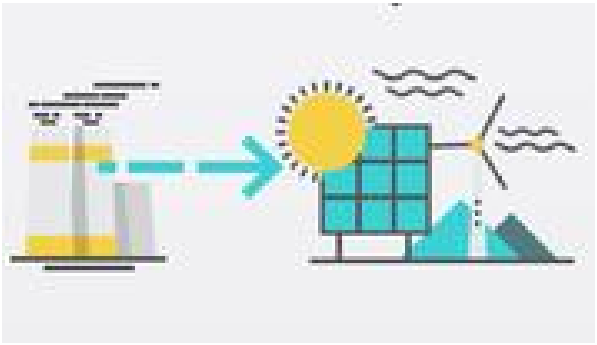
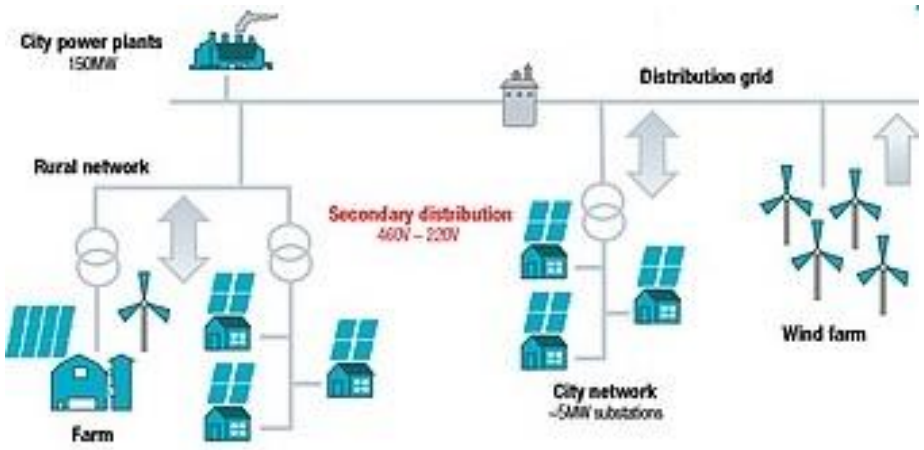
Asia Pacific Economic Cooperation (APEC)
Workshop on Environmental Services
Hanoi, Vietnam
May 11, 2017

The MEGATREND D's of Energy Innovation



Decarbonation



Decentralization

Datafication

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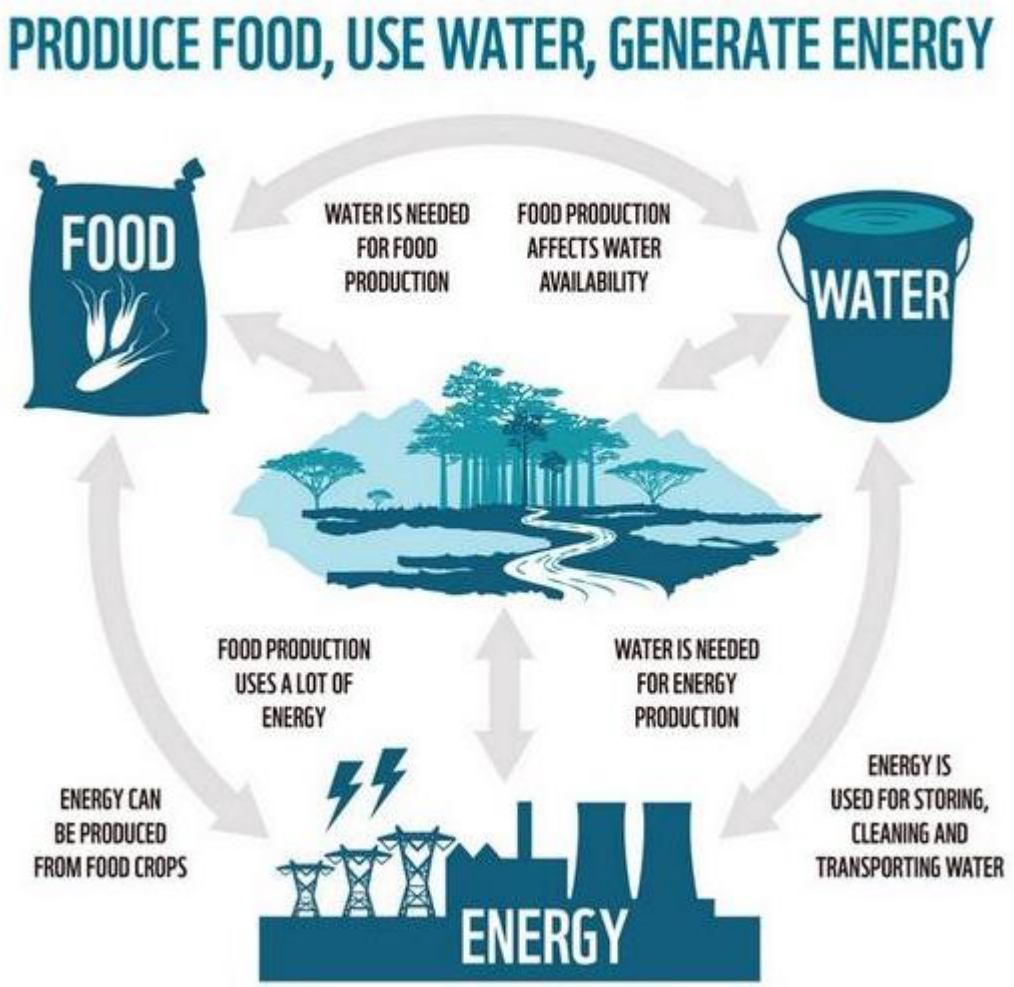
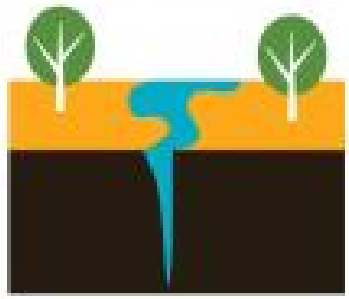
The “Nexus” and Climate Change



Changes in the intensity, frequency and seasonality of precipitation

Sea level rises and melting glaciers



Changes in groundwater and river flows

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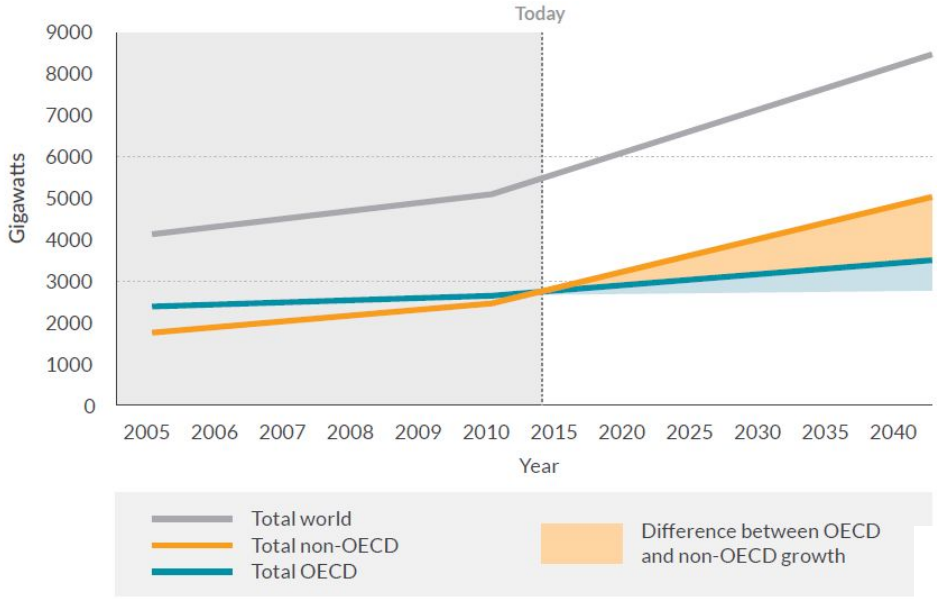
Global power & water demand is growing...



Water needs electricity

8% of global power production is used to make water available for human needs

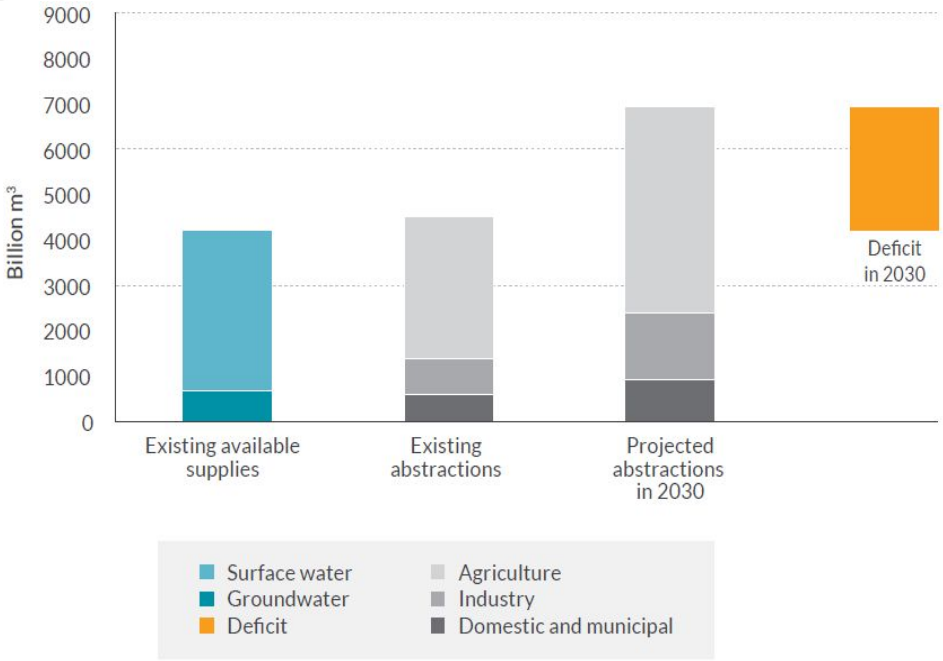
Electricity needs water

15% of global water withdrawals

Food needs both

70% of global water 30% of global energy use

> Every drop of water that has to be pumped, moved, or treated to meet health and food needs requires energy. Inefficiency and waste in the use of water for industrial production increases energy demands and raises emissions.
>
> **Effective comanagement of water and energy, including the integration of water, food and energy programs, as well as support for and development of technology, can lead to significant returns on investment.**



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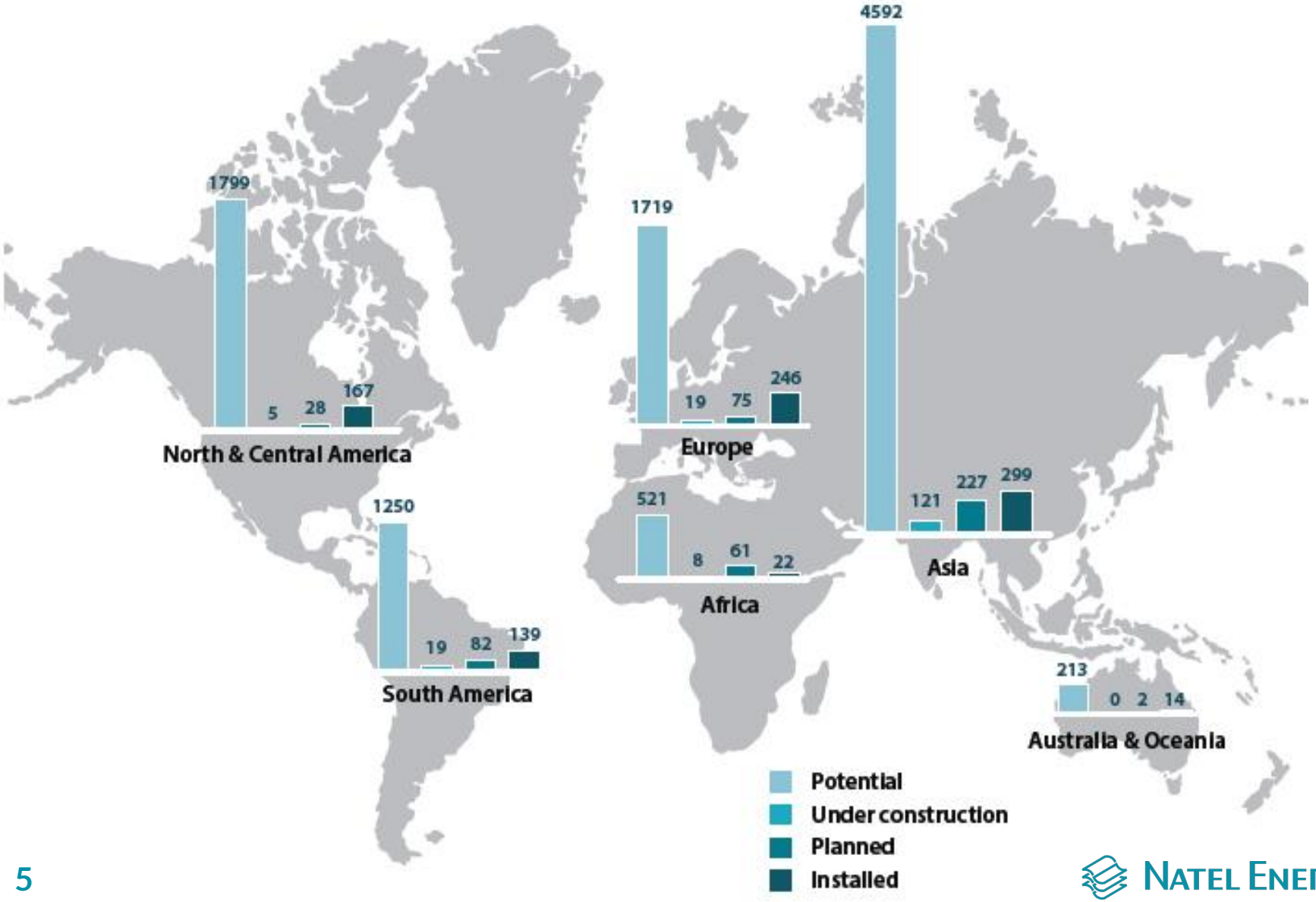
Hydropower is one KEY leverage point to enable more sustainable, nexus-driven development...



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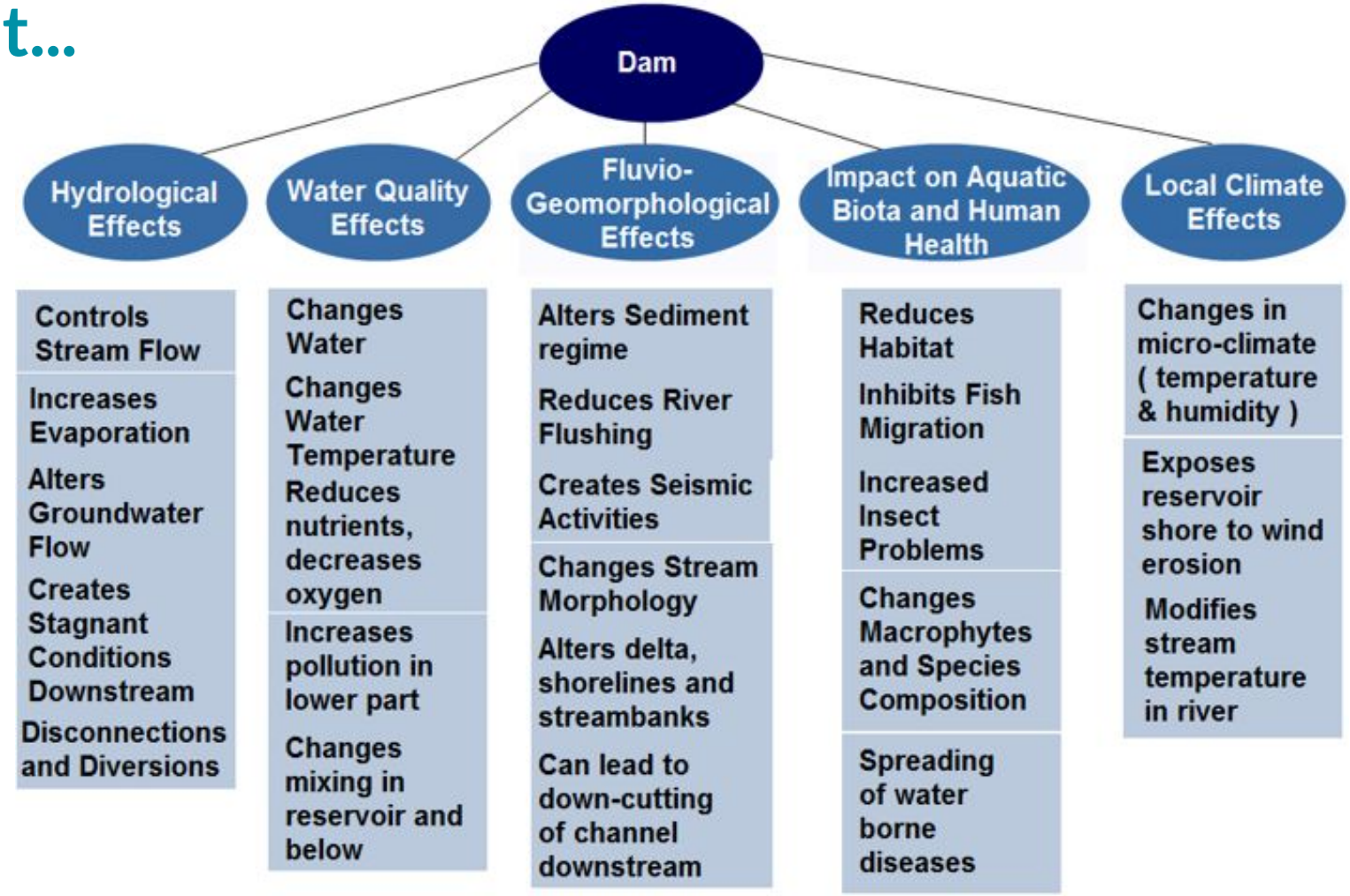
But...



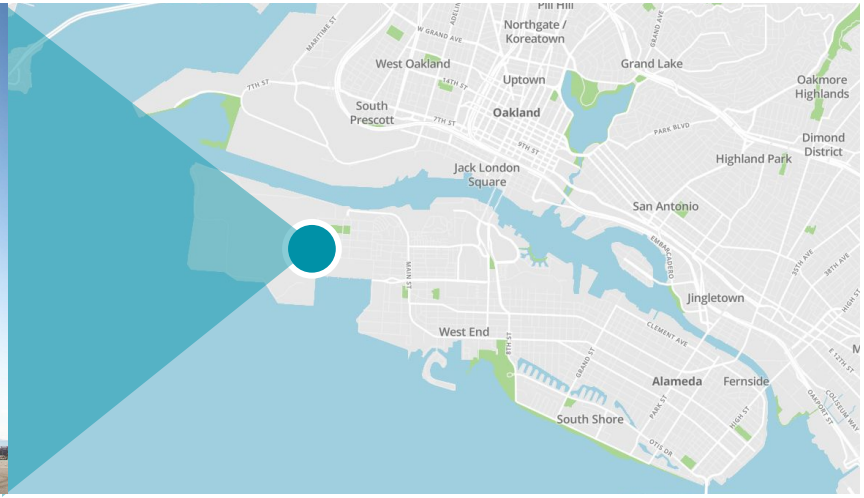
The value of the critical ecosystem services lost due to conventional, large-scale hydro often outweighs the benefits associated with reliable, base-load electricity...

We need to change the way **hydropower** is developed to make more efficient use of a dwindling resource under **high demand.**

Natel Energy is...

...an international **water+energy** innovation company based in California.

...driven by a vision of hydropower that is a climate resilient, distributed, baseload, renewable energy solution at both small and utility-scale.



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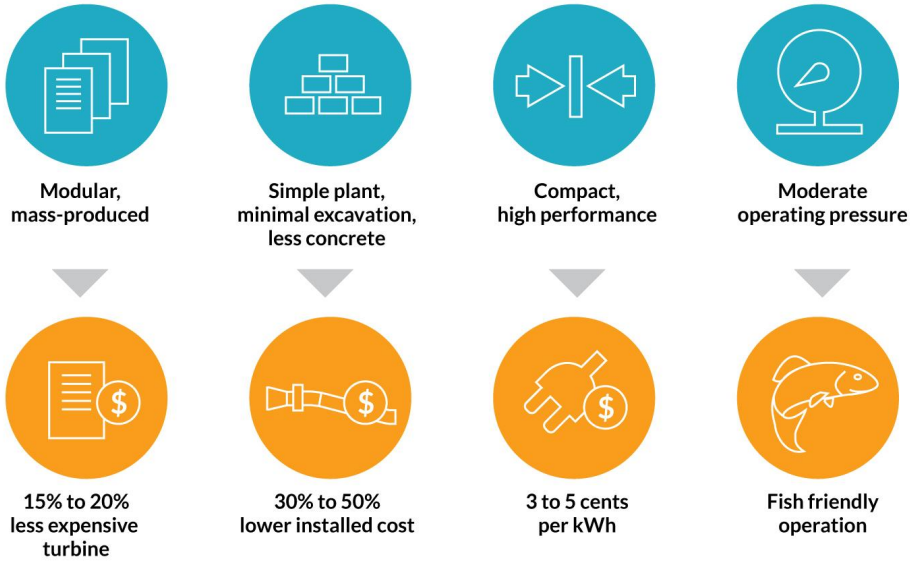
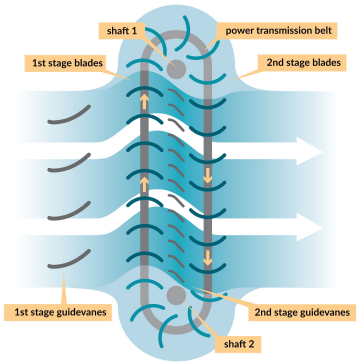
Innovation: the hydroEngine®

- **Patented** turbine designed around a linear powertrain
- **Modular, standardized** units
- **Fish friendly** design
- Designed for high **performance (90% turbine efficiency)** in low pressure, high flow settings
- Simplified **civil works** and installation

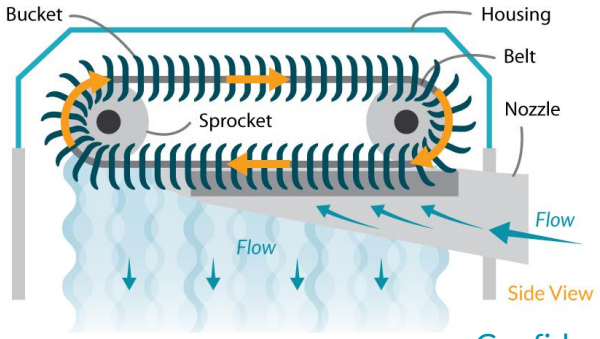


Fully flooded



- No cavitation
- Self-cleaning blades
- Works with draft tube to enable very low-head operation in sites with large tailwater fluctuations
- High specific speed (large flow, high speed, low head)

Free Jet: Linear Pelton



- 90% hydraulic efficiency
- Jet deflector: instant depower with no change in flow rate; no water hammer and no overspeed risk
- Powertrain in air
- No draft tube

Projects with the hydroEngine

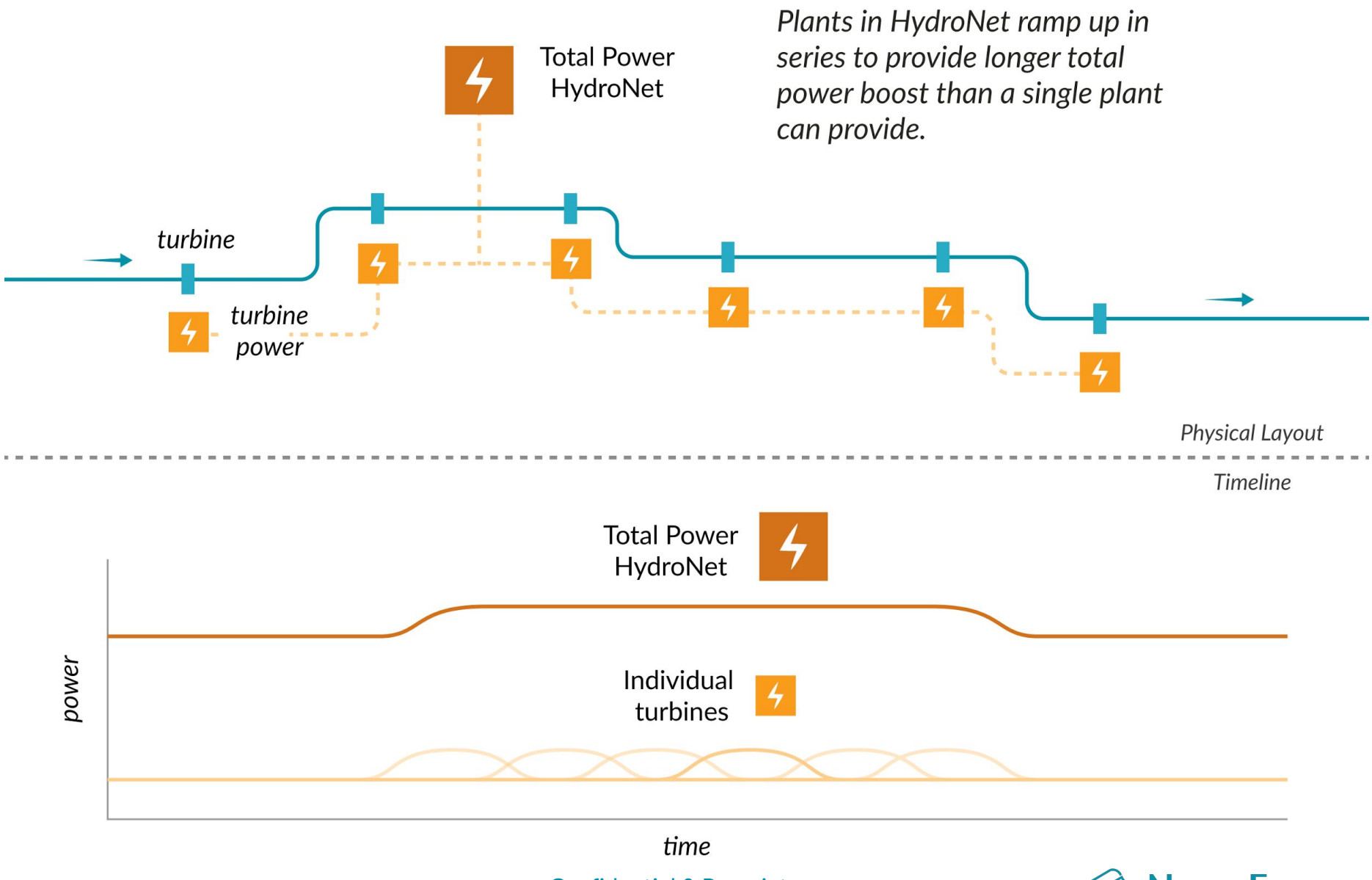
irrigation canals

existing dams

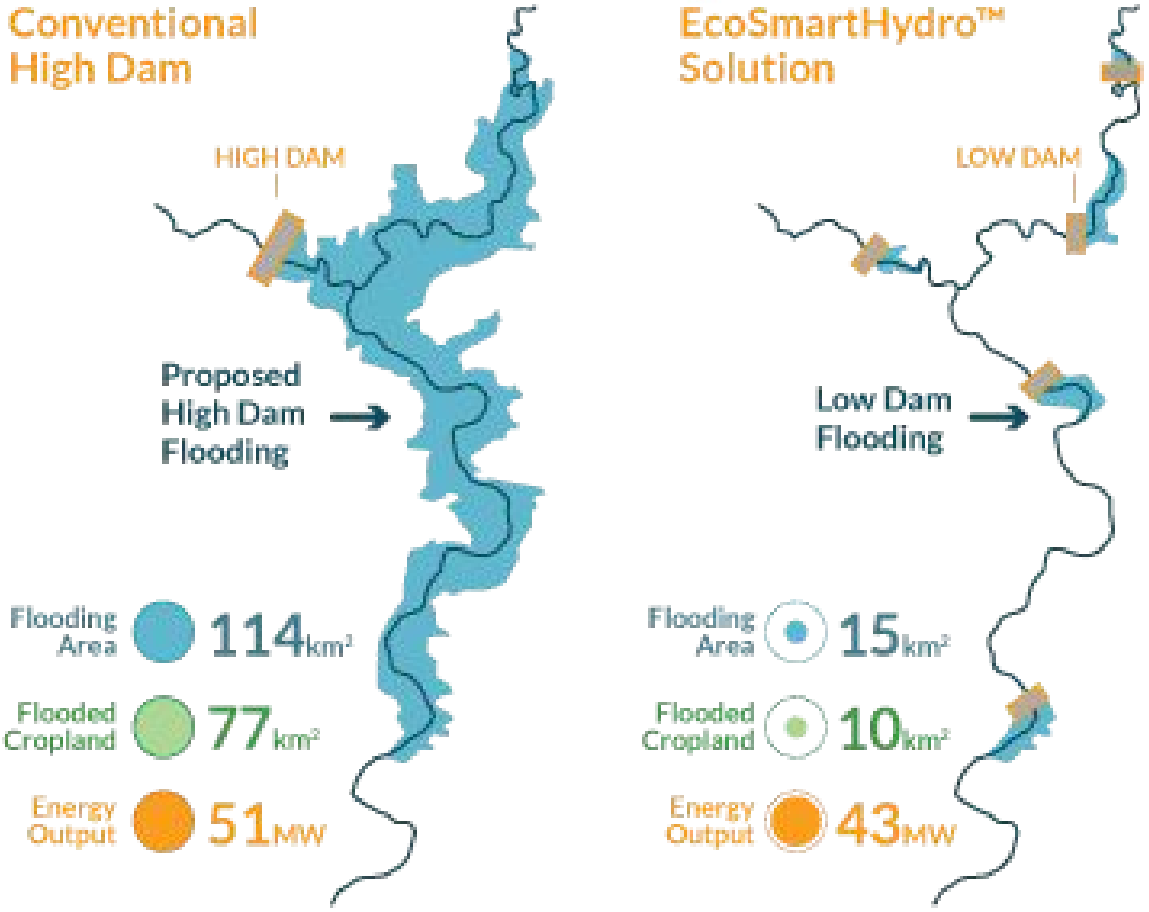
natural waterways

(run-of-river)

HydroNet - Grid Services from Irrigation Canals



EcoSmartHydro™



...is a blueprint to develop distributed, utility-scale, impact-minimizing cascades of climate-resilient hydropower projects - both **retrofits of existing infrastructure** and for **new stream-reach developments**.

Faster to construct / commission

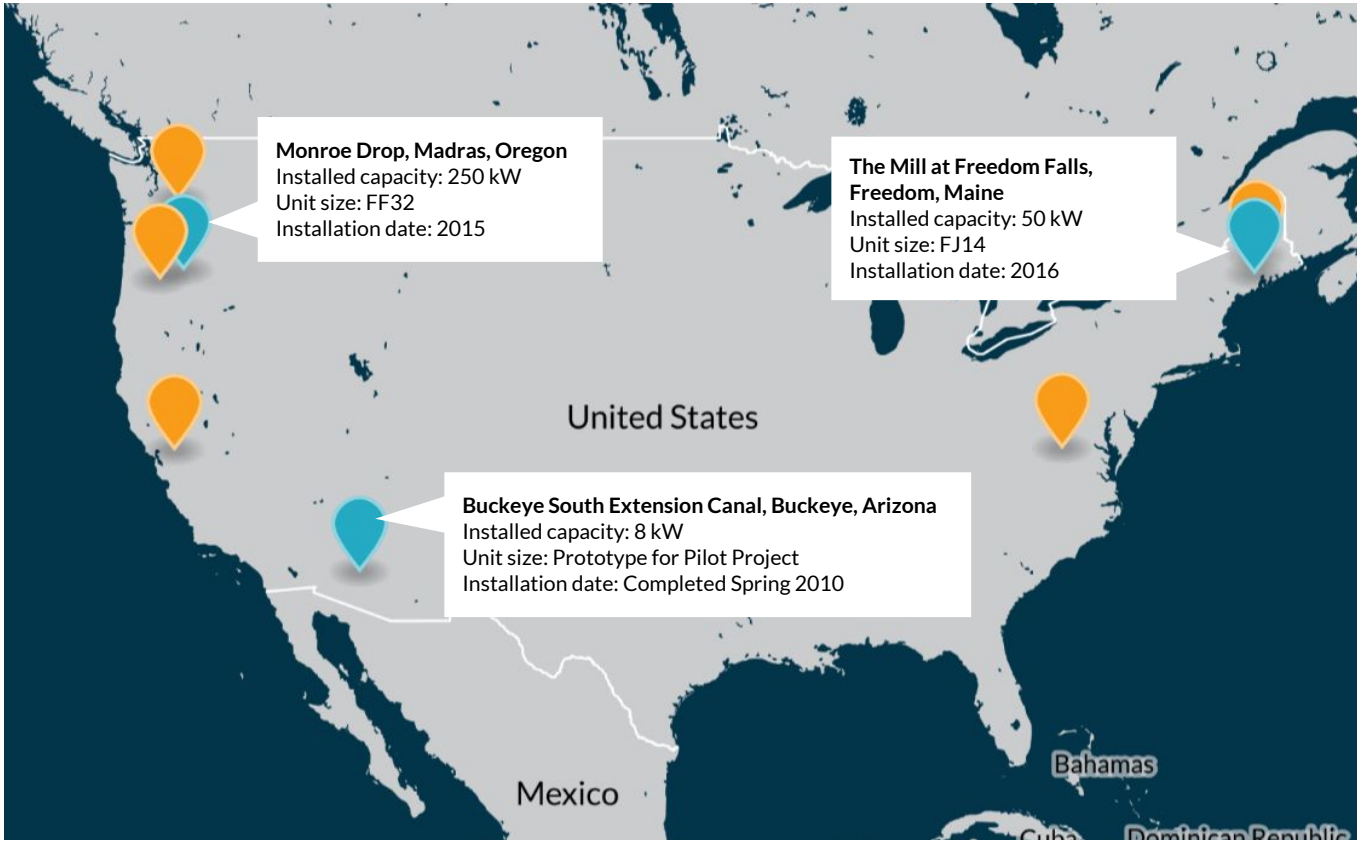
↓

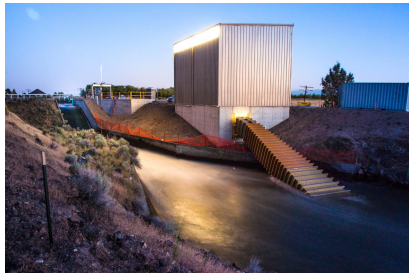
Shorter time to service debt and generate returns

Lower impact, multiple co-benefits → 70-90% of the energy, 5-10% of the inundation

Materials efficient construction → 40% less concrete, 50%+ less excavation

Completed Projects:





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Natel Pipeline Detail

Global Project Portfolio

Natel's Business Model:

OEM Sales

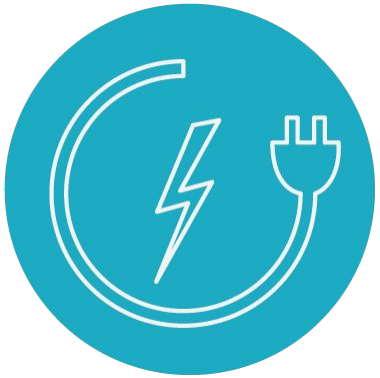
Sell hydroelectric generation systems that combine patented hydroEngines® with monitoring and maintenance contracts to developers, utilities and irrigation districts.

HYDROELECTRIC SYSTEMS

Project Development

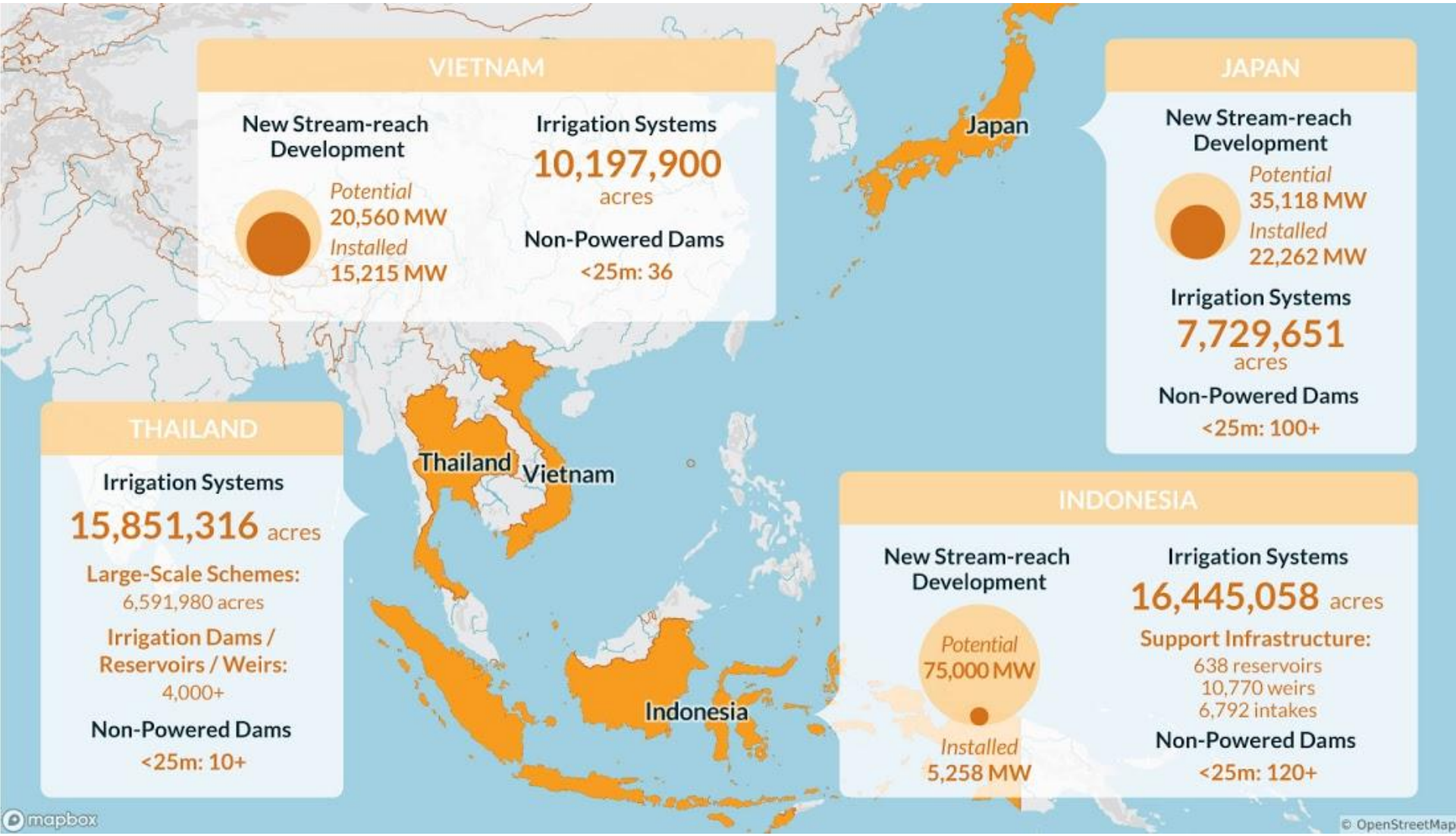
Develop and sell projects that deliver:

1) High value, hydro-led renewable energy;
2) Water (groundwater recharge, improved annual flows, household water access, etc.); and
3) Environmental and social co-benefits.



PROJECTS

Regional APEC markets have high potential



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General and Policy Challenges:

Overall Challenges

1) Generating developer & government interest in distributed hydropower development;
2) Securing development and project financing for new technologies in new geographies;
3) Addressing perceived technology risk => industry tends to be EXTREMELY risk averse to hardware innovation; and
4) Facilitating cross ministerial and departmental coordination - siloed thought and actions.

Policy Challenges:

1) Absence of specific policies about leveraging existing water resource infrastructure to generate power;
2) Fluid policy environments that often change w/ administrations (tariff structures, permitting processes, etc.);
3) Power off-take values that are based on the current grid cost of depreciated or subsidized mega-coal/hydro; and
4) Generally unclear regulatory and permitting pathways.

Sustainable, renewable energy needs clear policies, clear permitting, and clear paths to accurately valued offtake.

Thank you!

Michael Spolum
Regional Director of Business Development
+66-92-536-7589
michael@natelenergy.com
www.natelenergy.com

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