Micro Hydro Power from an Irrigation System

Pacific Ag Show 2013
Micro Hydro Basics

- Use excess pressure head or high flow to generate electricity
- Converts energy that would be wasted into “green” energy
- Can substitute for a pressure reducing valve
- A micro hydro system will convert mechanical energy into electrical energy
Micro Hydro and Irrigation

• Gravity fed Irrigation system often have excess pressure
• Normal method of dealing with excess pressure is to release it
• Excess pressure can be a resource
• BC ideal for this type of power production
• High capital costs, low electricity rates, seasonal operation, reduce feasibility
Micro Hydro Equipment

• In general, micro hydro are custom setups

• Different turbines, generators and electrical setups based on conditions

• MH Experts in BC and Washington
Economics

• Typically, most micro hydro systems are not economically viable

• Economics are better if you don’t have access to grid power

• Economics improve as hydro rates increase
Other Factors

• Fisheries
• Water power licensing (can take years)
• BC Assessment
• Insurance
• Interconnection Agreements
Net-Metering

- Allows micro hydro connection to grid
- 50 kW and less (subject to change)
- Excess power paid at 9.99¢/kWh
- Design must be approved by BC Hydro
General thoughts

• Plan your project well
• Try to account for all possibilities
• If serious, engage an experienced supplier
• Costs can quickly spin out of control
• Not generally a money maker
• Ranch with gravity fed irrigation system from two streams

• Several kilometers of existing pipeline (some replaced in 2008)

• Used PRVs to reduce pressure at the top of the field

• Wanted to generate hydro power using excess pressure
System Layout

Intake 1500 ft AMSL

Powerhouse 1243 ft AMSL

Pivot Center 1116 ft AMSL

Bottom of field 1005 ft AMSL

Fraser River 550 ft AMSL
Plan

• Insert a turbine system into existing irrigation pipeline
• Get rid of PRVs
• Use water to generate electricity and then use it to irrigate
• Have better control over pressure in the pivot
Challenges

• Prefer a closed system
• Sloped field
• Seasonal flow
• Excess power production
• Competition for water
Solution

- Use Pumps as turbines
- Use motors as generators
- 2 pumps in series with automated switching
- Totally enclosed system
- Grid connected
- Note: This is not a standard setup
Design
Photos
Photos
Results

• 21 kW maximum power
• 45/90 psi pressure reduction
• Net Metered into BC Hydro grid
• Automatic turbine switching
Cost

- Turbines and intertie equipment $40,000
- Pipework/fittings $14,000
  - Installed by rancher
- Building $7,000
  - Constructed by rancher
- Electrical hookup $12,000
- Automation $5,000
- Pipeline replacement $140,000
Revenue

- Power Use 33,800 kWh annually
- Power production 37,800 kWh annually
- Annual Revenue Cheque $400
- Total Revenue $2,000
- Average User Revenue $3,500
• Net-Metering program has seen rate increases twice since start of program (Currently 9.99¢/kWh)

• Consideration of a higher feed in tariff for green power production