Considerations in Evaluating Efficiency Programs in the Agriculture Sector

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Introduction to CWEE

Advance water management solutions for the integrated savings of water & energy resources
Deemed savings values
*tipulations based on historical & verified data*

**Measurement & Verification (M&V)**
a *project-by-project approach involving estimating energy and/or demand savings*
- Retrofit Isolation
- *Whole Facility* billing regression analysis
- Calibrated Simulation (e.g., EnergyPlus)

**Large-scale consumption data analysis**
*uses metered energy use data to compare the energy use of the program participants with the energy use of a control group*

Farm Sites in Research Study
Agricultural Electricity

Agricultural Accounts
- PG&E ~ 13,300 meters
- SCE ~ 3,400 meters

In Total:
~ 1,900,000 billing records
~ 450,000,000 hourly kWh records
Challenges

Data availability:
- Groundwater extraction
- Crop production levels
- Operational changes

Regional long term trends, which are driven by external factors:
- Drought
- Groundwater levels
- Crop transitions
Irrigation Pump Rebate Programs

Can efficiency program savings be identified using a simple, pre-post comparison?

→ Yes, but estimated savings are unreliable in small sample sizes
Behavior-based Programs

Additional Challenges
• Expected savings are small (<10%)
• Impossible to isolate
• Causal attribution is difficult

Control Group Comparison
• Matching methods used to identify similar control group (using baseline data)
• Panel data regression model used to incorporate longitudinal (over time) variation and cross-sectional (between farm) variation
Behavior-based Programs

- Smaller savings require larger samples sizes to identify.
- Power calculations are illustrated, given the observed variation and selected model.

→ Larger sample sizes (more participating farms) are needed for these types of studies.

![Graph showing power calculations for different savings levels with varying sample sizes.](image)
Conclusions

Technology retrofit programs
• Pre-post comparisons (using retrofit isolation, or whole facility billing regression analysis) are possible, given access to the appropriate data
• An alternative is to carefully aggregate billing/consumption data regression analysis from many retrofits & farms

Behavior-based efficiency programs
• Large-scale consumption data analysis with a control group is the best approach
• Ideally designed as Randomized Controlled Trial (RCT)
• If RCT was not planned for, quasi-experimental approaches are possible
• In either case, control group meter data is required
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