DEVELOPMENT OF ENERGY MODELS WITH LIMITED DATA TO OPTIMIZE USE AND BENEFITS OF RENEWABLE ENERGY IN ISOLATED FOOD-ENERGY-WATER SYSTEMS: A REMOTE ALASKA COMMUNITY EXAMPLE (PA23B-1162)

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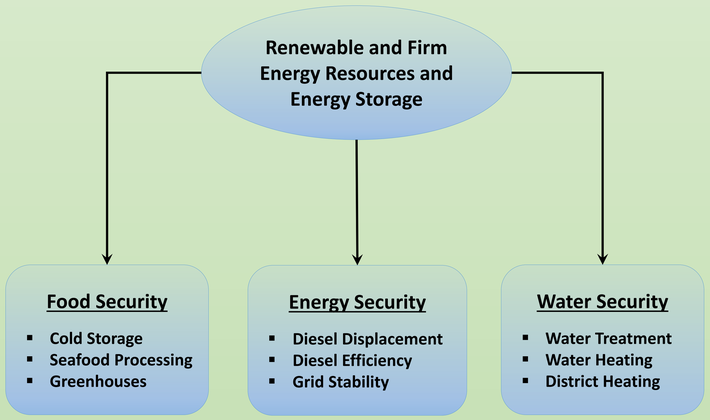
INTRODUCTION

Alaska's Remote Islanded Microgrids

70 of ~200 Alaska remote islanded microgrids use renewable energy sources

ENERGY DISTRIBUTION MODELS



Renewable energy resources and connections to food-energy-water (FEW) systems in Alaska communities

FEW SYSTEMS MODELING

OPPORTUNITIES

- Relative isolation of the communities provides avenues for modelling closed FEW systems.
- Renewable energy optimization using FEW dispatchable loads.
- Limited FEW infrastructure systems provide an opportunity to characterize the often complex FEW system dynamics.

CHALLENGES

- Existing larger FEW infrastructure models are not scalable to remote islanded FEW systems.
- High degree of non-linearity within the connections and energy flows of FEW systems.
- Lack of reliable and quality data from the communities.

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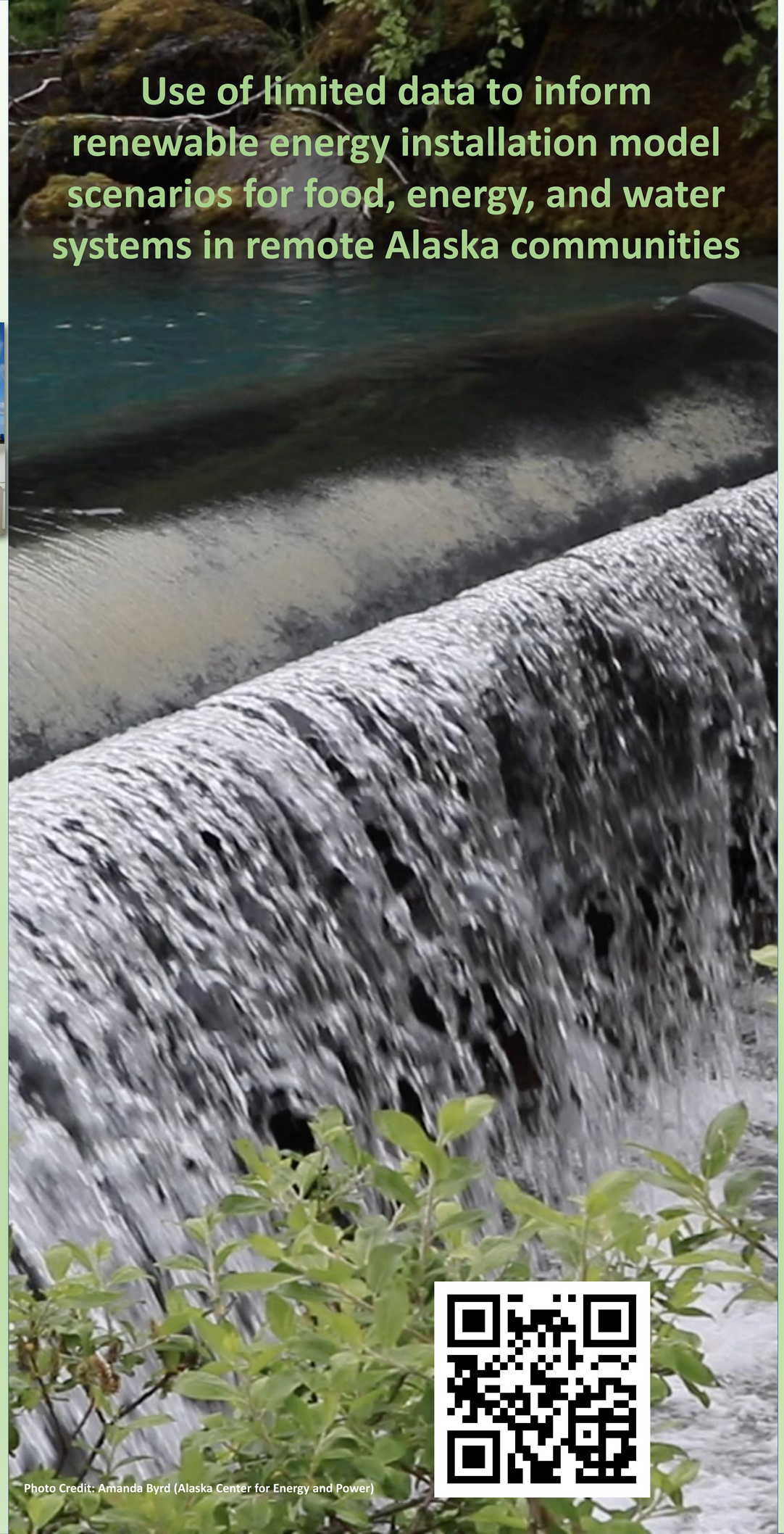
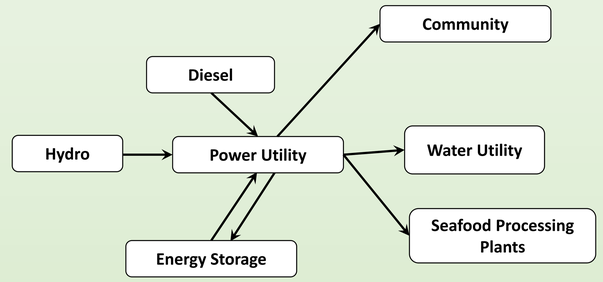


CORDOVA COMMUNITY

Population: 2300
Grid Size: 3-10 MW
Power Generation Capacity:
- 7.2 MW Run-of-River Hydroelectric
- 11.2 MW Diesel
- 1 MW/1 MWh Energy Storage System

CORDOVA ON-GRID FEW SYSTEM DYNAMICS



CORDOVA'S FEW FACTS

- Fishing industry is Cordova's main economic engine.
- Summer community load can be as high as 10 MW due to the seafood processing plants.
- Summer water demand for the community is over 75 million gallons per month.
- As much as 60% of the summer load is met by the run-of-river hydroelectric power (7.2 MW).
- Hydro capacity exceeds diurnal off-peak and nighttime demand resulting in 10 million kWh of the run-of-river water spillage.

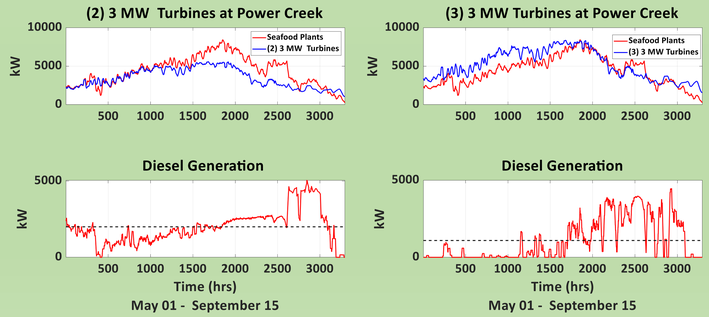
ENERGY STORAGE SYSTEM BENEFITS

- Annual diesel consumption reduced by 10%.
- Total diesel off time increased to around 45%.

ADDITIONAL 3 MW HYDRO TURBINE BENEFITS

- Diesel fuel consumption reduced by ~50%.
- Increasing summer hydro power supply by 74%.

BEFORE (LEFT) AND AFTER (RIGHT) SCENARIO



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