/cost structures may be established
- ❑ If entrenched, generally slow to disappear (not a “silver bullet” problem- long term effort needed).

NPS are Complex and Difficult to Fix...

- ❑ Difficulty in verifying that progress is being made.
- ❑ Political will/funding for long-term effort?
- ❑ Need to work with both Supply-Side and Demand-Side of problem
 - Supply-side – viable hardware, design and management techniques (PIER program) are available to the users (demand-side)

NPS program design – demand side...

On the demand side –

- ❑ NPS problems are substantially the result of management actions, either design or operational.
(Hardware is only as good as its management)
- ❑ Thus, if a NPS problem is to be fixed, there must be a change in management action - people have to change the way they think and act.

NPS program design...

There are generally three components...

1. **PROBLEM AWARENESS** - If management doesn't see a problem, or doesn't believe it is their problem, nothing will change.
 2. **SOLUTION AWARENESS** - If management sees the problem but doesn't see that there is anything that can be done, nothing will change.
 3. **RESOURCES** - However, even if management sees the problem and has a solution, nothing will be done unless resources (time, expertise, money) are available to implement the solution.
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NPS program designer responsibilities...

- ❑ **Problem awareness**
 - Identify the real (or priority) problem(s).
 - Address both hardware and management issues.

- ❑ **Solution awareness**
 - They must be economical and widely adaptable.
 - They must be complete (hardware and management).
 - They must not cause “re-directed impacts”.

- ❑ **Resources**
 - Engineering services
 - Low interest loans / outright grants
 - Trusted information/education

Implement sufficient marketing/outreach/education effort for all!!

APEP view – Energy and Water...

We've always seen the connection:

1. $\text{kwh/year} = \text{kwh/AcFt} \times \text{AcFt/year}$
(ENERGY)

2. $\text{Kwh/AcFt} = 1.024 \times \text{TotIDynHead} / \text{OvrlPmpEff}$
(good hardware = specific objective of APEP)

3. $\text{AcFt/Year} = \text{Ac} \times (\text{Etc} - \text{EfRain}) / (1 - \text{LR}) \times \text{IE}$
(good management = WATER = specific objective)

APEP offers...

- ❑ Technical Assistance (no site-specific engineering)
- ❑ Knowledge (systems approach)
 1. Know how to install an efficient pump
 2. Know how to maintain an efficient pump
 3. Know how much water needs to be pumped
 4. Know how much water has been pumped

Efficient Hardware

Good Management
- ❑ Subsidized pump efficiency tests (energy audit)
- ❑ Incentive rebates for pump retrofit/repair

APEP Achievements (6/02 – 10/05)...

- 7,000+ pump tests
 - About 500 tests remaining to end of 2005

- 449 pump retrofits
 - 18.9 million kwh approved
 - 390,000 therms approved

- 90 educational seminars (statewide)
 - Probably 5 more to end of 2005

Ag Pumping Efficiency Program...

How people can participate...

1. Attend an educational seminar (free)
2. Get a pump efficiency test (subsidized)
3. Apply for an incentive rebate for a pump retrofit (in range of 25-50% of project cost)

Participation – Educational Seminars...

The Mobile Education Centers are self-contained pumping plants that travel around the state.

They can demonstrate...

- Real-time pump efficiency test with computerized displays of performance
- Correct flow meter use
- Variable Frequency Drives
- Cost of inefficient pumping

Picture of MEC – a self-contained pumping plant consisting of a 28' gooseneck trailer, generator, water supply, pumps, VFD and standard motor controls, and valves

Participation – the Pump Test...

OPE – Overall Pumping Plant Efficiency

- ❑ OPE tells you how much usable energy you get from the energy you buy -
 - If the overall OPE is 50%, the other 50% of energy you paid for is wasted.
- ❑ We know achievable levels of OPE –
 - Thus, knowing OPE leads to an estimate of the benefit/cost of a pump repair.

Participation – the Pump Test...

Estimates of before and after repair pumping cost are on the report...

	EXISTING EFFICIENCY	IMPROVED EFFICIENCY	ESTIMATED SAVINGS
6. kWh/AF:	438	370	68.4
7. Estimated Total kWh:	77,134	65,095	12040
8. Average Cost per kWh:	\$0.16		
9. Average Cost per hour:	\$15.43	\$14.92	\$0.51
10. Average Cost Per Acre Ft.:	\$70.11	\$59.17	\$10.94
11. Estimated Acre Ft. Per Year :	176.0	176.0	
12. Overall Plant Efficiency:	43.7%	67.0	
13. Estimated Total Annual Cost:	\$12,341.52	\$10,415.13	\$1,926.39

– But since the cost of the repair is not known, no ability to do payback, rate of return, etc. on the report – but the owner can.

Participation – the Pump Test...

- ❑ Snapshot of the pumping plant at the operating condition(s) tested

- ❑ More helpful if:
 - You have original specifications and pump performance curve
 - Done on a regular basis
 - Done at normal operating conditions (testing a well in winter?)

Participation – the Pump Test...

- ❑ Contact a Participating Pump Test Company:
 - Visit the web site
 - Call us
 - Call your local pump repair company

- ❑ Arrange for test with the Test Company

- ❑ Test Company takes care of paperwork, we pay the Test Company directly

Participation – The Pump Test...

- Basic policies:
 - MUST use a Participating Pump Test Company
 - One test every 23 months for electric (11 mo for gas)
 - Won't retest if pump has previously been tested at <30% (20% submersibles, 6% gas) OPE
 - No subsidy if test is for a real estate transaction or result of mandate from government or quasi-government agency

- You will have to sign an Access Agreement and the Record of Test

- We subsidize tests. In rare cases you may have to contribute – know cost before-hand

Participation – the Incentive Rebate...

- ❑ Basic policies for eligible retrofit projects...
 - Must be a working pump
 - Must have pump tests before (20 months) and after (4 months) project
 - Motor/engine or gearhead repair or retrofit are ineligible projects
 - Well rehab is OK but with pre- and post-tests within 1 month with rebate based on reduction of drawdown
 - No changes in operating condition (i.e. no rebate for a flood to drip irrigation conversion)

Participation – the Incentive Rebate...

- Basic policies continued...
 - No rebate for construction/finish of a new well
 - No rebate for simple impeller adjustment
 - Cannot deal with multiple pump projects (see your account rep.)

- You choose the pump repair company

- Can make application before or after the project (turf – projects started after May 1, 2004; municipal potable/tertiary-treated started after May 16, 2005)

Participation – the Incentive Rebate...

Two ways of calculating rebate – most common...

1. Multiply last year's energy use by 25%
2. Multiply that number by \$.10 (\$.65 if gas)

Example with 100,000 kwh/year

1. $100,000 \times .25 = 25,000$ (assumed kWh savings)
2. $25,000 \times \$.10 = \$2,500$ incentive rebate

Grants capped at 50% of project cost - we are generally in 20-30% range – unless high HP, high usage

Alternative Method for Grant Calc...

- Used when pre-test shows an OPE of 50% or greater

$$\text{Grant} = .10 \times (\text{Annual kWh} - (\text{Annual kWh} \times \text{OPE}_{\text{pre}} / \text{OPE}_{\text{post}}))$$

Used mostly with agency/district pumps with high usage
(economical to repair at higher OPEs)

Participation – the Incentive Rebate...

1. Fill out application and submit with:
 - i. Copies of utility bills for last 12 months
 - ii. Copy of pump test before the project

2. We review and issue Letter of Approval

3. When project is complete you send:
 - i. Copy of an invoice marked PAID
 - ii. Copy of the after-project pump test

4. We send you the check

APEP in Summary...

A fully-integrated energy efficiency program for water pumping in California – offering...

1. Education – using Mobile Education Center
2. Technical Assistance
3. Subsidized pump efficiency tests
4. Incentive rebates for pump retrofit/repair

APEP Advantages...

Address multiple resource management problems with 1 program:

1. Energy – good hardware, good management
2. Water and water quality – management includes improved water use efficiency
3. Air quality – funding from two sources (EPA and Valley CAN) for pilot projects to extend into diesel-powered pumping plants
(To the extent that there are inefficiencies in the pumping plant or operation, runtime is increased and thus emissions are increased)

APEP Advantages...

- ❑ Leverages available resources (multi-agency funding)
- ❑ Reduces confusion in the field (one program)
- ❑ Trusted information source (non-profit, public service Center for Irrigation Technology @ CSU, Fresno)
- ❑ Helps to minimize redirected impacts (we see, and are “authorized” to use funding in addressing, all areas)

Ag Pumping Efficiency Program...

WWW.PUMPEFFICIENCY.ORG

(Especially the current Policies and Procedures and the list of Participating Pump Test Companies)

APEP

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