# Solar Vs. Hydro Case Study

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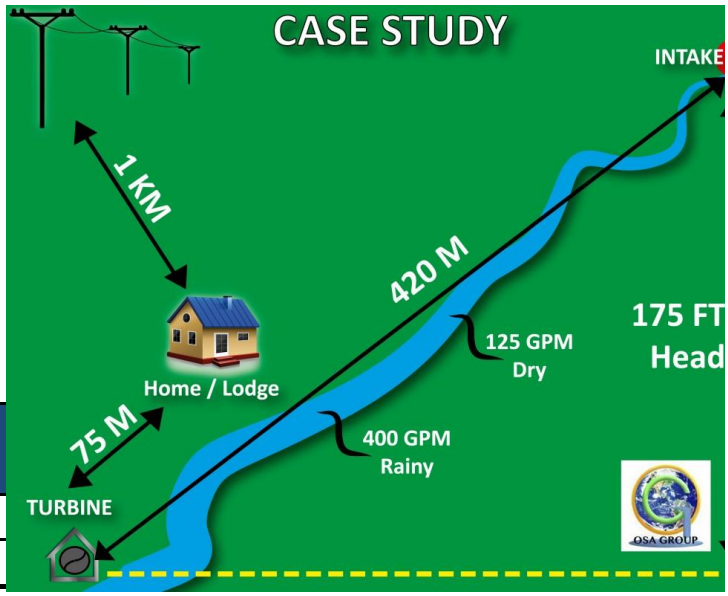
This excerpt provides a Case Study highlighting economic differences between hydroelectric and solar power supply for both independent and grid-tie cases for both an American style home and a small Ecolodge. To see the full article: http://news.soldeosa.com/the-power-center/

## Case study: An economic analysis

We have a 35-hectare property with confirmed hydro close to an optimal build site. Either a conventional U.S.-style home or a small-scale commercial ecolodge will be built. The grid is one kilometer away. The property owners need to know what their power supply will cost for each alternative in order to decide how to develop the property.




| Case | Demand Kw-hrs | Solar Kw | Hydro Kw |
|---|---|---|---|
| **Home** | 20 | 5 | 0.83 |
| **Lodge** | 75 | 18.8 | 3.1 |

For roof-mount solar, the estimate is based on normalized costs from recent projects of $5.10 for independent and $3 for grid-tie systems on average, per installed watt. Hydroelectric costing varies as a function of pipe size, distance and other factors, every single case unique. Cost estimation for a 4" pipeline hydro for this case study is shown below on the left. On the right, the modeling of capital and economics on all pipe sizes and potential operating capacity is reported according to the same estimation model.

| Item | Units | Qty | Unit Cost | Subtotal |
|---|---|---|---|---|
| Intake | job | 1 | $ 3,000 | $ 3,000 |
| 4" SDR 26 PVC | pieces | 70 | $ 85 | $ 5,950 |
| Valves and fittings | lot | 1 | $ 750 | $ 750 |
| 4000 watt turbine | set | 1 | $ 5,000 | $ 5,000 |
| 3500 watt inverter | unit | 1 | $ 2,800 | $ 2,800 |
| S-550 rolls batteries | unit | 4 | $ 625 | $ 2,500 |
| Outback Flexmax-80 | unit | 1 | $ 900 | $ 900 |
| Outback Mate control | unit | 1 | $ 100 | $ 100 |
| AWG #8 cable | meters | 225 | $ 1 | $ 305 |
| 1.25" PVC conduit | pieces | 12.5 | $ 15 | $ 188 |
| Turbine Housing | job | 1 | $ 4,000 | $ 4,000 |
| Labor and Oversight | job | 1 | $ 15,000 | $ 15,000 |
| **TOTAL** | | | | **$ 40,493** |

| Pipe D inches | Output Watts | Cost $ | Per Watt $/Watt | Solar Equiv $/Watt |
|---|---|---|---|---|
| 1.5 | 717 | $ 24,013 | $ 33.51 | $ 5.58 |
| 2 | 1023 | $ 29,958 | $ 29.28 | $ 4.88 |
| 3 | 2000 | $ 35,153 | $ 17.58 | $ 2.93 |
| 4 | 4000 | $ 40,493 | $ 10.12 | $ 1.69 |
| 6 | 8000 | $ 70,263 | $ 8.78 | $ 1.46 |

These data now allow for a full-throated analysis of the two energy paradigms available: 1) independent and 2) grid-tie.

***Independent***

Home demand can be met with a 2" diameter hydro pipeline for $30,000. To offset the demand with solar requires a 5,000-watt charging source for a capital sink of $25,000. Solar is $5000 less, for a savings of 25%.

For the lodge, the dry-season maximum hydro is through a 3" pipe with a 2,000-watt output. But lodge demands require 3,325 watts, so hydro is inadequate for sole-source independent supply. The hydro deficit of 1,125 watts is equal to a 6.75 Kw solar equivalent, costing $34,425. Adding the cost of a 3" pipeline hydro and 6.75 Kw solar and stripping out equipment duplicates yields a cost of $64,000. A solar equivalent of 18.75 Kw costs $95,625. So, a hybrid independent system is 49% less costly than a solar-only independent power supply.

| INDEPENDENT | Home | Lodge |
|---|---|---|
| Solar Only | $ 19,125 | $ 99,625 |
| Hydro Only | $ 25,000 | NA |
| Hybrid | NA | $ 64,000 |

***Grid-Tie***

For the home, the 1 km distance from the grid imposes a capital sink of $50,000 just to extend the primary grid in order to connect. Implicitly a grid-tie connection in this case is wildly non-viable, with payback periods for either solar or hydro measured in decades.

**3.2 Kilowatt independent roof-mount solar power: Ojochal**


**2.4 Kilowatt independent roof-mount solar power: Ojochal**

For the lodge, however, its 75 Kw-hr daily demand can be offset in eight months of hydro production by a flow rate of 228 gallons per minute, the upper flow limit in 4" pipe and well within the stipulated resources. The capital costs of $90,000 incur yearly power bill offsets of $9,811, giving this option a payback period of 9.2 years and a return on investment 11 percent.

Solar costs to achieve the same hydro capacity include the same $50K grid extension plus $56,250 for the required solar charging source, a $106,250 capital sink for solar, $16,000 more than hydro.

| GRID-TIE | Home | Lodge |
|---|---|---|
| Solar | NA | $106,250 |
| Hydro | NA | $ 90,000 |

***Conclusion***

In this case, it is most economically prudent to discard grid-tie because of the distance from the grid and the relatively modest power demands. For the home, the best solution is solar-independent. For the lodge the best solution is independent hybrid hydro/solar. Had the grid been at the building site and not a kilometer away, then solar grid-tie would have been best for the home and hydro grid-tie for the lodge. If the head and flow are different, or facility demands, the costing matrix turns out different as well. But these variables are either known or easy to measure and calculate, and once hydro is defined in all its hypothetical ranges for any given site, economic comparison with its solar equivalent is straightforward and against facility demand an intuitive analysis.

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