

Small Hydro Retrofit/Upgrade Evaluations

Mountain Counties Water Association
Small Hydro Workshop
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Mead
& Hunt

Prospect: Update/Retrofit Existing Hydro?

- What are evaluation steps?
- How to get started?



Review Original Design Basis

- Key parameters = Head/Flow
- Conduit and unit sizing basis – you may have to live with some of this (especially conduits/conveyance)



Review Original Design Basis

- Original streamflow or canal releases –
What was the original system?
Develop a good baseline understanding
of head and flow characteristics.



Review Original Design Basis

- Regulatory commitments at the time (if any)?
 - Different seasonal flow constraints
 - Different minimum releases (if any)
 - Different ramping rates
 - Allowances for sensitive or RTE species



Photo courtesy of River Partners

Valley Longhorn
Elderberry Beetle
(*Desmoceros californicus*
dimorphus)

What's Changed?

Detailed Condition Assessment

- Is performance degraded due to:
 - Turbine/runner wear?
 - Operating flow/head change since inception?



Is the equipment simply worn out?

Detailed Condition Assessment

- Is performance degraded due to:
 - Repeated electrical equipment/controls failure and required maintenance result in extended outages?
 - Non-functional or problem bypass or outlet conduits and valves?

Detailed Condition Assessment

- Or is it lack of documentation:
 - Monitoring data and ineffective automation?
 - Poor documentation of original operating protocols?
 - Schematics and part number diagrams?
 - Maintenance records, unable to order replacement parts?



*Anyone
remember this
logo?*

Current and Future Conditions

■ Operations

- What are the future projected water demands?
- If you don't uprate, how much will decommissioning cost?



■ Legal

- Are your rights to the water clear and unambiguous?
- Will your rights be challenged?



Current and Future Conditions

- Regulatory (licensing)
 - Less favorable
(higher/faster ramping rates usually mean less overall water for generation)
 - Higher instream flow releases (turbine/generator running out of optimum range, spill or bypass due to capacity constraints?)



Current and Future Conditions

- Regulatory (licensing-continued)
 - New environmental requirements (usually more discharge, but tighter constraints on operating protocols to meet e.g. fish spawning, recreational releases, RTE species impacts)

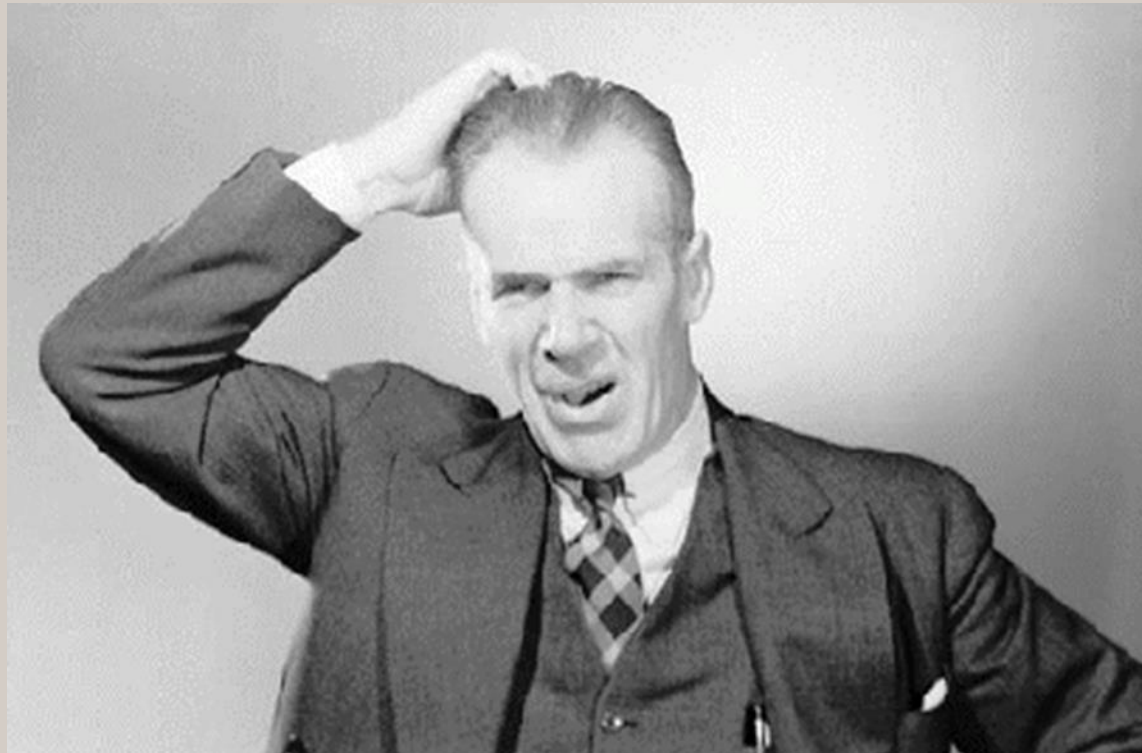


Chinook Salmon



Coho Salmon

WHAT NEXT?



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IDENTIFY YOUR MAIN GOALS

- Is this essentially an upgrade/maintenance activity to avoid continuous maintenance on old equipment?
- Are you trying to avoid a decommissioning decision and what that will cost?
- Is the primary goal to generate as much electricity (maximize revenue) as possible? Is this purely a fresh start economic analysis of feasibility?

ALTERNATIVE PROJECT CONCEPTS

- Develop a basis for evaluation of your options, tailored to specific project objectives.
- Use these to establish various conceptual cost and revenue estimates.



WITH PROJECT GOALS IN MIND

- Step One
 - Re-evaluate the anticipated head/flow conditions to give a general sense of need to uprate or rebuild
- Step Two
 - Develop a general economic basis for comparing current cost vs. future revenue as the primary filter

DEVELOP BETTER IDEA OF COST/REVENUE (Be Realistic)

Develop Broad Estimates

- **Anticipate direct costs**
- **Anticipate indirect costs**
- **Anticipate financing options**
- **Project revenue basis considering current and future electric price trends**

DEVELOP INCREASING LEVELS OF COST INFORMATION

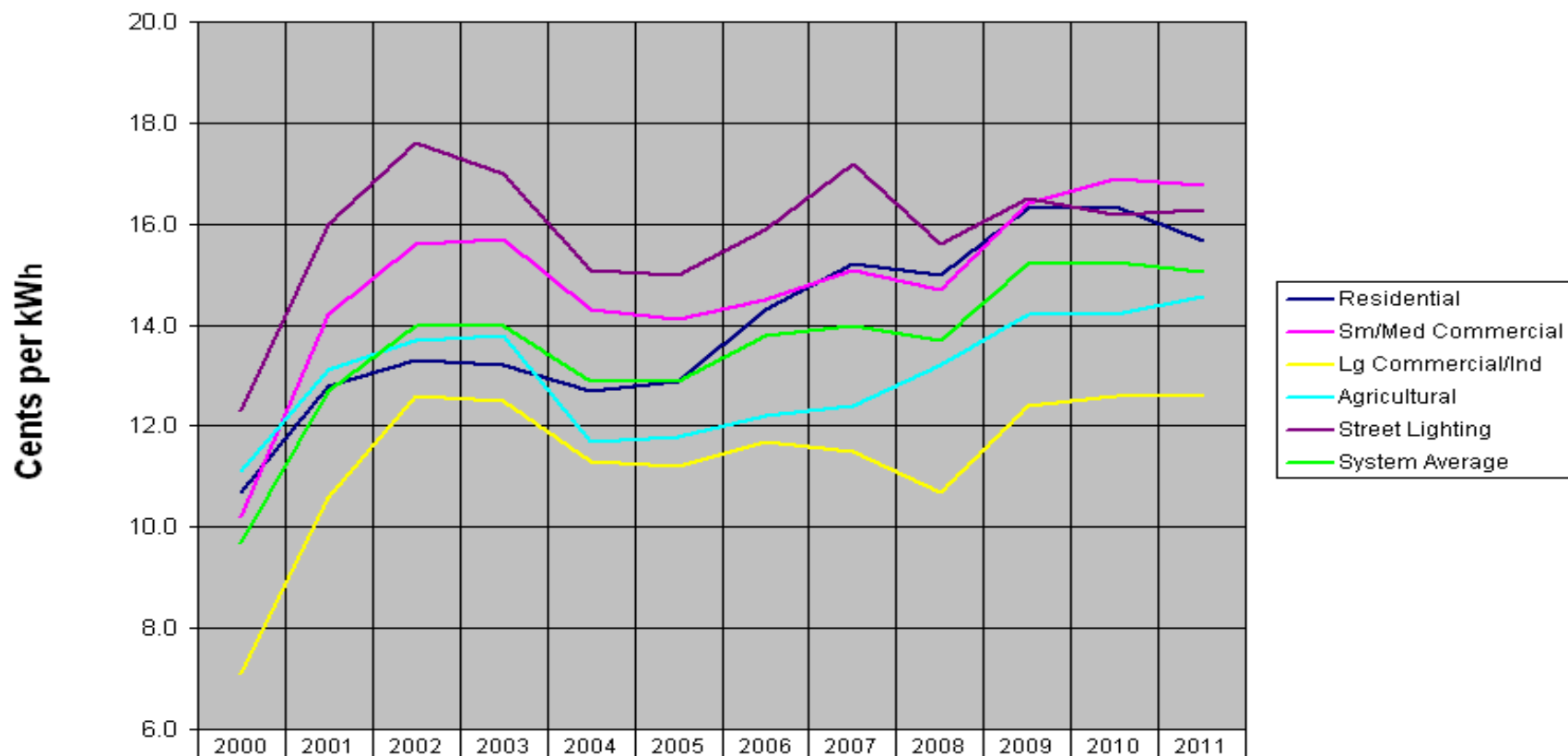
- Get water to wire quotes from existing vendors in the turbine/generator size rating you anticipate.
- Estimate the ancillary construction costs (powerhouse building, lighting, communication, switchyard equipment and construction)



DEVELOP INCREASING LEVELS OF COST INFORMATION

- Estimate the interconnection and upgrade costs.
- You may want to stick with current generation rates to avoid new interconnection requirements.

PG&E Average Bundled Rates by Class 2000-2011



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Residential	10.7	12.8	13.3	13.2	12.7	12.9	14.3	15.2	15.0	16.3	16.3	15.7
Sm/Med Commercial	10.2	14.2	15.6	15.7	14.3	14.1	14.5	15.1	14.7	16.4	16.9	16.8
Lg Commercial/Ind	7.1	10.6	12.6	12.5	11.3	11.2	11.7	11.5	10.7	12.4	12.6	12.6
Agricultural	11.1	13.1	13.7	13.8	11.7	11.8	12.2	12.4	13.2	14.2	14.2	14.6
Street Lighting	12.3	16.0	17.6	17.0	15.1	15.0	15.9	17.2	15.6	16.5	16.2	16.3
System Average	9.7	12.7	14.0	14.0	12.9	12.9	13.8	14.0	13.7	15.2	15.3	15.1

CPUC FEED IN TARIFF

Feed-in tariffs jointly proposed as buying price by major CA utilities (May 5, 2011)

- Proposed starting price of \$89.23/MWh
- This is an oversimplification with fees and graduated performance terms affect net price.

PROJECT FINANCING

- What is your entity's access to capital?
- How would you structure the financing (long term or equity loan debt, municipal bond sale, etc.)?



DEVELOP REVENUE ESTIMATE

- What should you use as the basis for electric sales unit prices (RPS Feed-in Tariff or bid independently into the market?) Are you likely to get peak rates?
- What is the dependable capacity for electric generation income estimates? Strictly baseload or some type of peaking component?
- Project realistic term of capital-free operation, discounted by regular, anticipated O&M costs



CONSIDER OWNERSHIP STRUCTURE

- Consider alternative procurement and operating arrangements, such as:
 - Traditional DBB with owner/operator arrangement
 - Owner finances/constructs/operates with own forces
 - Or a third party build/operate/transfer (BOT) agreement?

STILL IN THE GAME?

- If the prospective project clears these hurdles, keep moving.
- Continue with:
 - Detailed design
 - License or exemption pursuit
 - Prequalify contractors
 - Update cost/revenue estimate to reflect latest project understanding

STILL IN THE GAME?

- Still a go?
Fully commit the
resources.

