Pacific Northwest
NATIONAL LABORATORY

Economic and Social Aspects of a Run of the River Powerhouse on the Nuyakuk River

23 May 2024

Mark Weimar, PNNL,

Thushara Gunda, SNL

U.S. DEPARTMENT OF ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy

Pacific Northwest
NATIONAL LABORATORY

Outline

- Background
- Economic Decision Support Tool - eDST
- eDST usability
- Conclusion
- Appendices

Project Background

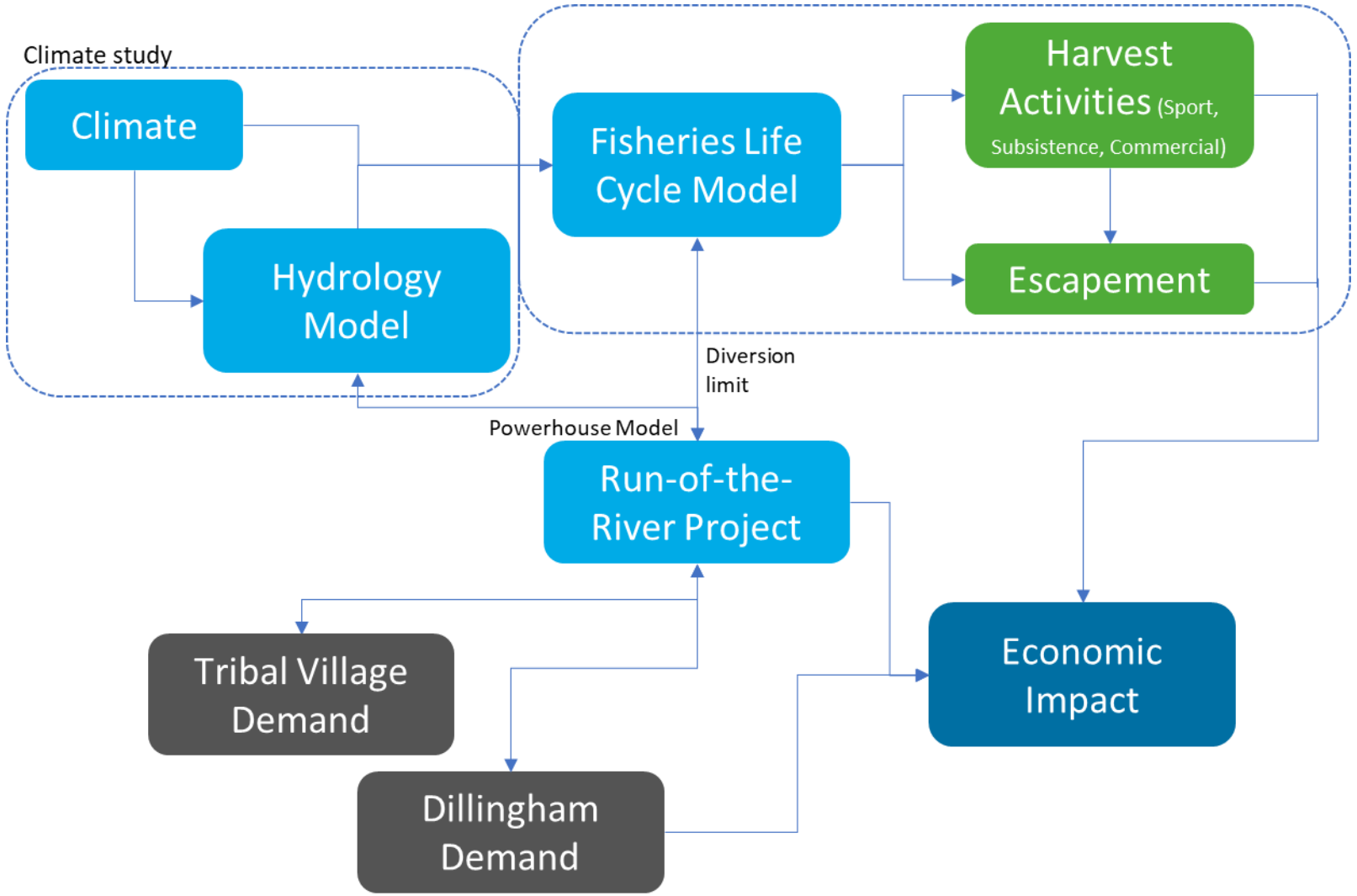
Energy Transitions Initiative Partnership Project

Project Background

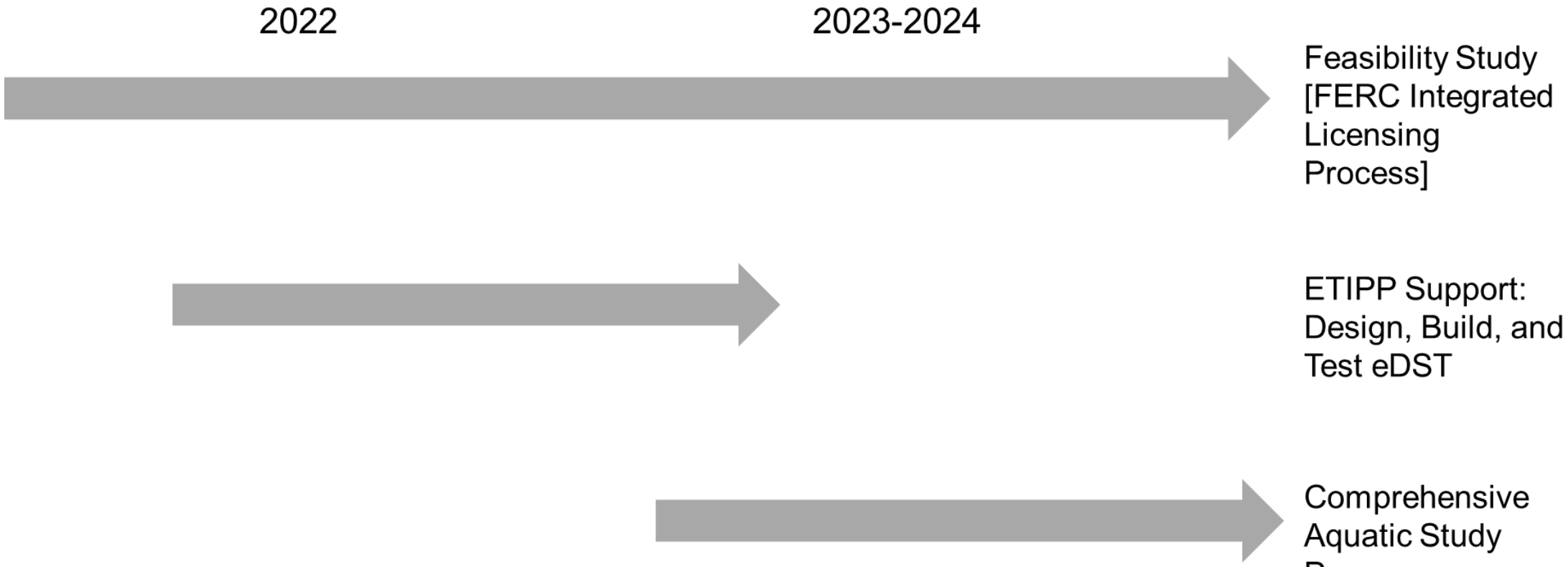
- Barge shipments containing the fossil fuels needed to power Dillingham's islanded grid are a significant expense to the community.
- Feasibility study currently in progress for siting a run-of the river hydropower project on the Nuyakuk River in Southwestern Alaska to diversify energy sources
- Nushagak Electric and Telephone Cooperative (NETC) of Dillingham, Alaska is leading the feasibility study activities and discussions
- DOE ETIPP grant intended to support project planning activities

Objective of the Study

- Develop an economic decision support tool (eDST) that facilitates evaluation of different scenarios
- Enables exploration of different assumptions
- Supports integration of findings with ongoing, planned studies for overall efforts

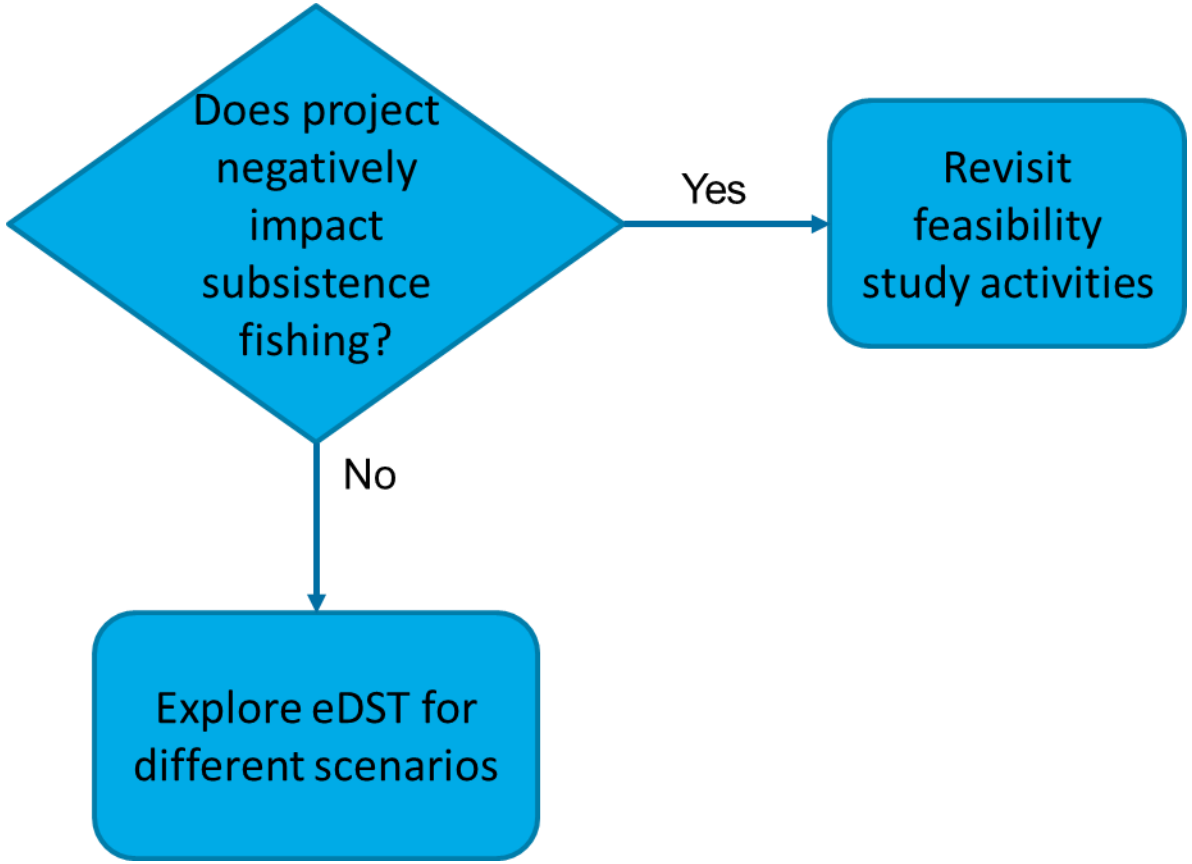


Timeline of Activities

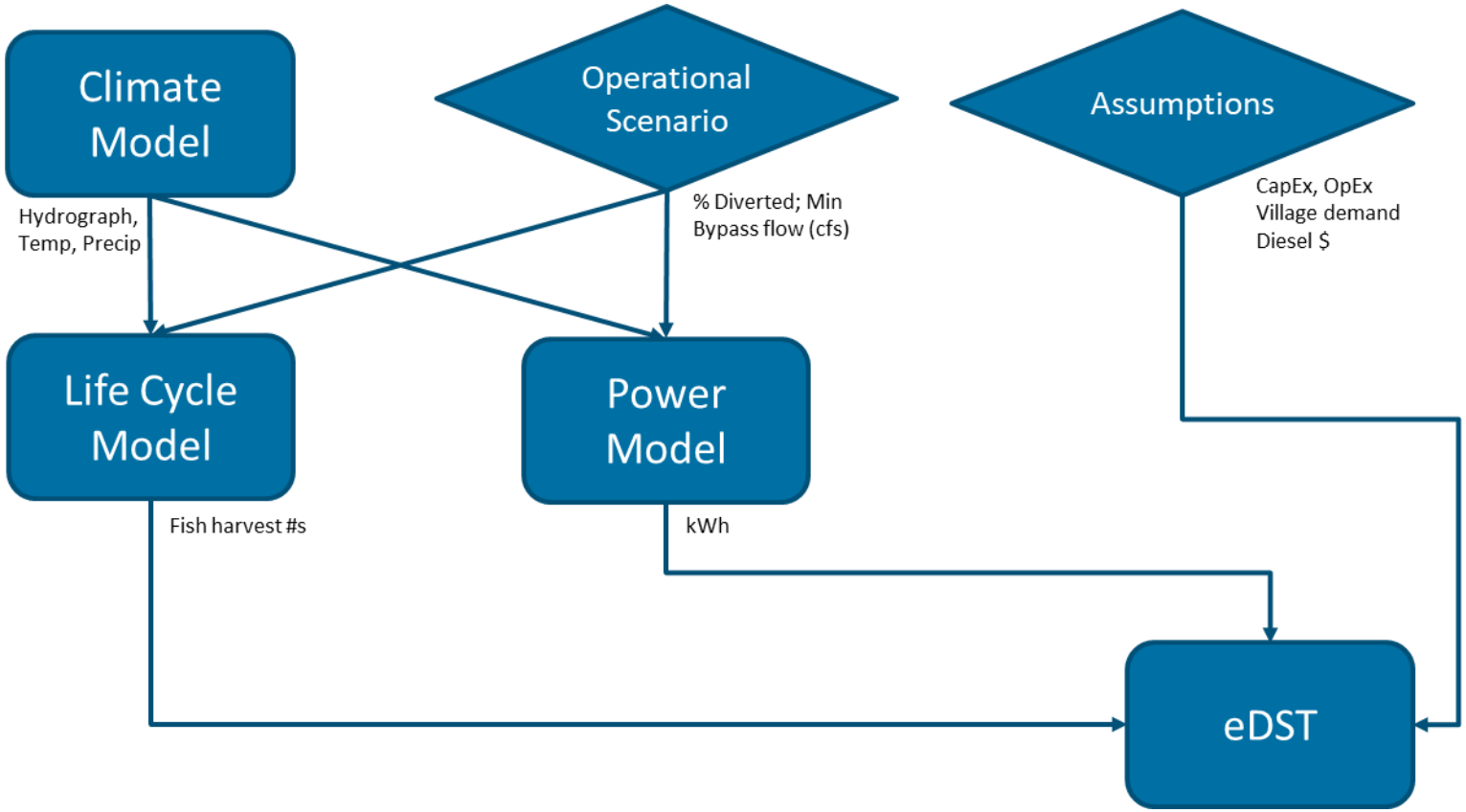


eDST Scope and Buildout

- Develop a way to consistently calculate the economic value of project activities related to:
- Fuel costs
- Commercial fishing
- Consider 50-year timeline horizon to capture the full life of the run-of-the-river hydropower project (i.e., powerhouse)
- Broader community activities are out of scope

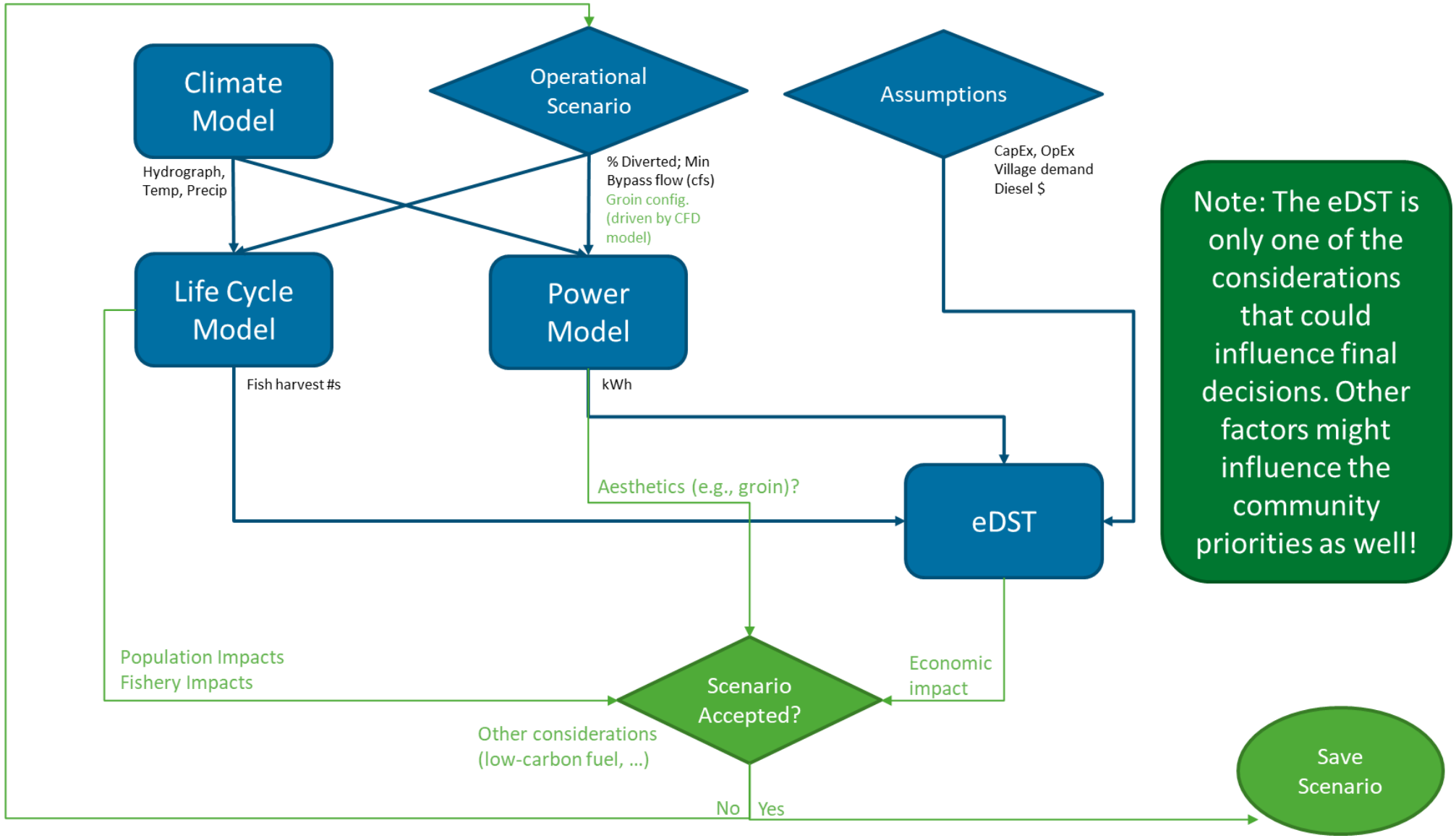


eDST Design



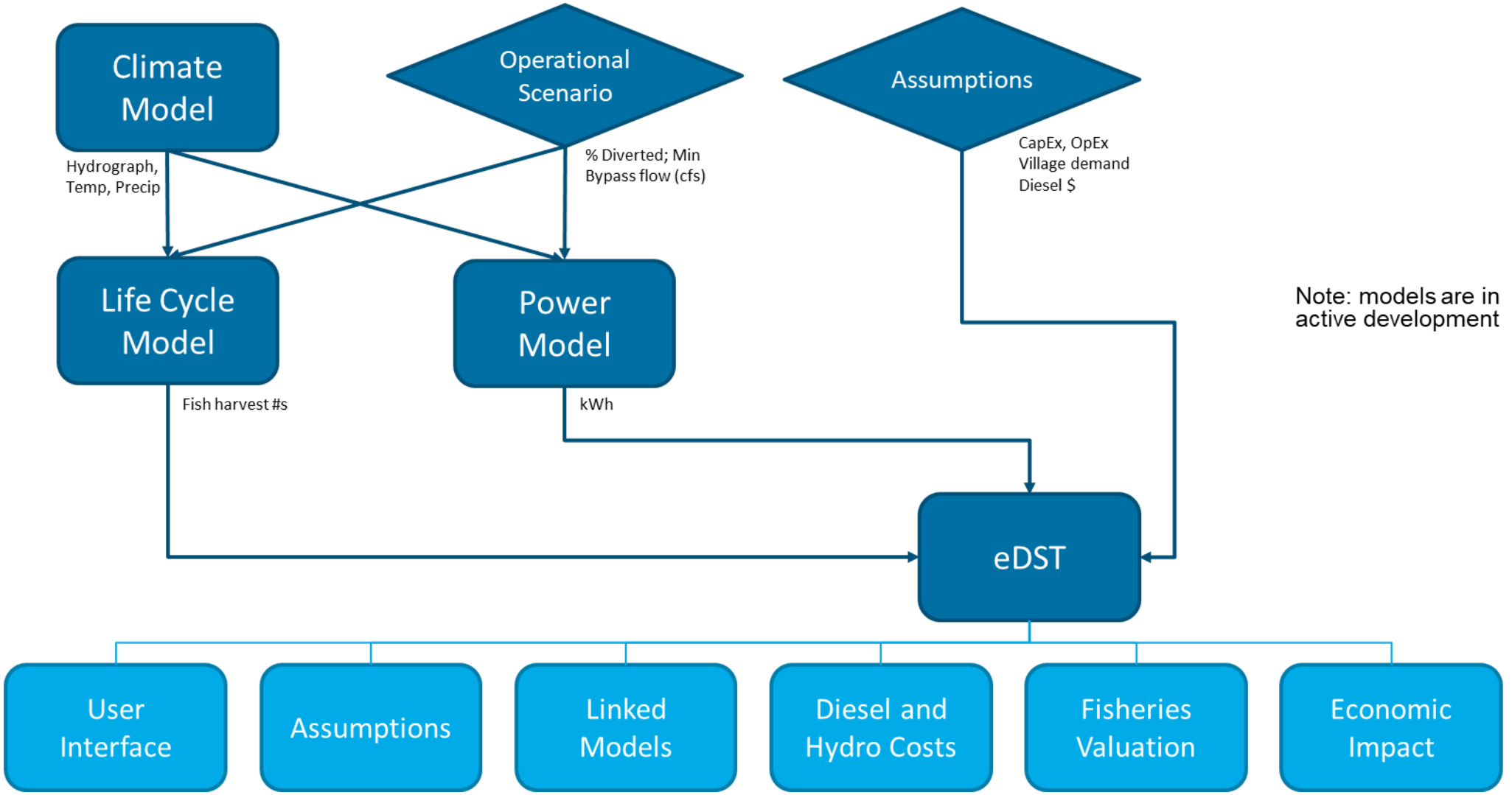
Note: models are in active development

eDST Design: Broader Context



Note: The eDST is only one of the considerations that could influence final decisions. Other factors might influence the community priorities as well!

eDST Design: Module Overview



Note: models are in active development

User Interface

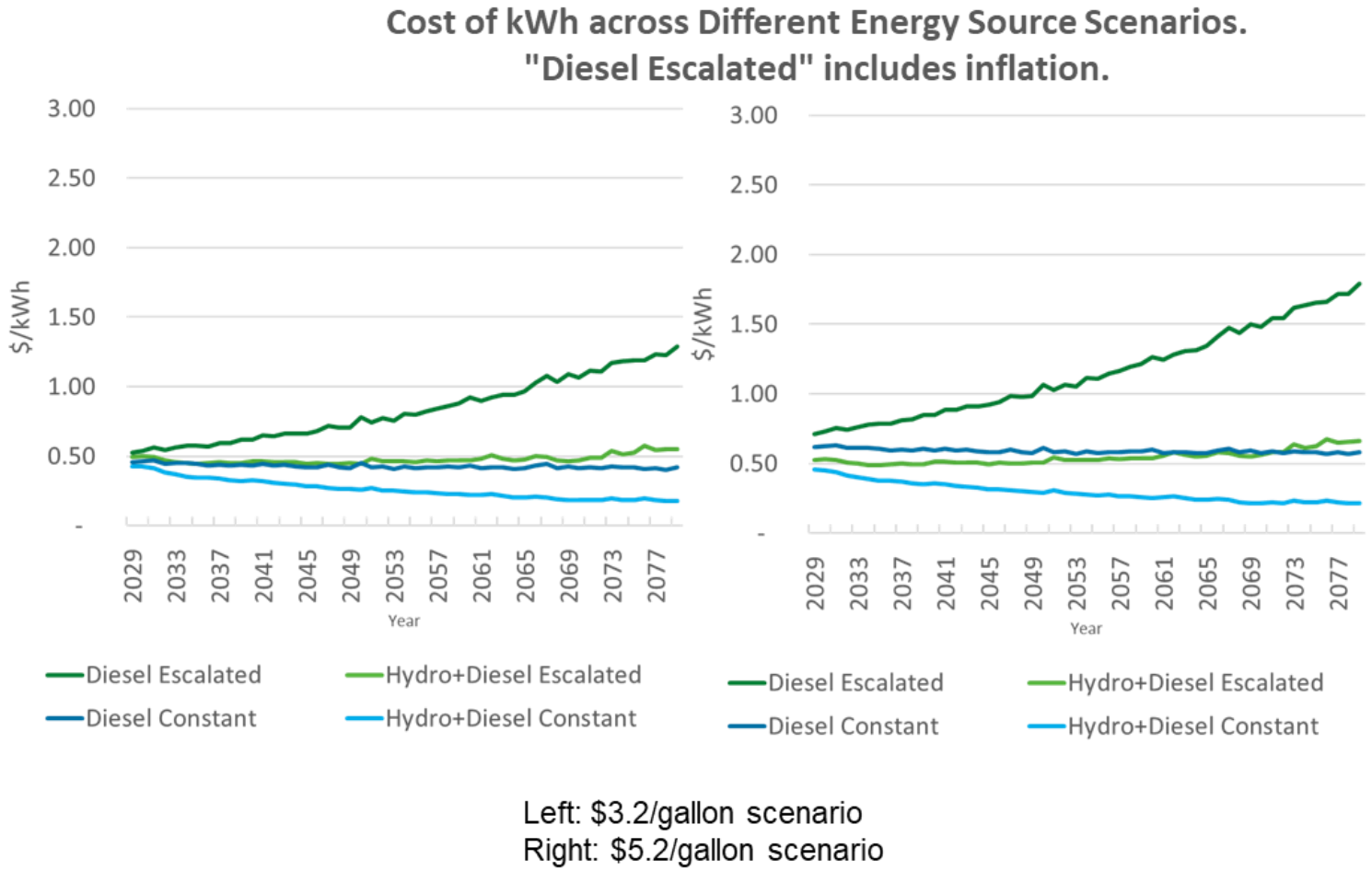
- The eDST spreadsheet has an embedded graphical user interface to enable easier exploration of key assumptions
- Associated outputs are visualized as graphs on the same page and can be saved as a pdf for future review.

Inputs within the User Interface (left)

Associated outputs within the User Interface (bottom)

Scenario Comparison – Example 1

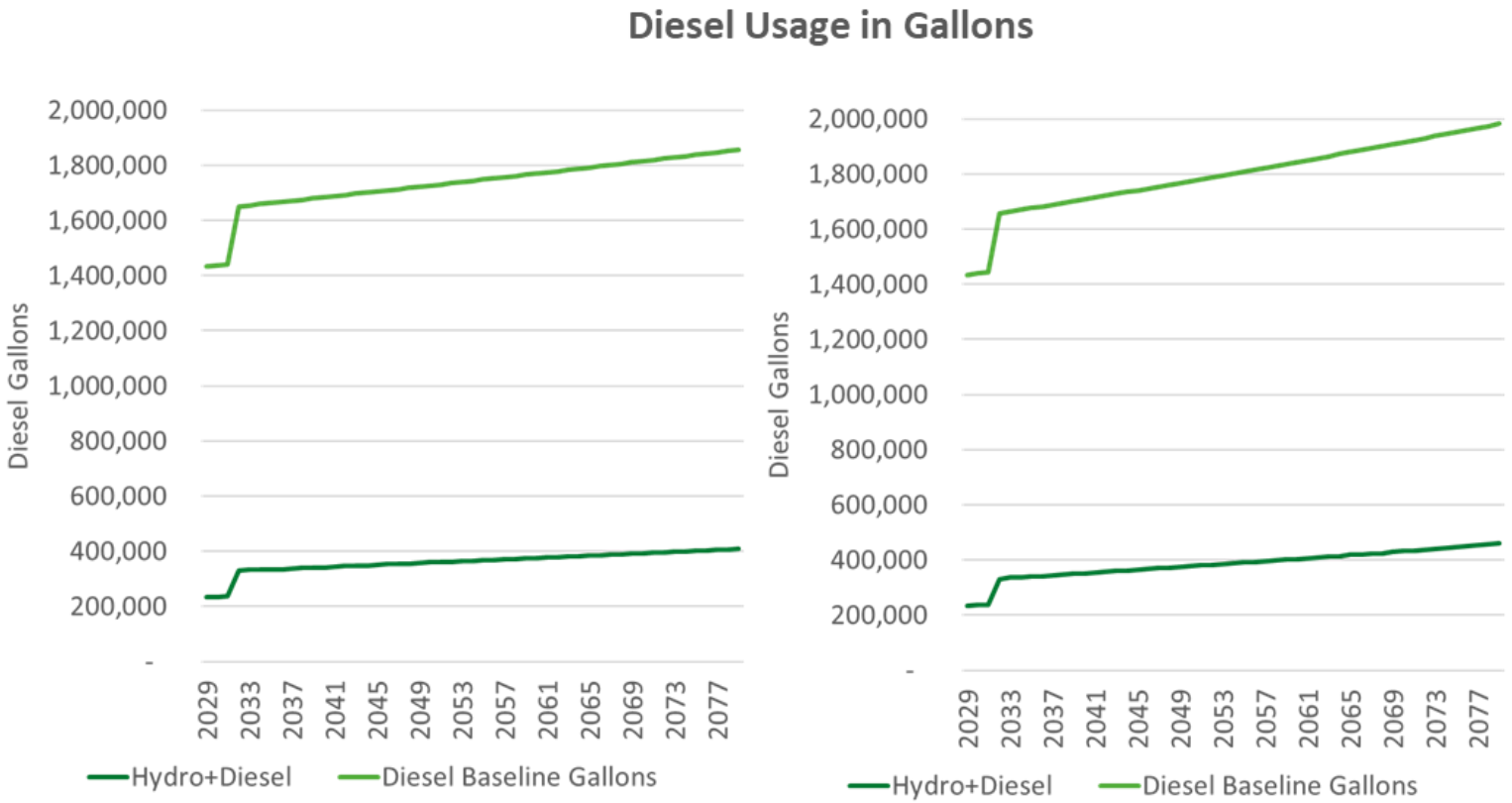
- Generated two scenarios with different prices of diesel: $3.20/gallon vs. $5.20/gallon
- eDST shows that for higher price of diesel, cost of kWh substantially increases after diesel only scenarios but doesn't change as much for hydro + diesel scenarios



Left: $3.2/gallon scenario
Right: $5.2/gallon scenario

Scenario Comparison – Example 2

- Generated two scenarios with different growth rates for Dillingham & Aleknagik:
  - 1.0025 vs. 1.0040 growth rate
- eDST shows that a higher growth rate leads to 20% increase in diesel consumption across both scenarios, but total cost of fuel is much higher in diesel only scenario



Left: 1.0025 growth rate
Right: 1.0040 growth rate

Note: In the scenario, increase in emissions after ~4 years is due to demand assumption from other villages being integrated into NETC

Economic Impact Summary

- Summarizes the various factors considered across diesel/hydro costs, fishery valuations, and social value of emissions
- Net Present Value summarizes the feasibility of the project
  - Negative value: infeasible from a fuel cost/commercial fisheries perspective
- See associated spreadsheets:
- “Economic Model

Economic Results

Cost of Baseline vs Powerhouse		
	Present Value of Baseline Costs	195,578,715
	PV ofDiesel Baseline CO2 Value	1,070,715,757
	PV of Diesel Baseline NOx Value	4,105,957,539
	PV of Diesel Baseline SOx Value	611,554
	Commercial Value: Sockeye	386,629,464
	Commercial Value: Chinook	26,270,613
	Sports Fishers Value	17,513,098,485
	Present Value of Powerhouse+ Gran	$232,806,190
	Hydro+Diesel CO2 Value	236,926,583
	Hydro+Diesel NOx Value	908,560,916
	Hydro+Diesel SOx Value	135,324
	Commercial Value:	386,629,464
	Commercial Value:	26,270,613
	Sports Fishers Value	17,513,098,485
Benefits		
	Change in Operating Costs	($37,227,475)
	Change in Value Carbon Reduction	833,789,174
	Change in Value Carbon Reduction	3,197,396,623
	Change in Value Carbon Reduction	476,230
	Commercial Value: Sockeye	-
	Commercial Value: Chinook	-
	Sports Fishers Value	-
	Total Benefits	**$3,994,434,553**

Screenshot of the “Economic Model” worksheet within the eDST

Note: these numbers reflect “test” data for fish, river flow, and power values. These assumptions may change dramatically as the other models are completed.

Verification & Validation Activities

- Diesel assumptions were adjusted based on input from NETC experts until expected numbers were observed for appropriate base electricity rate ($/kWh)
- Existing fish data did not align with eDST needs. Thus, we consulted SMEs to review associated assumptions.

Generator #	Engine Model	KW rating	Current Hours	Hours Remaining	Overhaul Cost/Mwh	Remaining Depreciation Value
10	3516-A	1135	139,614	-39,614	$10.33	$-
11	3512-B	1050	96,460	3,540	$11.31	$-
12	3512-B	1050	80,235	19,765	$11.31	$-
13	3512-B	1050	84,169	15,831	$11.31	$-
14	3512-C	1050	64,568	35,432	$11.31	$15,736.19
15	3512-C	1050	70,802	29,198	$11.31	$15,866.01
16	3456	455	20,341	79,659		$24,858.15
17	3608	2420	3,141	96,859	$2.90	$1,201,305.92
18	3608	2420				
Total		11680				

Example datasets that were compiled to help inform the generation of inputs for the eDST

Economic Impacts in Alaska from Commercial Fishing, Seafood Processing, and Tourism, 2019

	Direct	Indirect & Induced	Total
Seafood Industry			
Commercial Fishing			
Employment: (Seasonal) and Annualized	(8,600) 2,570	1,100	3,670
Labor Income ($million)	$223.20	$70.50	$293.70
Seafood Processing			
Employment: (Seasonal) and Annualized	(6,000) 1,200	500	1,700
Labor Income ($million)	$57.70	$23.10	$80.80
Economic Output ($million)			$990.00
Visitor Industry			
Employment: (Seasonal) and Annualized	(2,300) 1,400	600	2,000
Labor Income ($million)	$43.70	$24.20	$67.90
Economic Output ($million)			$155.00
Total All Industries			
Employment: Total (Seasonal) and Annualized	(16,900) 5,170	2,200	7,370
Labor Income ($million)	$324.60	$117.80	$442.40
Economic Output ($million)			$1,145.00
Source: McKinley Research Group			

Future Directions

- Currently, eDST is self-contained
- However, the spreadsheet was designed to enable integration with findings from:
  - Climate and hydro models
  - Life cycle model
  - Powerhouse model
- Additional assumptions and user interface items can also be updated within the eDST

Climate Model

- ?-based
- Inputs: Climate Projections
- Outputs: Temp, Precip, Hydrograph
- Lead: Sean McDermott (NOAA)

Powerhouse Model

- Excel-based
- Inputs: River flow, % Diverted
- Outputs: kWh
- Lead: Kevin Jensen

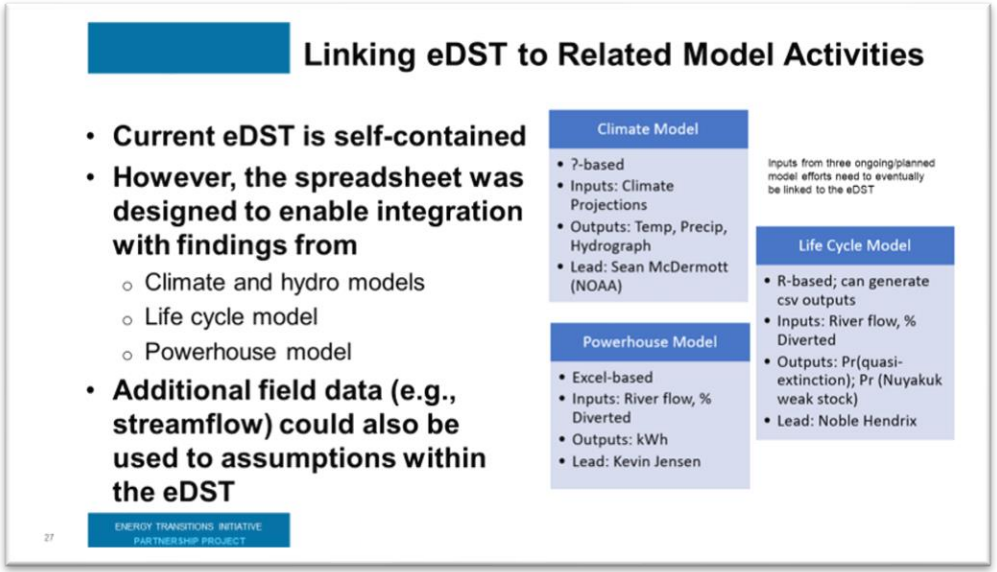
Inputs from three ongoing/planned model efforts need to eventually be linked to the eDST

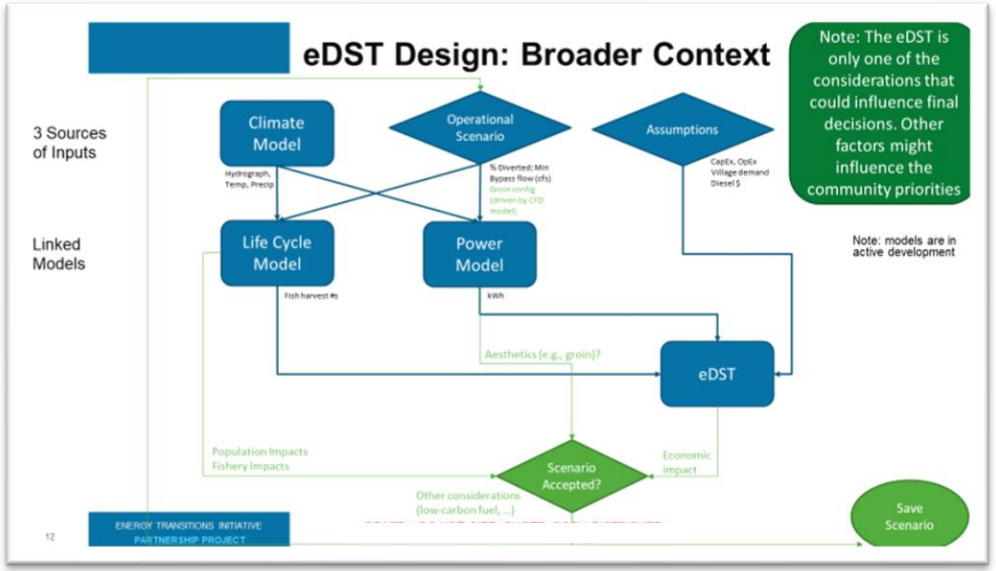
Life Cycle Model

- R-based; can generate csv outputs
- Inputs: River flow, % Diverted
- Outputs: Pr(quasi-extinction); Pr (Nuyakuk weak stock)
- Lead: Noble Hendrix

Conclusions

- The eDST is a useful tool to synthesize relevant economic details to support evaluation of the run-of-the-hydropower project into a single interface
- Effective use of the eDST requires use of best available information and constant review of the broader context





Pacific Northwest
NATIONAL LABORATORY

Thank you

Mark Weimar
Chief Economist
Pacific Northwest National Laboratory
+1-509-372-4906
mark.Weimar@pnnl.gov

Pacific Northwest
NATIONAL LABORATORY

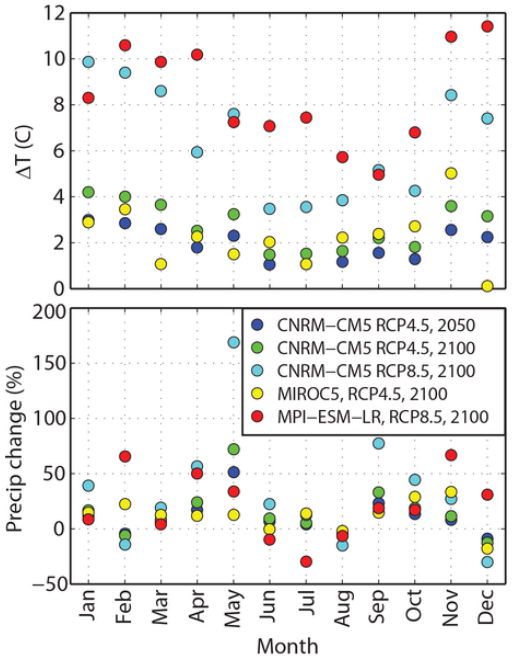
Appendix

3 Sources of Inputs: Climate & Hydro Data

- **Captures temperature, precipitation, and river flow for different climate conditions at a <u>monthly</u> scale**
- **Currently, eDST includes**
  - River flow baselines (based on averages of 1953-2020 data)
  - a flow rate change (based on published literature values, and is currently applied as a linear change over the simulation)

Assumed River Flow (cfs)	Average
Flow January	2,654
Flow February	2,266
Flow March	1,955
Flow April	1,934
Flow May	5,206
Flow June	15,350
Flow July	13,324
Flow August	8,851
Flow September	8,006
Flow October	7,824
Flow November	5,448
Flow December	3,524
Flow Rate Change (Climate Change)	
Flow Rate Growth January	0.0500%
Flow Rate Growth February	-0.0125%
Flow Rate Growth March	0.0250%
Flow Rate Growth April	0.0750%
Flow Rate Growth May	0.2125%
Flow Rate Growth June	0.0313%
Flow Rate Growth July	0.0125%
Flow Rate Growth August	-0.0250%
Flow Rate Growth September	0.1000%
Flow Rate Growth October	0.0563%
Flow Rate Growth November	0.0375%
Flow Rate Growth December	-0.0500%

Flow-related assumptions in eDST



Wobus C et al. 2015

Appendix: Future Work

3 Sources of Inputs: Operational Scenarios

- **Intended to capture consistent inputs into the life cycle and power models as well as eDST**
- **Currently, eDST contains diversion limits and has built-in estimates for:**
  - Generation of power from diesel vs. hydropower system
  - The fish that are born in the Nuyakuk

Percent of Flow Allowed for Power Generation (Diversion Limit)	
Flow Percent January	30%
Flow Percent February	30%
Flow Percent March	30%
Flow Percent April	30%
Flow Percent May	30%
Flow Percent June	30%
Flow Percent July	30%
Flow Percent August	30%
Flow Percent September	30%
Flow Percent October	30%
Flow Percent November	30%
Flow Percent December	30%

Diversion limit assumptions in eDST (left)

Estimates for power generation (below)

Power Generation				
	Riverflow in cubic ft/sec		3150	
	m		111,241.38	kg/s
	g		9.81	m/s^2
	hnet		7.13232	meters
	n		0.86	efficiency
	Power Output		6,693,676	per turbine
	Maximum		13,387,351.1	Watts
			13,387.35	kW max capacity
		Conversion cfs to kg/s	28.3168	
		Gross Head	26	Feet

Fish estimates for the Nuyakuk (below)

Fisheries								
			Dr Daniel Schinder, UW Fisheries Science					
			Ask Tim Sands	Ask for Highs and Lows for fish runs				
			From ADFG 2021 data					
			Nushagak Total	**Nuyakuk Affected %**	**Commercial**	**Sports**	**Subsistence**	**Escapement**
	Sockeye (Mil. Fish)		5.333	75%	56%	26%	6%	0.1191
	Chinook (Mil. Fish)		0.55	10%	54%	24%	4%	0.1727
	Coho	LCM isn't calculating		The key is to forecast the area with Sockeye				
	Pink	LCM isn't calculating		Variability of runs in the Nuyakuk.				
	Chum/Dog	LCM isn't calculating						

3 Sources of Inputs: Assumptions

- **Additional inputs required for the eDST, ranging from community growth rates to fuel/fish prices and construction costs**

Patronage Dividend		Not lately
Margin (TIER) Long term debt	1.5	ratio
DCR	1.2	ratio
Working Capital	1,000,000	Dollars
Dillingham Start Year		2029
Dillingham Growth Rate		1.015
Month		January
Dillingham & Aleknagik	Consumption (kWH)	1,535,751
Dillingham & Aleknagik	Capacity (kW)	2,770
Dillingham Commercial Start Year		2029
Dillingham Commercial Growth Rate		1.005
Month		January
Commercial	Consumption (kWH)	
Commercial	Capacity (kW)	
		1,535,751
Month		January
Koliganek Start Year		2021
Koliganek Growth Rate		
Month		
Koliganek	Consumption (kWH)	
Koliganek	Capacity (kW)	

Community growth rates (top)

Fish prices (right)

	Sockeye Weight	4	lbs
	Chinook Weight	8	lbs
Commercial Fish Price			
	Sockeye	3	$/lb
	Chinook	6	$/lb
Sports Value			
	Permitted	4	fish/person (max)
	Sports_Value	3,343	Value/Sports Fisherma
Subsistence Value			
	Sockeye	10.00	
	Chinook	17.18	
Commercial Economic Multiplier		2.86	
Total US Multiplier		5.41	Not currently used.
Construction Multiplier		2.10	From JEDI
Local Content		0.50	Assumption
Annual Jobs Operations Multiplier		2.25	From JEDI

Diesel

Generator #	Engine Model	KW rating	Current Hours	Hours Remaining	Remaining Depreciation Value
10	3516-A	1135	139,614	-39,614	$-
11	3512-B	1050	96,460	3,540	$-
12	3512-B	1050	80,235	19,765	$-
13	3512-B	1050	84,169	15,831	$-
14	3512-C	1050	64,568	35,432	$15,736.19
15	3512-C	1050	70,802	29,198	$15,866.01
16	3456	455			
17	3608	2420			
18	3608	2420			
Loan interest 1		0.004875	Quarterly Rat		
Loan interest 2		0.004725	Quarterly Rat		
Loan interest 3		0.003445	Quarterly Rat		
Loan interest 4		0.0024375	Quarterly Rat		
Loan interest 5		0.0044975	Quarterly Rat		

Diesel generation (top)

Diesel fuel costs (right)

Powerhouse Consumption	2.410%	
Line Losses (Distribution Loss)	6.109%	%
Fuel escalation rate	2.000%	%/year
Diesel Generator Interest Rate	0.000%	%/year
Inflation rate (monthly)	2.000%	%/year
Base year	2022	Year
Major Overhaul Equipment Amortizati	36	Months
Major Overhaul Large Diesels	$295,200.00	
Major Overhaul Small Diesels	$120,000.00	
Hours to Major Overhaul Large Diesel	40,000	Hours
Hours to Major Overhaul Small Diesel	22,000	Hours
Minor Overhaul Equipment Amortizati	18	Months
Minor Overhaul Large Diesels	$174,500.00	
Minor Overhaul Small Diesels	$75,000.00	
Hours to Minor Overhaul Large Diesel	20,000	Hours
Hours to Minor Overhaul Small Diese	11,000	Hours
Electricity Operating Taxes	0.0005	$/kWh
Loading	0.72	fraction
Average Fuel Efficiency	14.0811	kWh/gallon
Fuel Cost per gallon	$ 3.20860	$/gallon
Fuel Cost per kWh	0.22787	$/kWh
Fuel Cost per MWh	227.87	$/MWh
Lube oil cost avg.	$4.79	$/MWh
Repairs other than other production c	0.00971	$ total
Fuel_Surcharge	-	$/MWh (this is a formula
Actual Fuel Cost	-	$/gallon
Minium Diesel Capacity Factor	0.5	fraction
Optimal Diesel Capacity Factor	0.72	fraction
Other Production Costs	0.07178	$/kWh
CO2 Emission per kWh	1.6	lbs/kWh Tier 2
NOx Emission per kWh	0.01727	lbs/kWh Tier 2
SOx Emission per kWh	0.001000	gms/kWh Tier 2
CO2 Reduction Value	51.0	$/MT
NOx Reduction Value	18,000.0	$/MT
SOx Reduction Value	21,000.0	$/MT
Lbs/MT	2,204.62	Lbs/MT

				2025-2026	2027	2028	2029
Estimated Costs for Hydro Generation			Units	Pre-Construction	Construction Spend		
Construction				Year -4	Year -3	Year -2	Year -1
		-	($)				
x	Pre-construction costs	10,000,000	($)	10,000,000			
x	Powerhouse structure civil works	18,900,000	($)			9,450,000	9,450,000
	Water conveyence systems	19,700,000	($)			9,850,000	9,850,000
x	Electro-mechanical equipment	11,500,000	($)			5,750,000	5,750,000
x	Transmission and interconnection	31,000,000	($)				31,000,000
x	Lands and site preparation	27,574,000	($)		27,574,000		
x	Licensing and permitting	8,110,000	($)		8,110,000		
x	Project management	12,165,000	($)		4,055,000	4,055,000	4,055,000
x	Taxes and insurance	1,622,000	($)		499,862	366,101	756,038
	Contingencies	10%			4,023,886	2,947,110	6,086,104
	Total Project Cost	153,628,100		10,000,000	44,262,748	32,418,211	66,947,142
	Plant Size	10	MW				
	Total Output Multiplier	0.636	local only	This value is low due the amount of materials bought elsewhere			
	Construction Period	3	Years				
	Construction Interest Rate	2.00%					
	Debt/Equity Ratio	100%					
Transmission							
	Miles of Transmission	120	Miles				
	Cost per mile	550,000.00	$				
	kV of new transmission	34	kV				
	Estimated Cost of transmission	66,000,000	($)	Is this included above?			
	Estimated Transmission Losses	5.00%					
Project Spend Plan							
	Project year	-4	-3	-2	-1		
	Percent of Project by Grant	50%	50%	50%	50%		SUTA Program qu
	Grants by Year	5,000,000	22,131,374	16,209,105	33,473,571		Line of credit fror
	Other by Year						
Type of payment schedule		Mortgage Style					
Hydro & General Operational Period Costs							
	Hydro Power House Consumption	1.0000%					
	Operations Period Interest Rate	4.0%					
	Discount Rate Owners Hurdle Rate	7.00%					
	Federal Tax Rate						
	Gross Receipts Tax	0.0005	$/kWh				
	Property Tax Rate or lease cost	No property or sales tax					
	Insurance Rate (% of Capital)	0.30%					
	Operations Period Interest Rate	4.00%					
	Fixed O&M Costs	53,571	$/MW				
	Variable O&M costs	9.92	$/MWh				
	Annual Cost Escalation Rate	2.0%					
	Hydro Major Repairs	1,000,000	($)				
	Years of major repairs	3	# times over __years				
	Interest rate on major repair sinking f	0.50%					
	Major Repair Interval Length	40	year				
	Interval period	13					
	Depreciable Life	100	year				
	Loan Life	40					
	Valuation Life						
Other Costs							
	Operating Margin	0.03	Fractio				
	G&A	1,400,715	2022				
BCA period (years)		50	years				
Hydropower multiplier		3.28	JEDI				

Hydropower construction costs (top/left)

Appendix: Future Work

"Linked Models"

- **Using built-in assumptions, the eDST estimates**
  - the amount of power that is being generated from the hydropower system for a given month/year
  - breakdown of fish across escapement, commercial, sports and subsistence categories
- **These estimates for power/fish are intended to be developed and provided by associated models once those are completed**

Power Model Outputs -- Economic Model Inputs

	Days in Month	31	29	31	30	31	30	31	31
	Days in Month	31	28	31	30	31	30	31	31
	Year	2029	2029	2029	2029	2029	2029	2029	2029
	Hours	744	672	744	720	744	720	744	744
		1/31/2029	2/28/2029	3/31/2029	4/30/2029	5/31/2029	6/30/2029	7/31/2029	8/31/2029
		January	February	March	April	May	June	July	August
Hydropower Generation									
	Estimated River Flow (cfs)	2,653.79	2,265.69	1,954.59	1,933.95	5,205.93	15,349.73	13,323.79	8,851.00
	Hydro Diversion Limit (fraction of flow)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	River flow for Power (cfs)	796	680	586	580	1,562	4,605	3,997	2,655
	Max Generation Power from Hydro (kW)	1,357	1,158	999	989	2,661	7,846	6,811	4,524
	Hydropower Generation (kWh)	1,009,261	778,276	743,349	711,772	1,979,863	5,649,330	5,067,157	3,366,115

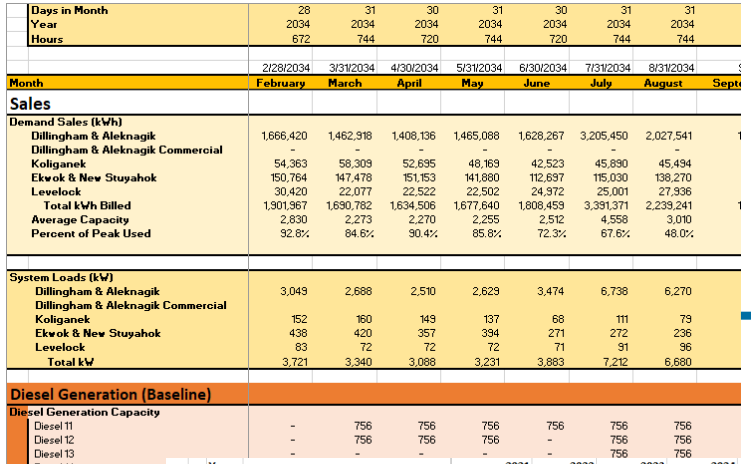
Life Cycle Model

			2029	2030	2031	2032	2033	2034	2035
	Sockeye %		0.010%	Can be ignored once actual data is available					
	Chinook %		0.001%	Can be ignored once actual data is available					
Baseline									
	Sockeye	Million Fish	4.000	4.013	4.015	4.016	4.018	4.020	4.021
	Chinook	Million Fish	0.055	0.055	0.055	0.055	0.055	0.055	0.055
Powerhouse Version									
	Sockeye	Million Fish	4.000	4.013	4.015	4.016	4.018	4.020	4.021
	Chinook	Million Fish	0.055	0.055	0.055	0.055	0.055	0.055	0.055

Current representation of hydropower generation (top) and fish numbers (bottom) within the eDST

Diesel and Hydro Costs

- **Monthly economic model calculates diesel and powerhouse-related costs**
  - Contains baseline (diesel only) and powerhouse alternative (diesel + run-of-the-river hydropower project)
  - Approach includes both book values and cash flow
  - Values are aggregated to annual values
- **Two associated spreadsheets:**
  - “Diesel and Hydro Monthly”
  - “Annual Diesel and Hydro Costs”



Days in Month	28	31	30	31	30	31	31	
Year	2034	2034	2034	2034	2034	2034	2034	
Hours	672	744	720	744	720	744	744	
	2/28/2034	3/31/2034	4/30/2034	5/31/2034	6/30/2034	7/31/2034	8/31/2034	
Month	February	March	April	May	June	July	August	Sept
Sales								
Demand Sales (kWh)								
Dillingham & Aleknagik	1,666,420	1,462,918	1,408,136	1,465,088	1,628,267	3,205,450	2,027,541	1
Dillingham & Aleknagik Commercial	-	-	-	-	-	-	-	
Koliganek	54,363	58,309	52,695	48,169	42,523	45,890	45,494	
Ekwok & New Stuyahok	150,764	147,478	151,153	141,880	112,697	115,030	138,270	
Levelock	30,420	22,077	22,522	22,502	24,972	25,001	27,936	
Total kWh Billed	1,901,967	1,690,782	1,634,506	1,677,640	1,808,459	3,391,371	2,239,241	1
Average Capacity	2,830	2,273	2,270	2,255	2,512	4,558	3,010	
Percent of Peak Used	92.8%	84.6%	90.4%	85.8%	72.3%	67.6%	48.0%	
System Loads (kW)								
Dillingham & Aleknagik	3,049	2,688	2,510	2,629	3,474	6,738	6,270	
Dillingham & Aleknagik Commercial								
Koliganek	152	160	149	137	68	111	79	
Ekwok & New Stuyahok	438	420	357	394	271	272	236	
Levelock	83	72	72	72	71	91	96	
Total kW	3,721	3,340	3,088	3,231	3,883	7,212	6,680	
Diesel Generation (Baseline)								
Diesel Generation Capacity								
Diesel 11	-	756	756	756	756	756	756	
Diesel 12	-	756	756	756	-	756	756	
Diesel 13	-	-	-	-	-	756	756	
Diesel 14								
Diesel 15								
Diesel 16								
Diesel 17								
Diesel 18								
Total Capacity								
Generation+losses								
Diesel Gallons Used								
Capacity Factor								

Monthly values (left) are aggregated to annual numbers (bottom)

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029
Meter Consumption					-	-	-	-	18,604,293
Diesel Cost Baseline									
Diesel Gallons Consumed									1,433,777
Cash Costs									
Fuel Cost					-	-	-	-	5,284,432
Fuel Surcharge	Delete this row								-
Lube oil cost avg.					-	-	-	-	111,124
Other Production Costs									1,439,350
Generator maintenance costs between overh	Labor, generator repair, buildings, grounds				-	-	-	-	225,259
Major Overhaul					-	-	-	-	-
Minor overhaul					-	-	-	-	86,151
Operating Costs					-	-	-	-	7,146,316
Diesel + Hydro									
kWH Demand									18,604,293
Diesel Generation									3,303,515
Diesel Gallons Used									234,606
Financing					10,000,000	44,262,748	32,418,211	66,947,142	
Grants					5,000,000	22,131,374	16,209,105	33,473,571	
Other									
To Finance					5,000,000	22,131,374	16,209,105	33,473,571	
Debt					5,000,000	22,131,374	16,209,105	33,473,571	
Equity (Minimum)					-	-	-	-	
Capitalized Value									79,905,147
Principal					5,000,000	27,231,374	43,985,107	78,338,380	79,905,147
Interest					100,000	544,627	879,702	1,566,768	3,196,206
Payment									$4,037,087
Total					5,100,000	27,776,001	44,864,809	79,905,147	$79,064,266

Diesel Depreciation & Loan Amortization

- **Note: two background-related data tables remain in the eDST**
  - Diesel depreciation
  - Diesel loan amortization assumptions
- **These tables…**
  - Capture a lot of information that was hard to embed within the assumption page.
  - Are linked directly to the “Annual Diesel and Hydro Costs” worksheet

12/28/2021 2:0 7:54 pm

ASSET MANAGEMENT

DEPRECIATION CALCULATION

Detail For Period NOV 2021

Part: A

L Div: I GL Account: 344.0 GENERATORS GL Dept: 0 Depr GL Div: I GL Account: 403.4 DEP EXP - OTHER PR GL Dept: (

epr Method: Combination 0.5834 % Accum GL Div: I GL Account: 108.4 DEPR RESERVE-OTH GL Dept: (

set	Description	Total Salvage Value	Capitalized Cost	Depr Rate	Months To Depr	Amount Depreciated	Accumulated Depreciation	Loss Amount	Balance To Depr	Mth Depr
440003	GENERATOR UNIT #3	-	-	4.00		-	-	-	-	(
440004	GENERATOR UNIT #4	-	-	4.00		-	-	-	-	(
440005	GENERATOR UNIT #5	-	-	4.00		-	-	-	-	(
440006	GENERATOR UNIT #6	-	-	4.00		-	-	-	-	(
440008	GENERATOR UNIT #8	-	-	4.00		-	-	-	-	(
440009	GENERATOR UNIT #9	-	-	4.00		-	-	-	-	(
4400117	GENERATOR UNIT#7	-	1,441,039.30	0.58		8,407.02	193,361.46	-	1,247,677.84	2
4400118	GENERATOR UNIT#8	-	1,441,039.30	0.58		8,407.02	193,361.46	-	1,247,677.84	2
440014	GENERATOR UNIT#14	-	154,247.72			899.88	142,111.05	-	12,136.67	8
440015	GENERATOR UNIT # 15	-	155,290.19			905.96	143,048.02	-	12,242.17	8
4400 16	GENERATOR UNIT #16	-	110,882.30			646.89	88,611.71	-	22,270.59	8
440051	GOVERNOR AND INS T	-	13,213.91	0.33		44.04	12,111.00	-	1,102.91	8
440100	JACKET WATER COOL!	-	204,687.40	0.33		682.22	102,337.69	-	102,349.71	8
ota l:		-	3.520.400. 12			19.993.03	874.942.39	-	2.645.457.73	

Loan AK 026 N8

Draw	Date	Amount	Interest Rate	Quarterly Interest Rat
1	8/21/2019	$ 11,371,408.52	1.95%	0.004875
2	10/11/2019	$ 349,114.00	1.89%	0.004725
3	11/30/2020	$ 325,000.00	1.378%	0.003445
4	8/30/2021	$ 876,176.97	0.975%	0.0024375
5	11/30/2021	$ 610,300.51	1.799%	0.0044975
Total		**$ 13.532.000.00**		

Screenshots from the diesel depreciation (top) and diesel loan amortization (bottom) worksheets within the eDST

eDST Module: Fisheries Valuation

- **Involves two calculations:**
  - A total run for the Nuyakuk based on river flow
  - Categorization of total run into escapement, subsistence, commercial, etc.
- **Fish within commercial and sport fisheries categories are then multiplied by associated $/lb to calculate a total dollar value**

			2029	2030
Baseline				
	Sockeye %		0.010%	
	Chinook %		0.001%	
	Sockeye	(Mil. Fish)	4	4.013
	Chinook	(Mil. Fish)	0.1	0.055
Sockeye				
Commercial			2.2413	2.2486
Sports			1.0413	1.0446
Subsistence			0.2413	0.2420
Escapement			0.4763	0.4778
Chinook				
Commercial			0.0298	0.0299
Sports			0.0133	0.0134
Subsistence			0.0023	0.0023
Escapement			0.0095	0.0095
Commercial Value				
	Sockeye	$	29,101,058	29,195,970
	Chinook		1,322,101	1,326,413
Sports Fishers Value				
Number of fisherman				
Value			881	
Subsistence Value				
	Sockeye		2,41	
	Chinook		40	
Total Economic Impact			86	

Powerhouse Alternative				
Available Riverflow for fish	(cfs)		53,438	53,612
Fish Return to Nuyakuk				
	Sockeye	(Mil. Fish)	4.00	4.01
	Chinook	(Mil. Fish)	0.06	0.06
Sockeye				
Commercial		Fish (Mil.)	2.2413	2.2486
Sports		Fish (Mil.)	1.0413	1.0446
Subsistence		Fish (Mil.)	0.2413	0.2420
Escapement		Fish (Mil.)	0.4763	0.4778

Annual values for fish for baseline of diesel (left) vs. powerhouse Alternative (bottom)