



# Irrigation Efficiency

## Deschutes SWCD workshop #2

July 21, 2022

# About us

Independent  
nonprofit

Serving 1.6 million customers of  
Portland General Electric,  
Pacific Power, NW Natural,  
Cascade Natural Gas and Avista

Providing access  
to affordable  
energy

Generating  
homegrown,  
renewable power

Building a  
stronger Oregon  
and SW  
Washington

# 18 years of affordable energy

From Energy Trust's investment of \$1.5 billion in utility customer funds:



**Nearly 660,000 sites** transformed into energy efficient, healthy, comfortable and productive homes and businesses



**10,000 clean energy systems** generating renewable power from the sun, wind, water, geothermal heat and biopower



**\$6.9 billion** in savings over time on participant utility bills from their energy-efficiency and solar investments



**20 million tons of carbon dioxide** emissions kept out of our air, equal to removing 3.5 million cars from our roads for a year

FIND YOUR  
**ENERGY  
SOLUTION**



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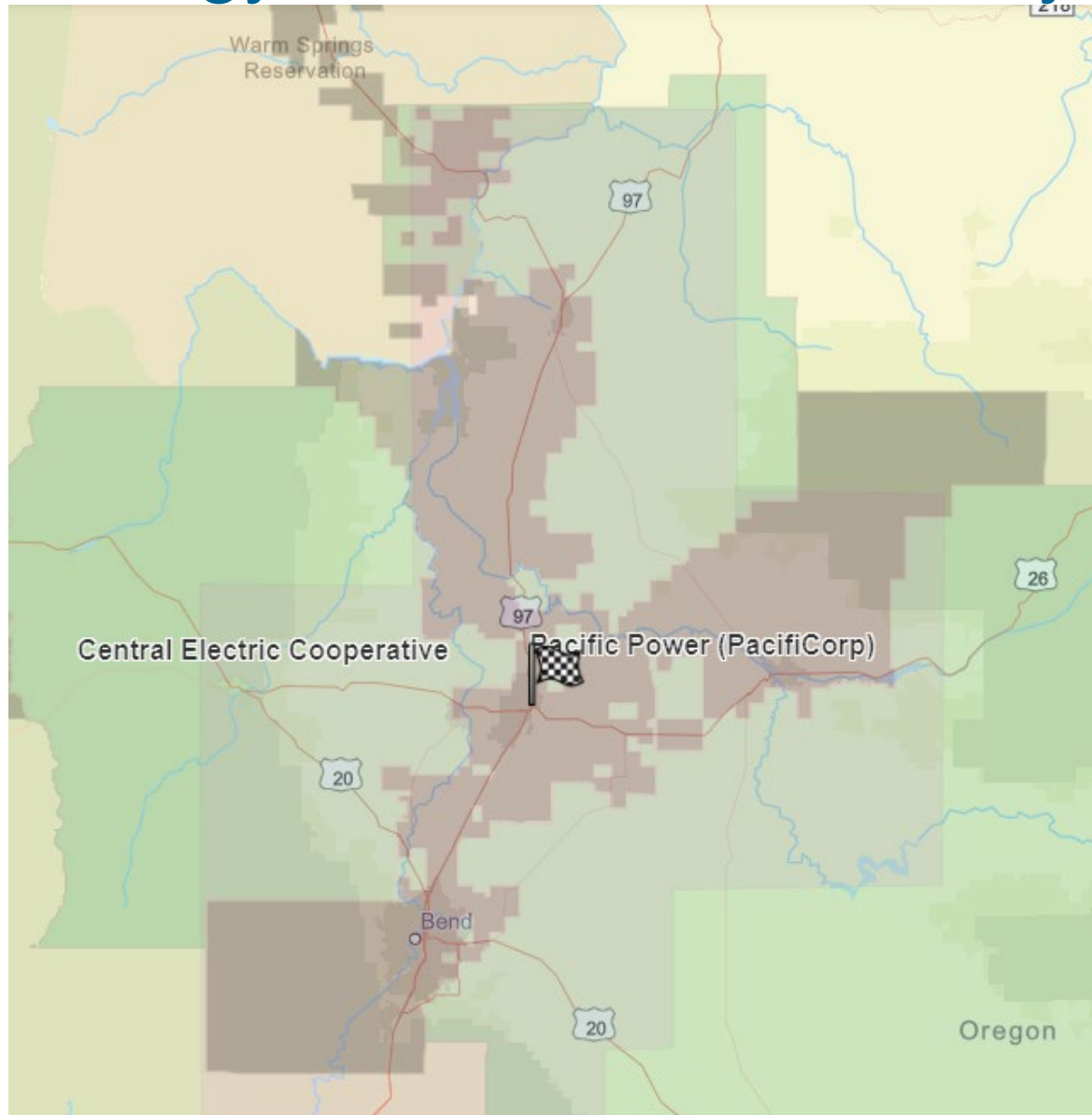
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**RENEWABLES**

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# Energy Trust Service Territory



# Calculated Incentive Process



We are always there to help guide you through the process.

# Two types of incentives:

## 1. Calculated Incentives

- Incentive proportional to energy savings
- Must sign incentive offer before ordering or purchasing anything

## 2. Rebates

- Prescriptive incentives (e.g. \$ per unit)
- Send in rebate form and receipt within six months and same year as purchase

If you're unsure, call us before you purchase!



# Pump Power/Energy



# Understanding Demand Charges

What the differences are between  
power demand and usage and how  
to save \$\$\$.



CENTRAL ELECTRIC  
COOPERATIVE, INC.

# First, a Little About CEC

- We are a customer/member owned electric cooperative. We exist to serve our member's needs to provide safe, reliable and affordable power.
- We serve 5,300 square miles of the mostly rural areas of Deschutes, Crook Jefferson, Grant, Linn, Wasco and Lake counties.
- We serve nearly 30,000 members/customers with over 37,000 meters. About 8% of our power load is used by irrigation, or enough to power over 3,700 homes.
- We have three offices; our headquarters in Redmond, with the other two in Bend and Sisters.



# What is Demand? (kW)

The easiest way to think about demand is like the speedometer on a car. Speed does not equal mileage. Just because you are going 60 mph doesn't mean you have traveled 60 miles.

- At CEC demand is measured for the highest 15 minute demand on a meter. Demand charges are not unique to CEC.
- It resets every billing cycle (month) to zero.
- It does not matter how many times a pump is turned on or off, we only record the maximum demand for the month whenever it happened.



# What is Energy Usage? (kWh)

Using the same analogy, energy usage is like an odometer. It records how many miles you have gone regardless of the speed you went.



- If you want to travel 20 miles whether or not you go 20 mph or 120 mph you are still only traveling 20 miles.
- If your pump is running when you don't need it you are incurring more cost than is necessary.



# Demand Examples

Example 1: Running a 20 kW load continuously for 50 hours would result in usage of 1,000 kilowatt hours (kWh) and have a demand charge of 20 kW.

$20 \text{ kW} \times 50 \text{ hours} = 1,000 \text{ kWh}$ . Demand = 20 kW.

Example 2: Running a 2 kW load for 500 hours would also result in usage of 1,000 kWh but would only have a demand of 2 kW.

$2 \text{ kW} \times 500 \text{ hours} = 1,000 \text{ kWh}$ . Demand = 2 kW



# Demand Examples – CEC Rates

Example 1:

$$20 \text{ kW} \times \$6.37 = \$127.40$$

$$1,000 \text{ kWh} \times .0502 = \$50.20$$

$$\text{Total} = \$177.60$$

Example 2:

$$2 \text{ kW} \times \$6.37 = \$12.74$$

$$1,000 \text{ kWh} \times .0502 = \$50.20$$

$$\text{Total} = \$62.94$$



# How to Reduce Your Bill

- If your pump goes on and off during the month then the demand charge is recorded once. Turning your pump on and off is **NOT** going to increase your demand charge further. Turn off your pump so you don't accumulate more power usage charges than is needed.
- Looking into variable frequency drives if you don't run at full capacity all the time on the pump. We have an incentive to install one!
- Downsizing your pump if it is oversized. If you buy a new one we also have an incentive for that.
- Lastly, timing of testing your irrigation system and bill cycles.



# Power and Energy Takeaways

- Charges for power and energy depend on utility and rate schedule
  - Pacific Power charges for demand similarly to CEC
- Starting pump will not necessarily increase demand charge
- Reducing power draw will help
  - Stagger operation of large draws
  - Reduce overall power draw
- How to save energy (and \$)
  1. Reduce power, or
  2. Reduce operation hours





# Pump Upgrades

- Save energy
  - Variable frequency drive (VFD)
  - Reducing hp (downsize, consolidate, trim impeller)
- Energy/ water savings depend on capacity control
  - Often throttle or bypass
  - Sometimes excessive irrigation



# Variable Frequency Drives

- AKA VFDs, variable speed drives
- How they work
  - Slow pump down
  - Maintain pressure needed
- No more throttling or flow bypass
- Maybe no more turning pump on/off between sets
- Acts like soft start



# Variable Frequency Drives (cont.)

- Good for:
  - Variable flow rates/pressures
    - Many lines
    - Variety of irrigation equipment
  - Oversized pump
    - Generating more pressure than necessary
    - System change?
- Less ideal for:
  - Single pump operating point
  - Pump very well sized



# Irrigation System Efficiency

# Water Application Efficiency

- Water wasted because of
  - Evaporation
  - Runoff
  - Blow-off
  - Over-irrigation
  - Uneven distribution
- Higher application efficiency
  - → Less water pumped
  - → Pump energy savings



# Flood Irrigation

- Application efficiency ~25-80%
- Many different methods
- May not require pumping



# Water Cannon/ Big Gun

- Application efficiency ~60%
- Relatively inexpensive and relatively inefficient
- Wide variety of
  - Area covered
  - Pressure required
  - Flow required
- Can utilize a traveler with booster pump
  - Historically gasoline or diesel powered
  - Solar powered available



# Wheel Line, Handline, Solid Set

- Application efficiency ~65%
- Typical baseline for region (my observation)
- Efficiency ideas
  - Be sure to fix leaks and replace components (~5 years)
  - Can replace impact sprinklers with rotating-type
    - Lower pressure required
  - Solar powered wheel line movers available
    - Historically gasoline powered





# Pod Irrigation

- Application efficiency ~75%
- Lower pressure than wheel line/handline
- Ideal for pasture
  - Hay?
- Energy Trust incentives!



# Pivot, Linear

- Application efficiency ~85% with standard sprinkler package
- Considerations
  - Relatively expensive
  - May need infrastructure change (power lines, bridges)
  - Wheel tracks
  - Crop yield increase
  - Labor savings
- Energy Trust incentives!



# Pivot, Linear (continued)

- Pivots
  - Ideally include booster pump for end gun
  - Flow requirement will vary with corner arm and/or end gun
- Linears
  - Often utilize diesel generator
    - May be able to use grid electricity or solar
- Efficiency ideas
  - Be sure to fix leaks and replace components (~5 years)
  - Ensure end gun turns off when not needed
  - Implement LESA/LEPA





# Precision Irrigation

## LESA

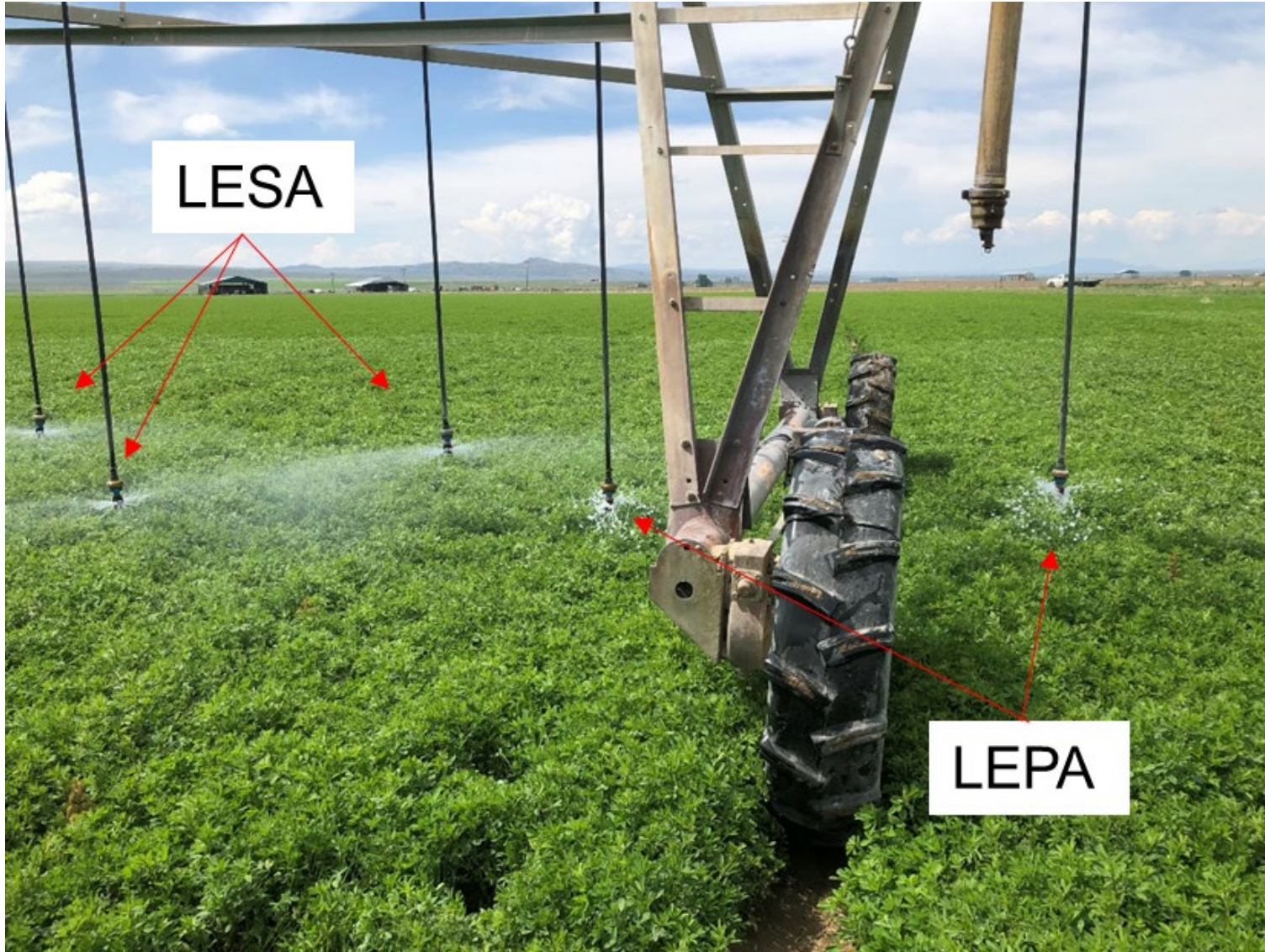
- Sprinklers at or under canopy
- Lower pressure (6-10 PSI)
- Higher application efficiency
- Requires additional sprinklers

## LEPA

- Water applied directly to ground
- Even lower pressure
- Even higher application efficiency
- Runoff or erosion may occur, can be addressed with furrow diking or speeding up



# LESA/LEPA



# Mobile Drip or "PMDI"



# LESA/LEPA/Mobile Drip Incentives

## Rebates

- Converting existing pivot /linear
- Rebate is per sprinkler drop
- Increased rebate amounts if VFD on pump

## Calculated Incentives

- Can include LESA/LEPA as part of new pivot or linear upgrade
- Combined incentive proportional to overall estimated energy savings



# Drip, Micro-sprinklers

- Application efficiency ~95%
- Very low pressure/flow required
- Requires filter station
- Crop yield increase
- Typically for row crops
  - Has been used in hay fields
- Energy Trust incentives!





# Efficiency Comparison of Irrigation Systems

Irrigation System Type	Application Efficiency	PSI	Annual Energy Cost
Big gun / hard hose traveler	60%	100	\$7,700
Wheel line / handline / solid set	65%	70	\$4,325
<b>Pivot / linear</b> (calculated incentive)	<b>85%</b>	<b>60</b>	<b>\$3,150</b>
<b>Drip irrigation / micro-sprinklers</b> (calculated incentive)	<b>95%</b>	<b>35</b>	<b>\$1,645</b>

# Scientific Irrigation Scheduling (SIS)

Using soil moisture data to irrigate only when needed

Past offering:

- \$3.22 / acre
- Incentive each year for 3 consecutive years
- Work with a specialized vendor

**We are working to improve this measure!**

Coming soon:

- Incentive proportional to actual energy savings
- Expanded scope

# Mainline upgrades

- Replace above ground with buried PVC
- Increase diameter
- Pump should have VFD



# On-farm Energy Assessments

# ODOE Energy Assessments

- Available anywhere in Oregon
  - Can help connect with Energy Trust or other utility incentives
- ODOE administers program
- Helps identify energy efficiency and renewable opportunities
- Available for ag producers or other rural small business
- Stop by our booth or contact us after show
- First step: submit interest form online

# Oregon Department of Energy and Energy Trust

Energy Efficiency and  
Renewable Energy  
Assistance for Oregon  
Farms & Ranches



## Tom Elliott

*Outreach Manager  
Industry + Agriculture*

[Tom.Elliott@Energy.Oregon.gov](mailto:Tom.Elliott@Energy.Oregon.gov)

503-428-0726

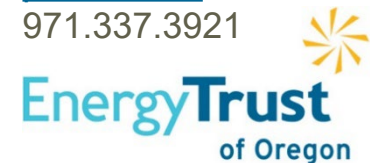


## Jessica Arnold

*Outreach Manager  
Industry + Agriculture*

[Jessica.Arnold@vim-pacific.com](mailto:Jessica.Arnold@vim-pacific.com)

971.337.3921



# Thank you!

**Brad Moore**

[brad.moore@cascadeenergy.com](mailto:brad.moore@cascadeenergy.com)

Direct: 503-837-2087



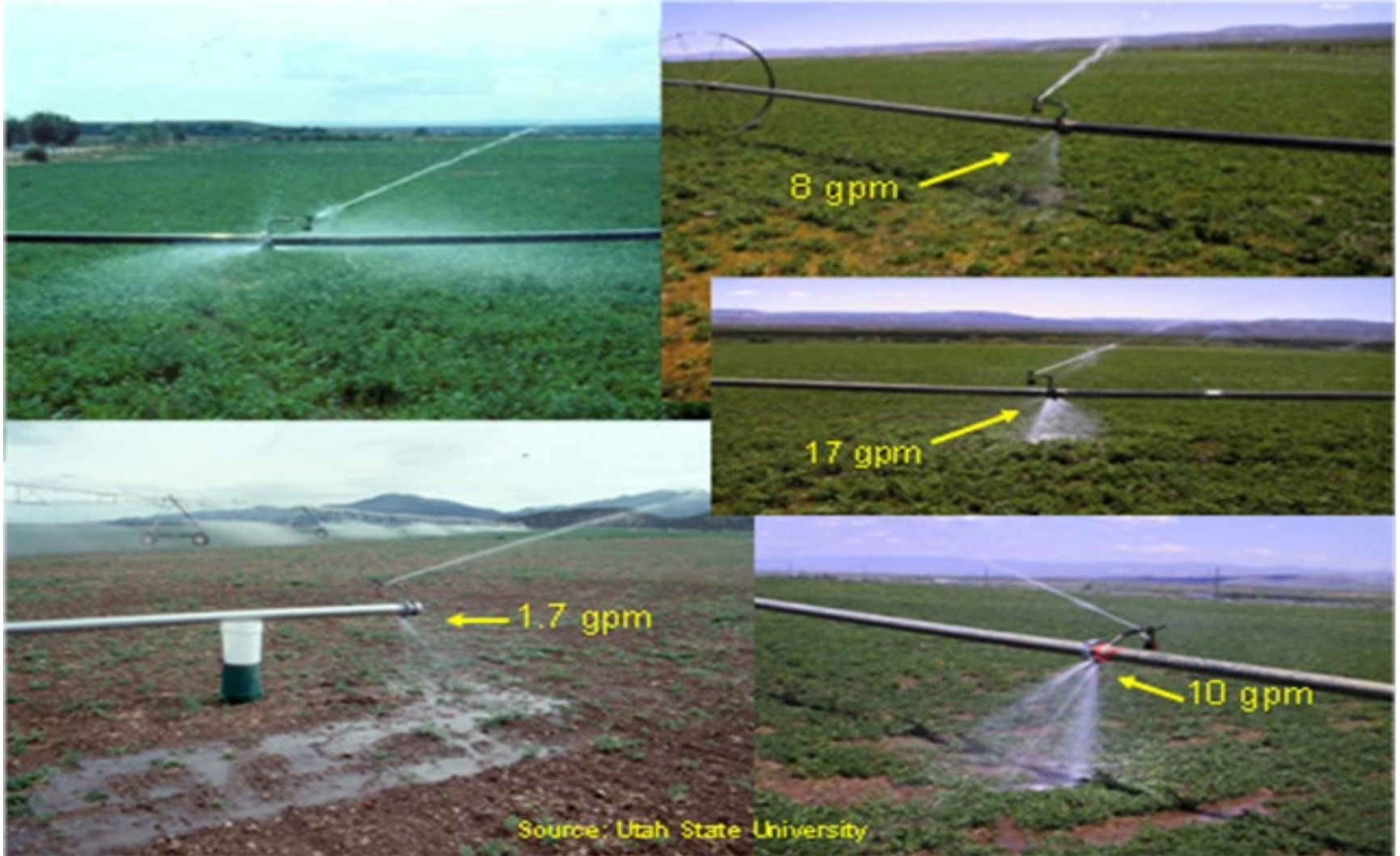
# Irrigation Efficiency

## Where is energy wasted in irrigation?

- Pumping excess water
  - Leaking pipes, drains, gaskets
  - Worn out nozzles
  - Low application efficiency (water not reaching root zone)
  - Over irrigation



# Irrigation Leaks – hand lines, wheel lines, mainline



# Irrigation Leaks – pivots and linears



# We can help you fix those leaks!

- **Rebates** for wheel line, handline, or mainline:
  - Sprinklers (impact or rotating-type)
  - Nozzles (regular or flow-controlling)
  - Gaskets
  - Drains
  
- **Rebates** for pivots or linears:
  - Goose necks
  - Drop tubes
  - Low-pressure regulators
  - Sprinklers
  - Multiple-configuration nozzles

# Irrigation Efficiency

## Where is energy wasted in irrigation?

- Pump working harder than it needs to
  - Flow bypass valves
  - Throttling valves
  - Larger pump than needed
  - Small diameter pipes & fittings

# Pump VFDs

## Quick summary

- VFDs installed on 125 and 100 hp pump
- \$4,400 per year cost savings
- \$15,000 cash incentives from Energy Trust
- Energy Trust incentives covered 43% of total cost



## Rajnus Seed, Klamath Falls

ESTIMATED ANNUAL SAVINGS: \$11,000

The 800-acre Rajnus Seed family farm in Klamath Falls has worked with Energy Trust on several energy-saving upgrades which are helping them to reduce labor hours and save money. Most recently the farm installed two new irrigation pumps with variable frequency drives, VFDs.

The new 125 horsepower and 100 horsepower pumps with VFDs are “saving a bunch, energy wise” says owner George Rajnus - an estimated \$4,400 in annual energy costs. For the project the farm received about \$15,000 in cash incentives from Energy Trust, or approximately 43 percent of the project cost. Rajnus plans to continue working with Energy Trust to uncover additional opportunities to reduce energy use.

# Pump consolidation and VFD

## Quick summary

- Replaced three pumps with one with VFD
- \$6,700 per year cost savings
- Rebates for drains, gaskets, nozzles, and pipe repair



## Fox Hollow Ranch, Madras

ESTIMATED ANNUAL BILL SAVINGS: \$6,700

Time equals money for Fox Hollow Ranch, a family business that produces carrot seed, bluegrass seed and peppermint oil. Located in Oregon's high desert, all 600 acres require irrigation, an arduous task until Energy Trust helped Fox Hollow replace three irrigation pumps with a single 125-horsepower pump and variable frequency drive. The new technology automatically adjusts pump speed to optimize pressure and water flow requirements, saving the ranch approximately \$6,700 in annual energy costs while also reducing water use.

And the benefits don't stop there. Depending on the weather and season, Fox Hollow runs anywhere from three to 20 lines off its main irrigation pipe. "Before, we spent a lot of time determining which pump to use when," said Nancy Richards, co-owner of Fox Hollow Ranch. "Now the variable frequency drive does that for us, making the job easier, quicker and safer for employees."

Several years ago, Energy Trust provided cash incentives to help the ranch replace drains, gaskets, nozzles and leaking pipes, and schedule irrigation to optimize the frequency and duration of watering crops.