


PLANNING FOR A SUSTAINABLE ENERGY FUTURE

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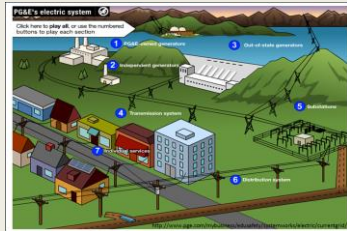
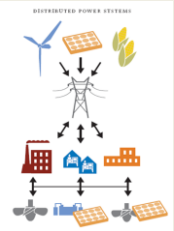
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Mekong Regional Energy Planning

- 40% of global energy growth by 2030 will be in Southeast Asia (IEA, 2016)
- 44 GW of hydropower capacity is planned for the Mekong Basin
- As of 2014, Vietnam's total installed power capacity was 34 GW and is estimated to increase to 129 GW by 2030.
- In 2016, Laos total installed capacity was 6.3 GW, with plans expand more hydropower, biomass, and coal projects that will produce an additional 4 GW by 2020.
- Critical energy decisions being made today; we encourage knowledge sharing and planning across the region

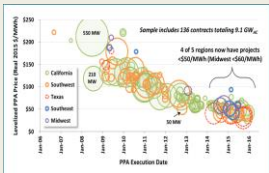

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Global Energy Transitions - opportunities

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Solar and Wind Opportunities

Source: (IRENA, 2014) 6

Grid Evolution

- High-efficiency long-distance transmission lines can support increasingly efficient point-to-point transmission from remote energy sources to urban demand centers
- Intermittent sources like wind and solar have been effectively integrated into the electricity supply with management changes only—expensive storage is not needed
- Distributed grid management allows for RE deployment closer to demand centers



LAOS ENERGY MODELING

Engaging with Southeast Asia's "Battery" – Lao PDR

- 17 GW of hydropower in Laos by 2030 with high potential ecological impacts
- Large hydro looks cheap, but what are the unpriced social and ecological risks?
- What is the optimal least cost expansion pathway for energy development?
- What are the broader lessons to be learned for regional scale planning?

Flexible Energy Futures

Large Hydropower

- "Bang for the buck"—considered lowest-cost, highest return option
- Creates large export opportunity
- Cost over-runs, ecological impacts, regional instability

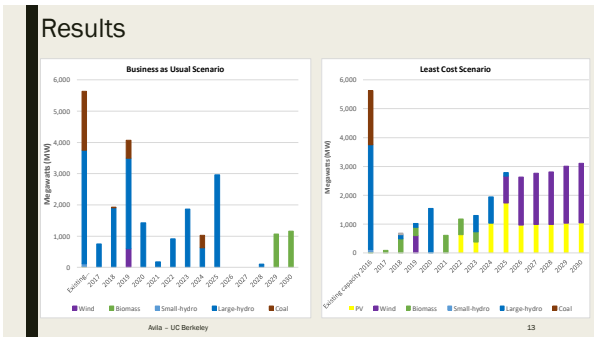
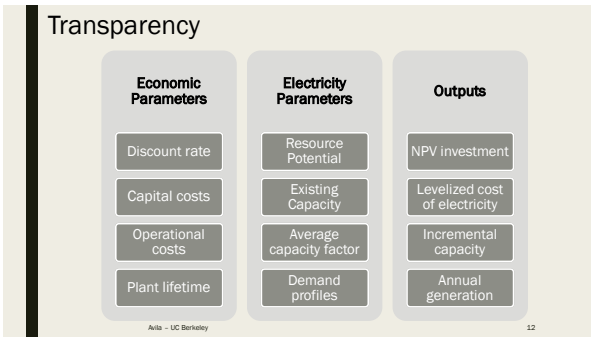
BUT

- Laos can **substitute** some of the worst performing planned hydropower projects for a more **diverse portfolio** of energy options without increasing costs—but it must identify clearly such projects.
- This may in turn increase **economic diversity and resilience** to shocks, social and ecological.
- Long-term **revenue and development** can be strengthened under alternative plans.

We build an integrated open-access electricity supply optimization model for Laos to evaluate alternatives to hydropower development.

Energy cost optimization model

- Long term energy planning (15-20 years)
- Minimizes total portfolio costs
- Constrained to meet annual energy demand, including exports
- Constrained to meet annual peak demand
- Renewable energy constrained to regional potential



Discussion

- The **opportunity cost** of developing mainstream hydropower is high.
- The results highlight that a significant wind resource in the Southern Laos zone could play an **Integral part to power exports** - all without the major impacts from hydropower development downstream at similar cost and generation profile.
- The least-cost scenario highlights the feasibility of significant **alternatives**: wind, solar and biomass development for power export at **lower overall costs** compared to the BAU.
- Installations of non-hydro renewables can quickly replace large-scale hydropower additions beginning in 2018. Wind and solar can comprise **large shares of the power mix by 2030**, generating similar levels of electricity production at a lower cost than building all planned hydropower projects.

| Scenario | Cost (NPV MM \$) | Net Difference (MM \$) relative to Full Build |
|-------------------|------------------|---|
| Business-as-Usual | \$ 10,795 | |
| Least Cost | \$ 8,165 | (2,630) |

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Takeaways

- **Substitution:** Laos can substitute at equivalent or lower cost renewables for the highest-impact dams. Diversified alternatives can meet domestic and international energy goals.
- **Interconnections:** regional and national interdependence, example: developing solar in the Laos "sunbelt".
- **Flexibility:** diversified portfolios are more resilient and adaptable to renewables in the future.
- **Modeling:** A increasingly precise shared model of the Mekong nexus can serve as the backbone for discussion of tradeoffs with private, government, community, and academic stakeholders.

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Opportunities for Vietnam

- Vietnam's energy future is critical to regional sustainability
- Power investments abroad can influence the types of projects built
 - *Foreign investment expands Vietnam's solar and wind product market*
- Energy portfolios are more secure and resilient when diversified



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THANK YOU.

Questions?

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