New Clear Free

SOLUTIONS

The purpose of New Clear Free Solutions is to:

provide energy oversight to the public and official decision makers using objective scientific, regulatory and financial information.

The objective of New Clear Free Solutions is to:

help ensure safe, affordable, and sustainable energy solutions for the public and environment.

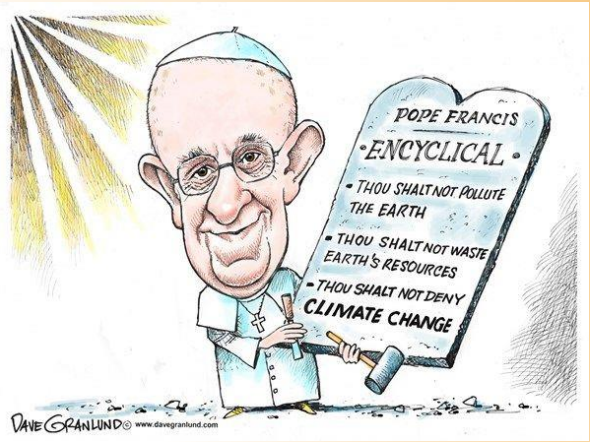
IF YOU FOCUS ON THE PROBLEM, YOU CAN'T SEE THE SOLUTION. NEVER FOCUS ON THE PROBLEM.

Official Decision Makers

SOLUTIONS COP21 PARIS 2015

Harper Agrees to End Use of Fossil Fuels by 2100, Make Deep Cuts to Emissions by 2050 at G7 Summit

By Carol Linnitt • Monday, June 8, 2015 - 15:42



COMMUNIQUÉ OF CANADA'S FIRST MINISTERS

Prime Minister Justin Trudeau and First Ministers in Vancouver.

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Provincial government creating select committee on climate change

08 April 2016

FREDERICTON (GNB) – A select committee of the legislative assembly is being established to develop a stronger New Brunswick response to climate change.

"Climate change is the single most significant challenge of our generation," said Environment and Local Government Minister Brian Kenny. "Through this select committee, we will foster dialogue on how we can seize the opportunities that come along with fighting climate change and address its impacts in a way that respects New Brunswick's distinct economic challenges and opportunities."

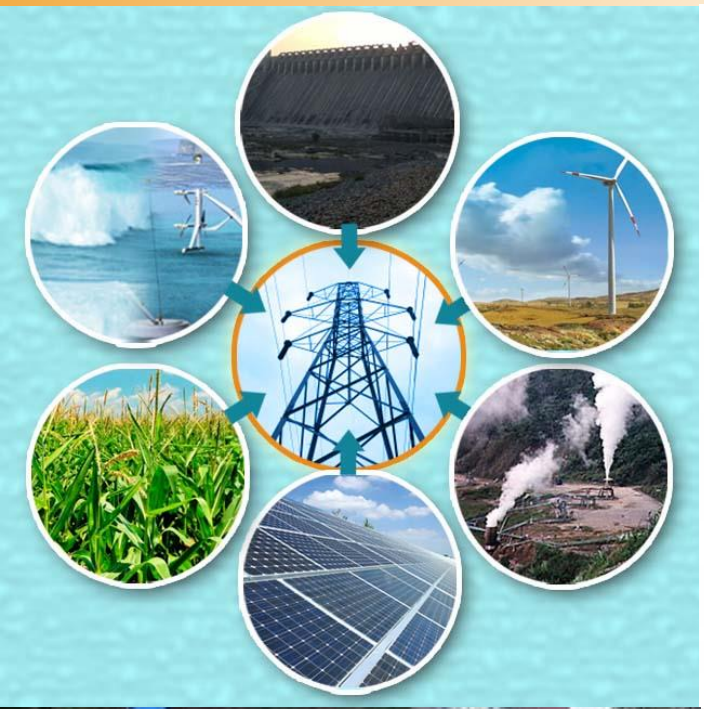
Our Request To The Board

- In the short term we want NB Power to model the various policy options, so that our government can compare them and make informed decisions.
- Modeling to include:

1. Rates
2. Emission Reductions
3. Job Creation
4. Benefits to due to Economic Activities
5. Financial Risk

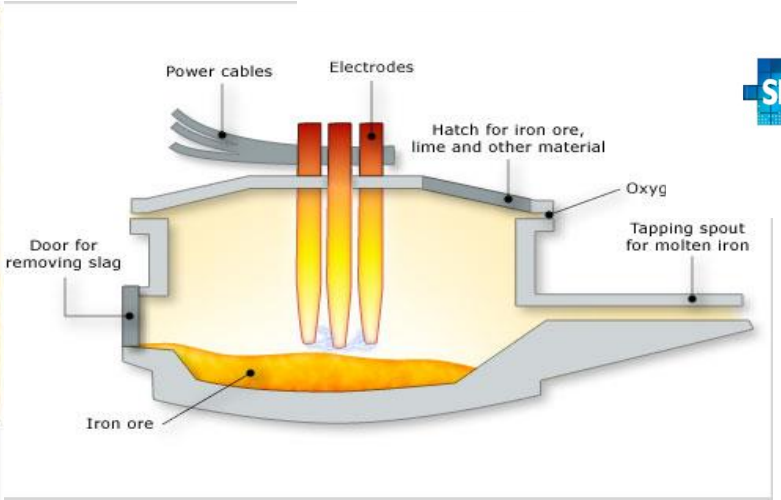
- In the long term, for the next iteration of the IRP, we want NB Power to reduce uncertainty in Levelized Cost Of Electricity with project specific cost data for wind, geothermal, and Combined Heat and Power Biofuel.
- Explore different generation mix options including phasing out nuclear.

Technical Barriers? NO



POWER SHIFT ATLANTIC ATLANTIQUE
An energy research project • Un projet de recherche sur l'énergie

Scientists have created an organic farm that stores more carbon than it emits



smart grid

Public VS Private Investment?

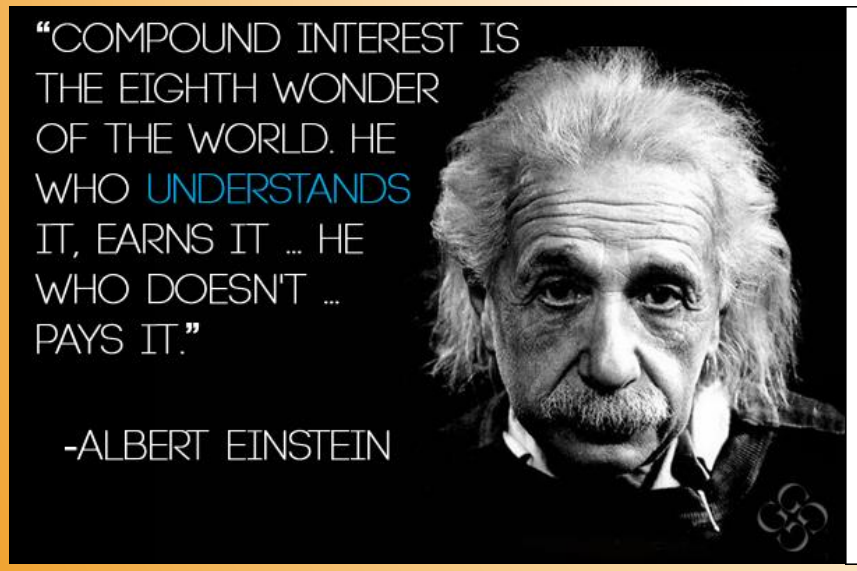
- Canada's Renewable Energy Resource Are Worth Billions of Dollars per year FOREVER.
- Significant New Source of Revenue for Provinces with No Fossil Fuel Resources.
- Revenue Replacement for Provinces that Rely on Fossil Fuel Revenue.
- MOST IMPORTANT DECISION!!!!!!!!!
- Room for Private Operations (Community Energy Projects, ect)

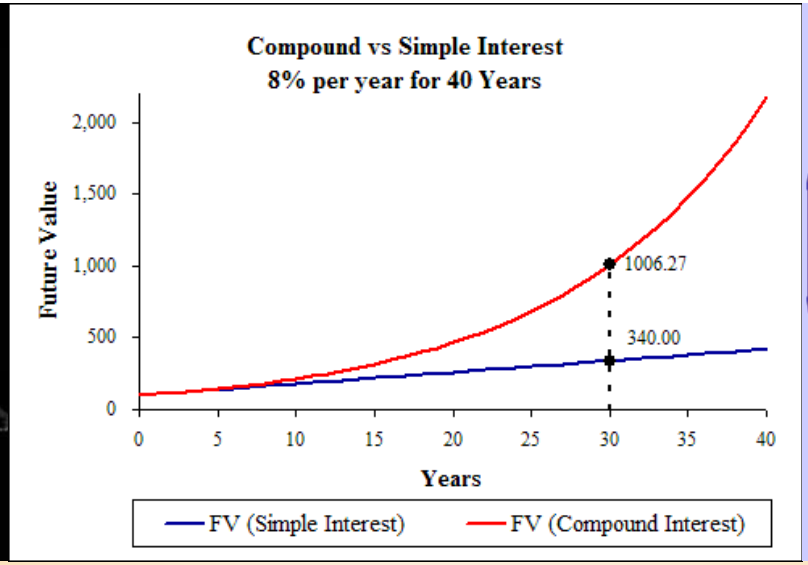
Policy Options?

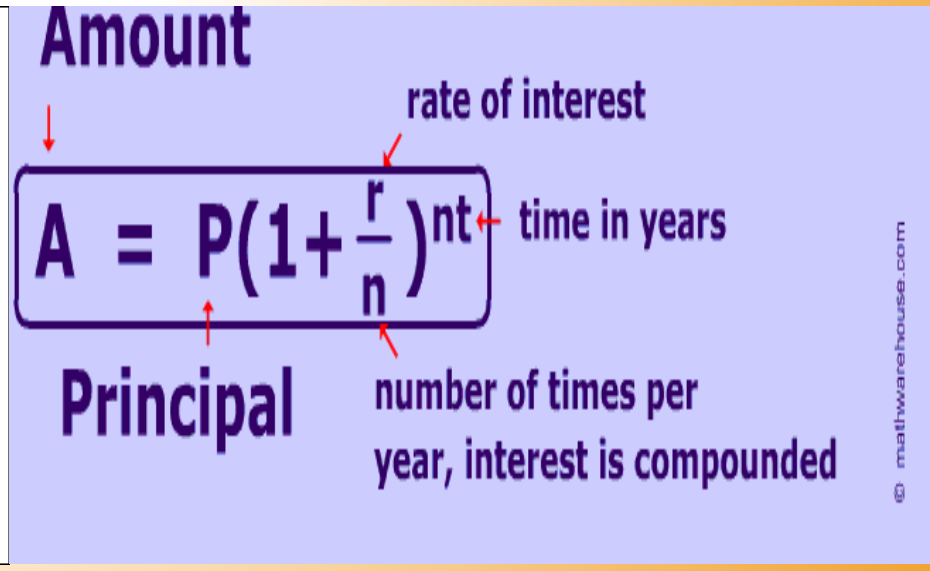
1. Carbon Tax
2. Cap and Trade
3. Regulation/Renewable Portfolio Standard (RPS)
4. Technology Subsidies
5. Long Term Power Purchase Agreements (PPA)
6. Best parts of All of the Above

Carbon Tax and Investment Plan (CTIP)

1. Tax Carbon and Invest In Renewable Energy
2. Reinvest Return on investment (PPA) in Renewable Energy
3. Repeat Until Renewable Portfolio Standard (RPS) is Reached







Policy Methodology

Yearly MWh=(Carbon Tax Revenue + Yearly Return On Investment)/In Service Capital Cost*Capacity Factor*365 Days Per Year* 24 Hours Per Day

Yearly Return On Investment=(Carbon Tax Revenue + Return On Investment)/In Service Capital Cost*Capacity Factor*365 Days Per Year* 24 Hours Per Day*(LCOE-O&M)

Yearly MWh=Sum of Yearly MWh of all investments within their operating lifespan

Yearly Return on Investment=Sum of Yearly Returns on Investment of all investments within thier operating lifespan

PPA=Levelized Cost Of Electricity(LCOE) – O&M Cost

Modeling Assumptions

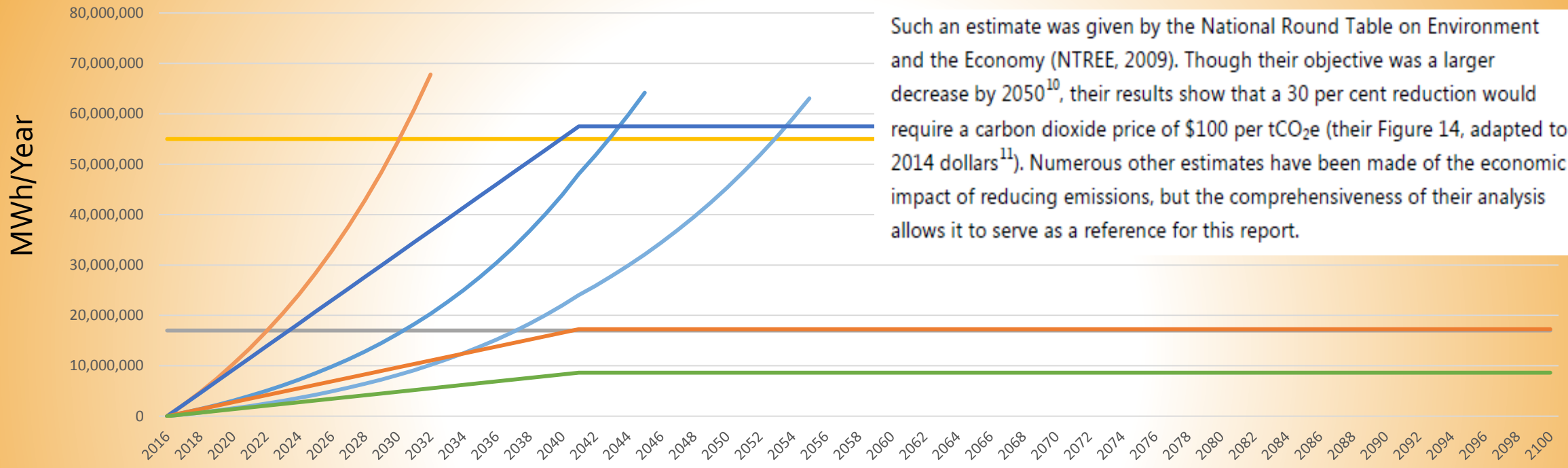
Policy Assumptions

- Carbon Tax is Economy Wide. (Everyone pays their fair share)
- Carbon Tax is Fixed Price with Declining Revenue as Carbon is Reduced. (Only plan that does not require increases)
- Fixed LCOE at $70/MWh With Return on Investment = LCOE-O&M. (Stable Rates, Technology Subsidy)
- Renewable Portfolio Standards Targets based on current energy usage

Technology Assumptions

- In Service Capital Cost mostly from NB Power Integrated Resource Plan
- O&M Cost mostly from NB Power Integrated Resource Plan
- Lifespan fixed at 25 years due to modeling complexities. (Most likely conservative)
- Not adjusted for inflation (Not needed for policy comparisons)
- No Technology Improvements. (VERY Unlikely)

Sensitivity Analysis Carbon Price



- Target 1 100% Renewabe Electricity MWh Per Year
- Target 2 100% Renewable Energy MWh Per Year
- $100 Per Ton MWh/Year CTIP
- $30 Per Ton MWh/Year CTIP
- $15 Per Ton MWh/Year CTIP
- $100 Per Ton MWh/Year Investement Only
- $30 Per Ton MWh/Year Investement Only
- $15 Per Ton MWh/Year Investement Only

Parliamentary Budget Office April 2016 (Revenue Neutral) $100/Ton

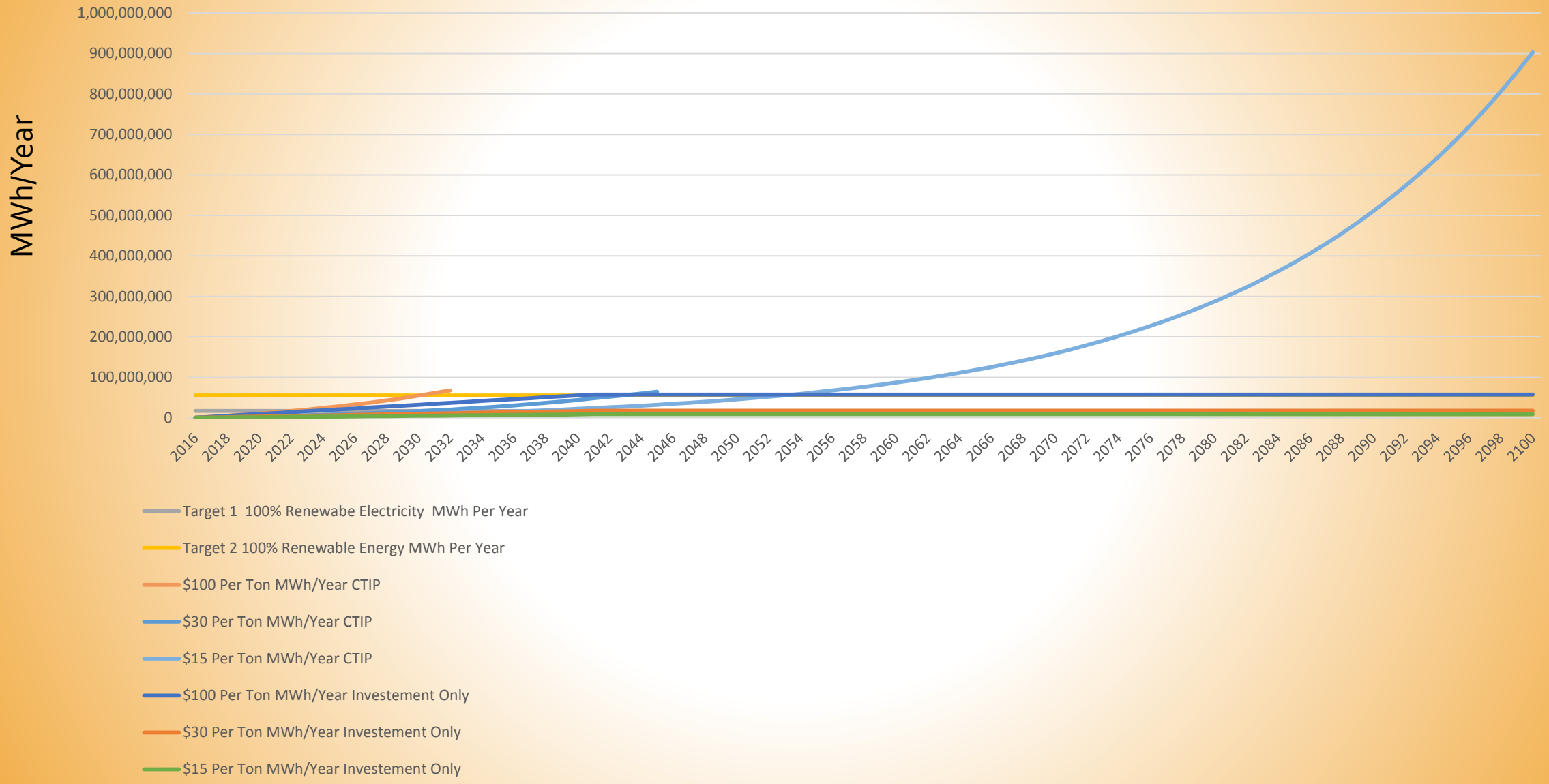
Such an estimate was given by the National Round Table on Environment and the Economy (NTREE, 2009). Though their objective was a larger decrease by 2050[10], their results show that a 30 per cent reduction would require a carbon dioxide price of $100 per tCO_2e (their Figure 14, adapted to 2014 dollars[11]). Numerous other estimates have been made of the economic impact of reducing emissions, but the comprehensiveness of their analysis allows it to serve as a reference for this report.

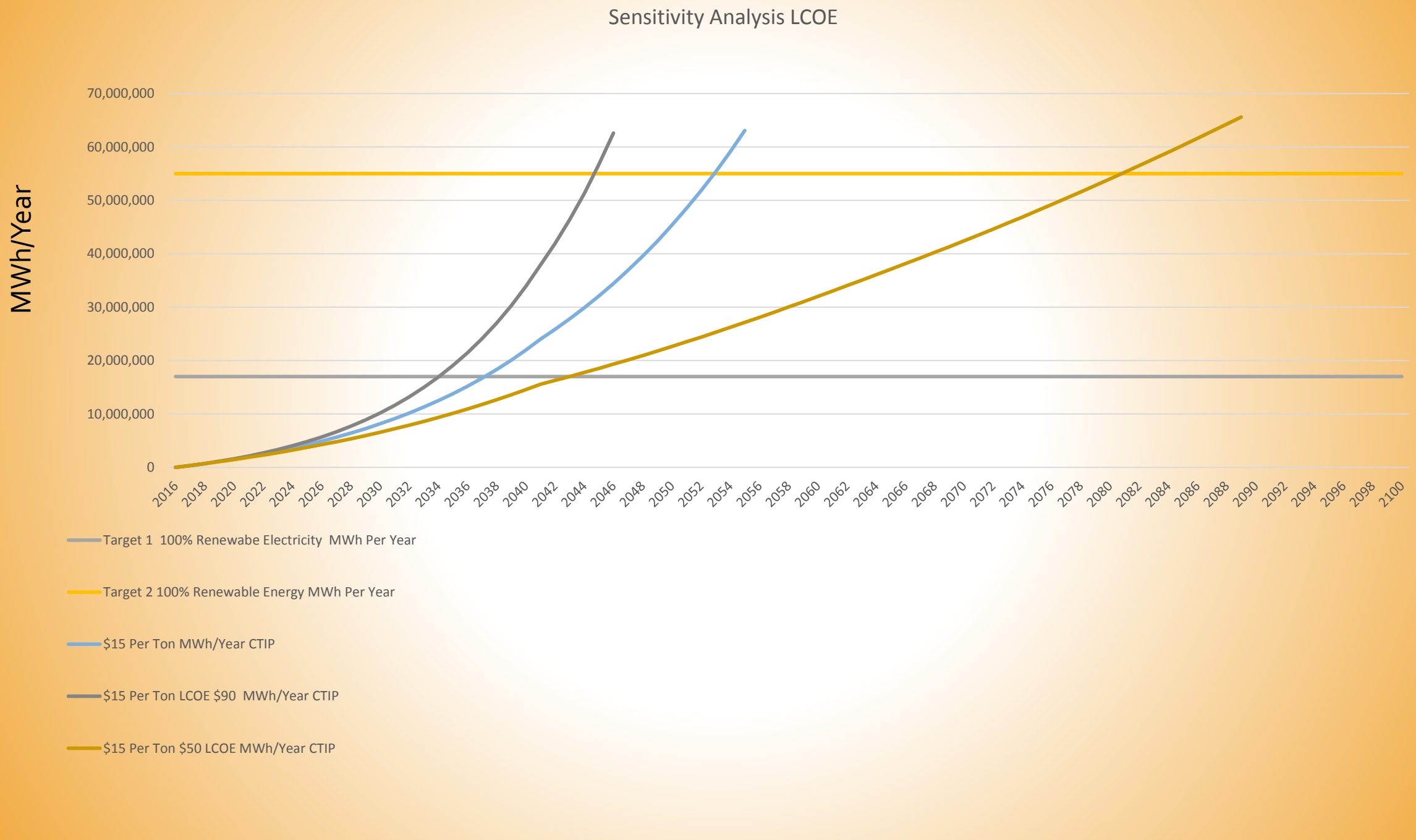
10-Year Plan - Rate Sensitivity / Mactaquac Cost Scenario Analysis

SUMMARY OF ANALYSIS

Sensitivity (a) - Original Fiscal Year Ending March 31 (in millions $)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Base Costs															
Average Rate Increase	2.00%	2.00%	2.00%	2.00%	2.00%	1.00%	1.00%	1.00%	1.00%	1.00%	3.05%	3.05%	3.05%	3.05%	3.05%
Capital Expenditures	277	318	273	235	251	444	775	808	1,046	1,110	955	658	492	447	246
Net Debt	4,806	4,677	4,520	4,364	4,160	4,159	4,489	4,798	5,361	5,960	6,354	6,488	6,825	6,976	6,847
% Debt in Capital Structure	90.4%	87.6%	84.6%	81.9%	79.0%	76.7%	76.3%	75.5%	76.2%	76.7%	76.2%	75.6%	78.7%	80.2%	79.9%
25% Increase in Costs															
Average Rate Increase	2.00%	2.00%	2.00%	2.00%	2.00%	1.00%	1.00%	1.00%	1.00%	1.00%	5.10%	5.10%	5.10%	5.10%	5.10%
Capital Expenditures	277	318	273	237	257	494	900	958	1,246	1,335	1,117	758	552	497	256
Net Debt	4,806	4,677	4,520	4,367	4,168	4,218	4,676	5,139	5,910	6,748	7,289	7,492	7,885	8,016	7,752
% Debt in Capital Structure	90.4%	87.6%	84.6%	81.9%	79.0%	77.0%	77.0%	76.9%	78.1%	79.1%	78.7%	78.1%	80.9%	81.6%	79.9%
50% Increase in Costs															
Average Rate Increase	2.00%	2.00%	2.00%	2.00%	2.00%	1.00%	1.00%	1.00%	1.00%	1.00%	6.75%	6.75%	6.75%	6.75%	6.75%
Capital Expenditures	277	318	273	240	262	544	1,025	1,108	1,446	1,560	1,280	858	612	547	266
Net Debt	4,806	4,677	4,520	4,369	4,176	4,275	4,856	5,469	6,438	7,500	8,176	8,440	8,904	9,088	8,663
% Debt in Capital Structure	90.4%	87.6%	84.6%	81.9%	79.0%	77.2%	77.7%	77.9%	79.5%	80.8%	80.3%	79.5%	82.2%	82.5%	79.9%
Sensitivity (b) - Smooth Fiscal Year Ending March 31 (in millions $)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Base Costs															

Sensitivity Analysis Carbon Price Without Truncating Data




Sensitivity Analysis LCOE
MWh/Year
70,000,000
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
2016
2018
2020
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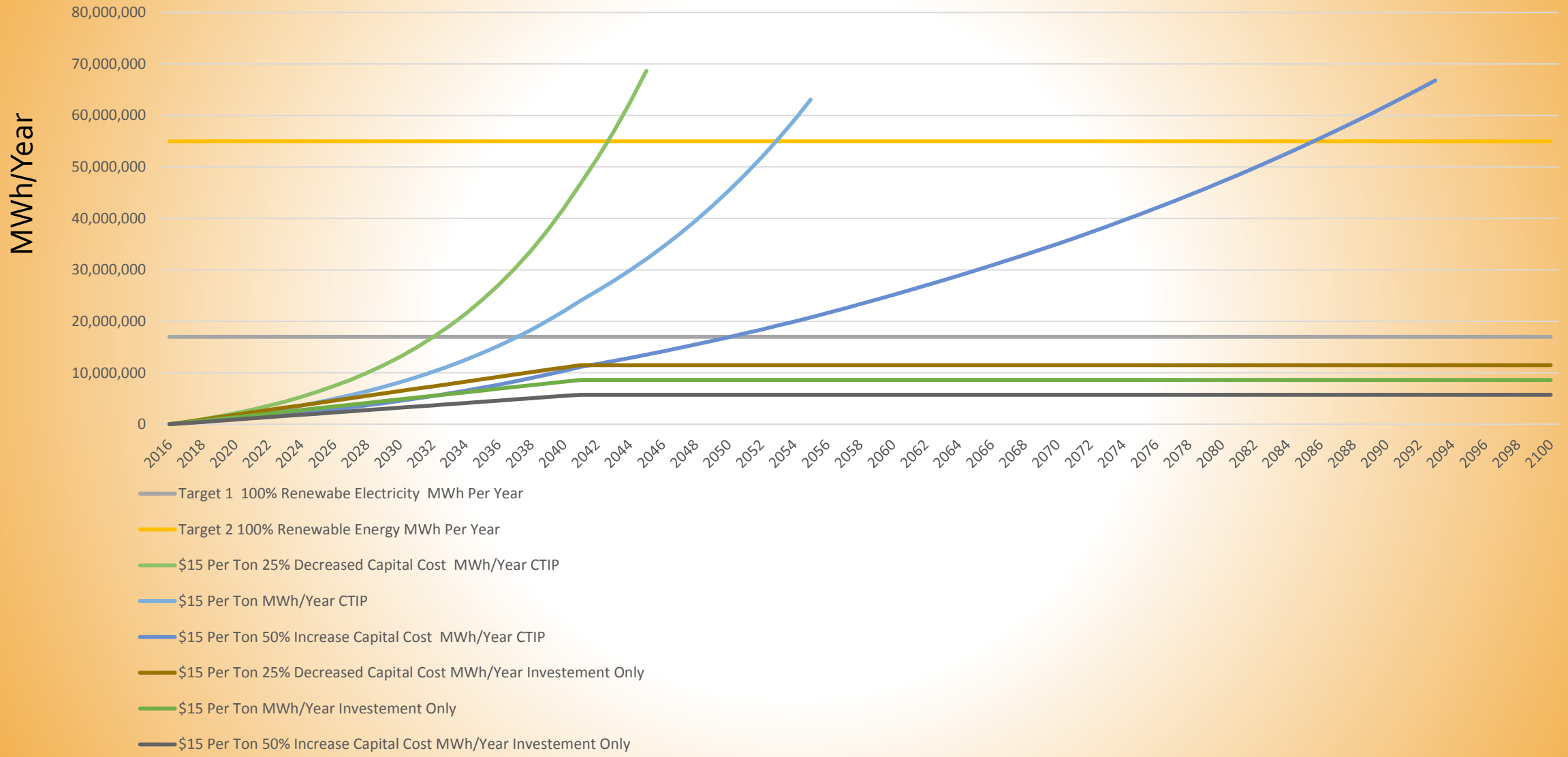
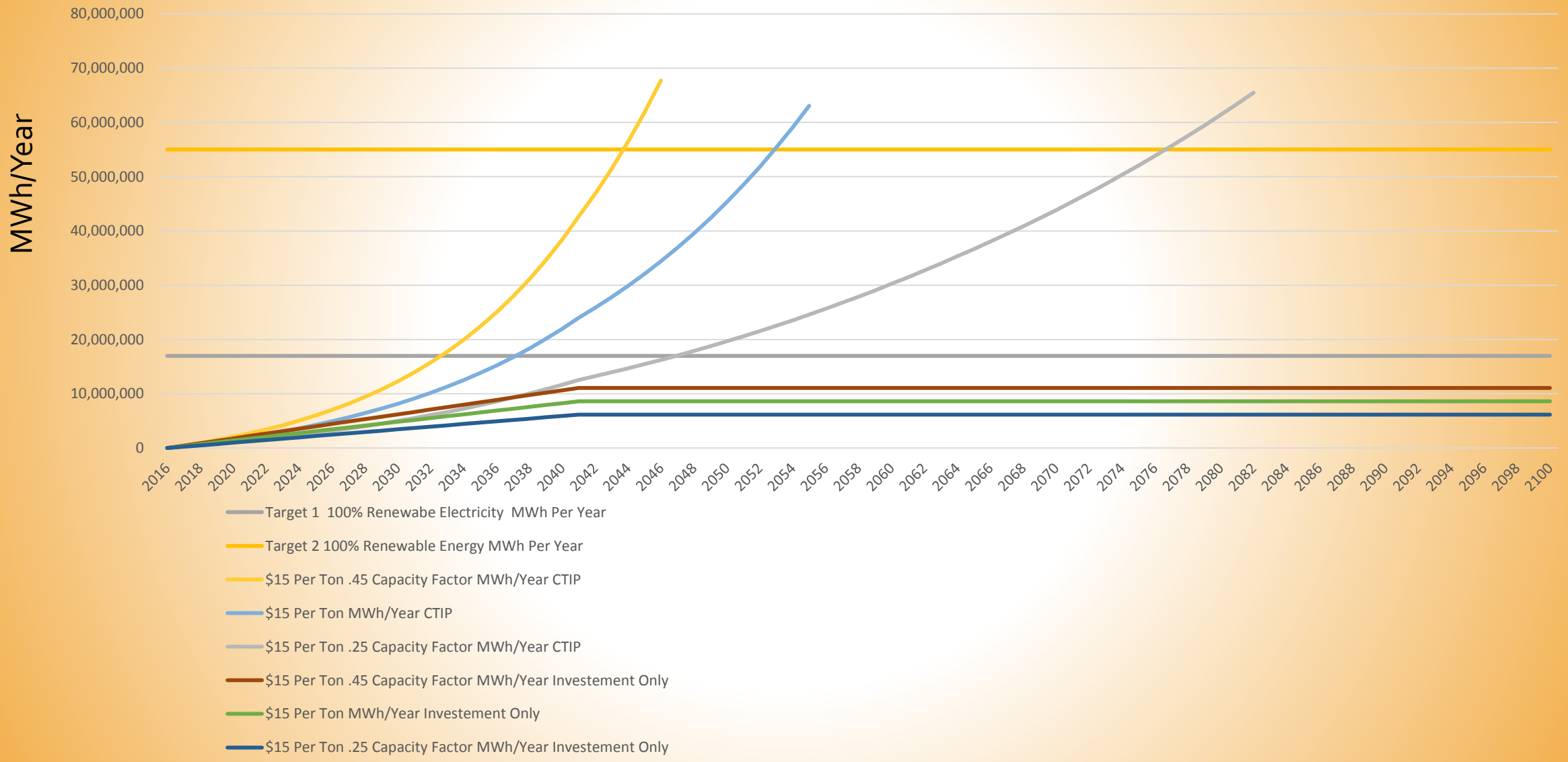
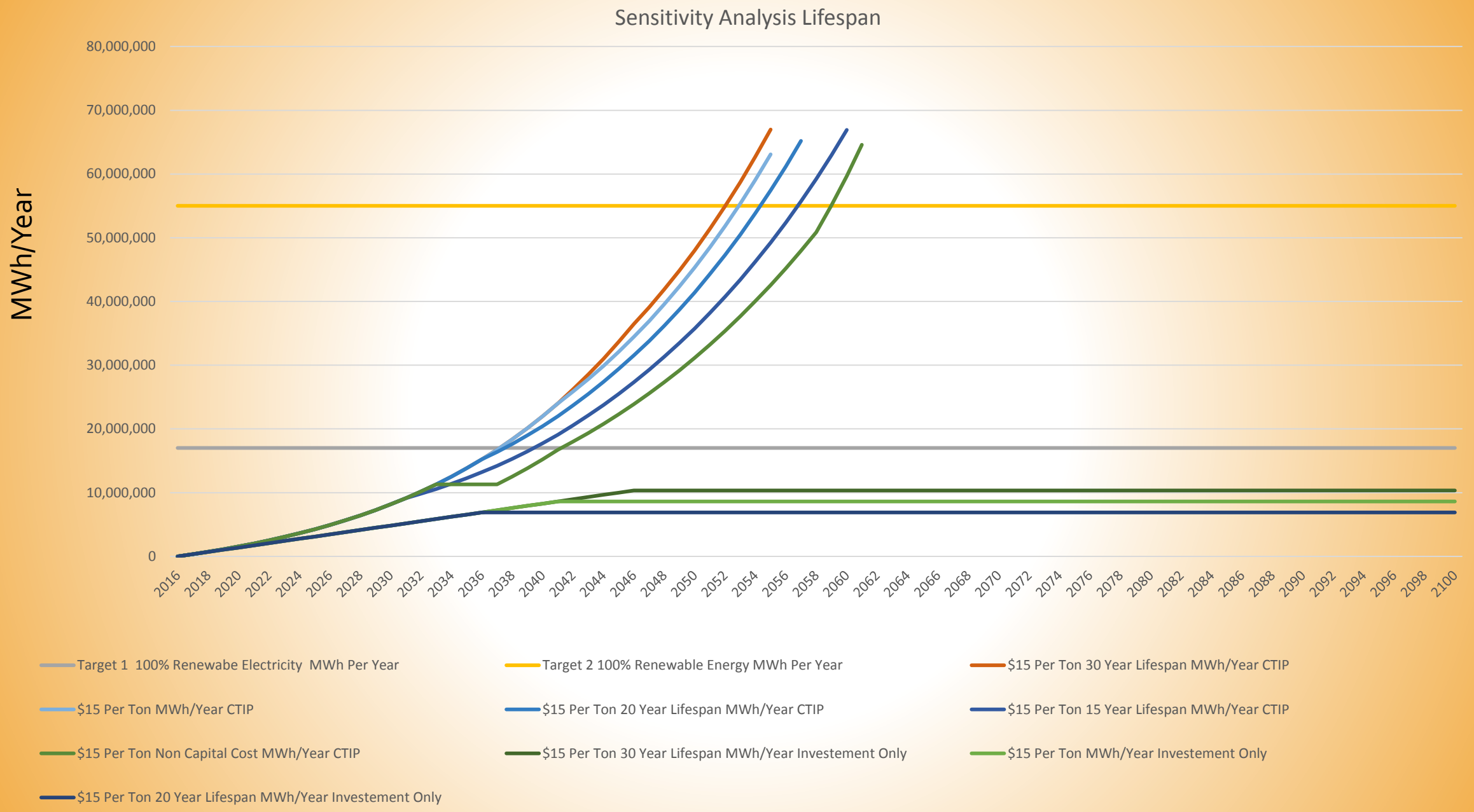
2100
Target 1 100% Renewabe Electricity MWh Per Year
Target 2 100% Renewable Energy MWh Per Year
$15 Per Ton MWh/Year CTIP
$15 Per Ton LCOE $90 MWh/Year CTIP
$15 Per Ton $50 LCOE MWh/Year CTIP

Sensitivity Analysis Capital Cost



Sensitivity Analysis Capacity Factor




Sensitivity Analysis Lifespan
MWh/Year
80,000,000
70,000,000
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
2016
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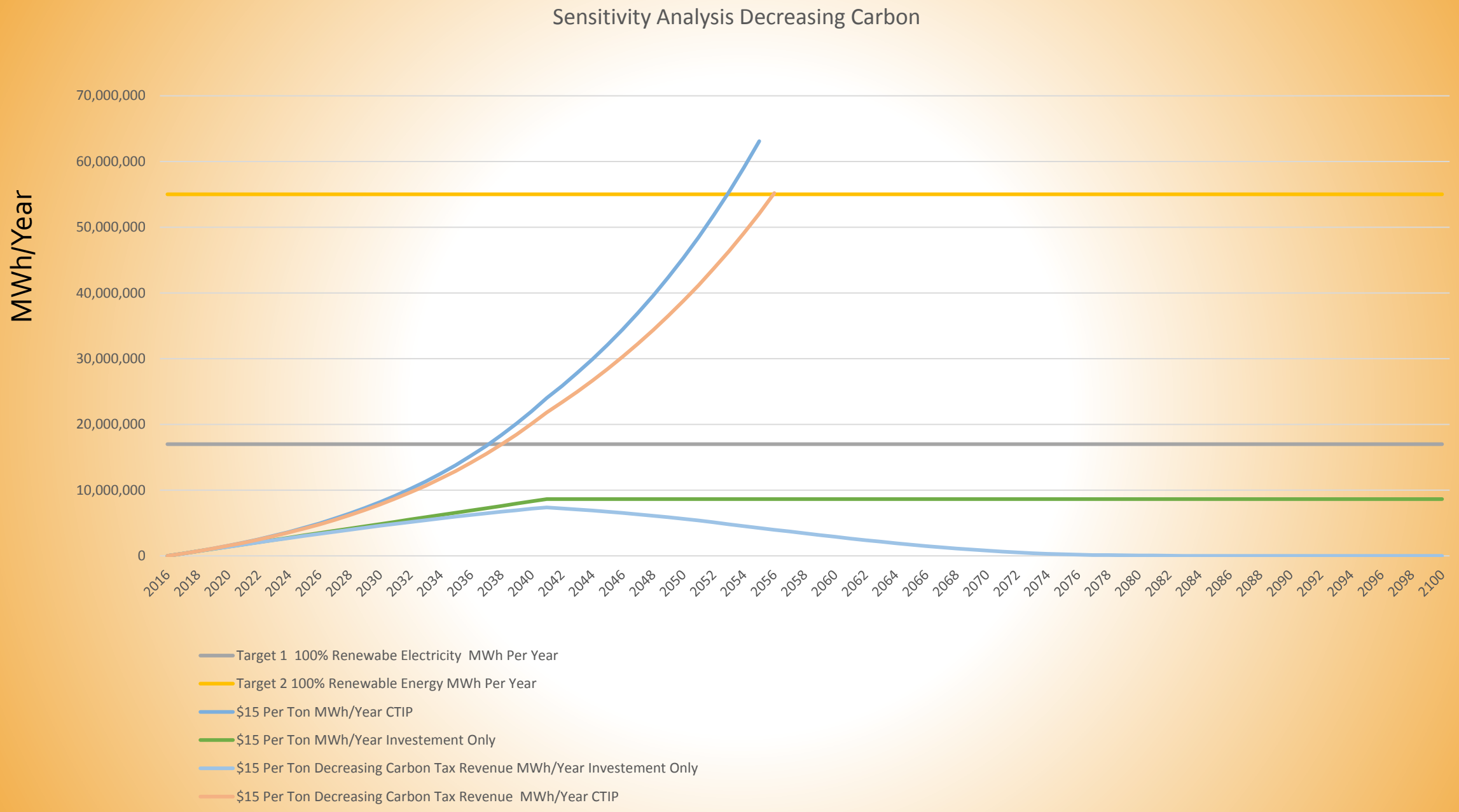
2100
Target 1 100% Renewabe Electricity MWh Per Year
Target 2 100% Renewable Energy MWh Per Year
$15 Per Ton 30 Year Lifespan MWh/Year CTIP
$15 Per Ton MWh/Year CTIP
$15 Per Ton 20 Year Lifespan MWh/Year CTIP
$15 Per Ton 15 Year Lifespan MWh/Year CTIP
$15 Per Ton Non Capital Cost MWh/Year CTIP
$15 Per Ton 30 Year Lifespan MWh/Year Investement Only
$15 Per Ton MWh/Year Investement Only
$15 Per Ton 20 Year Lifespan MWh/Year Investement Only


Sensitivity Analysis Decreasing Carbon
MWh/Year
70,000,000
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
2016
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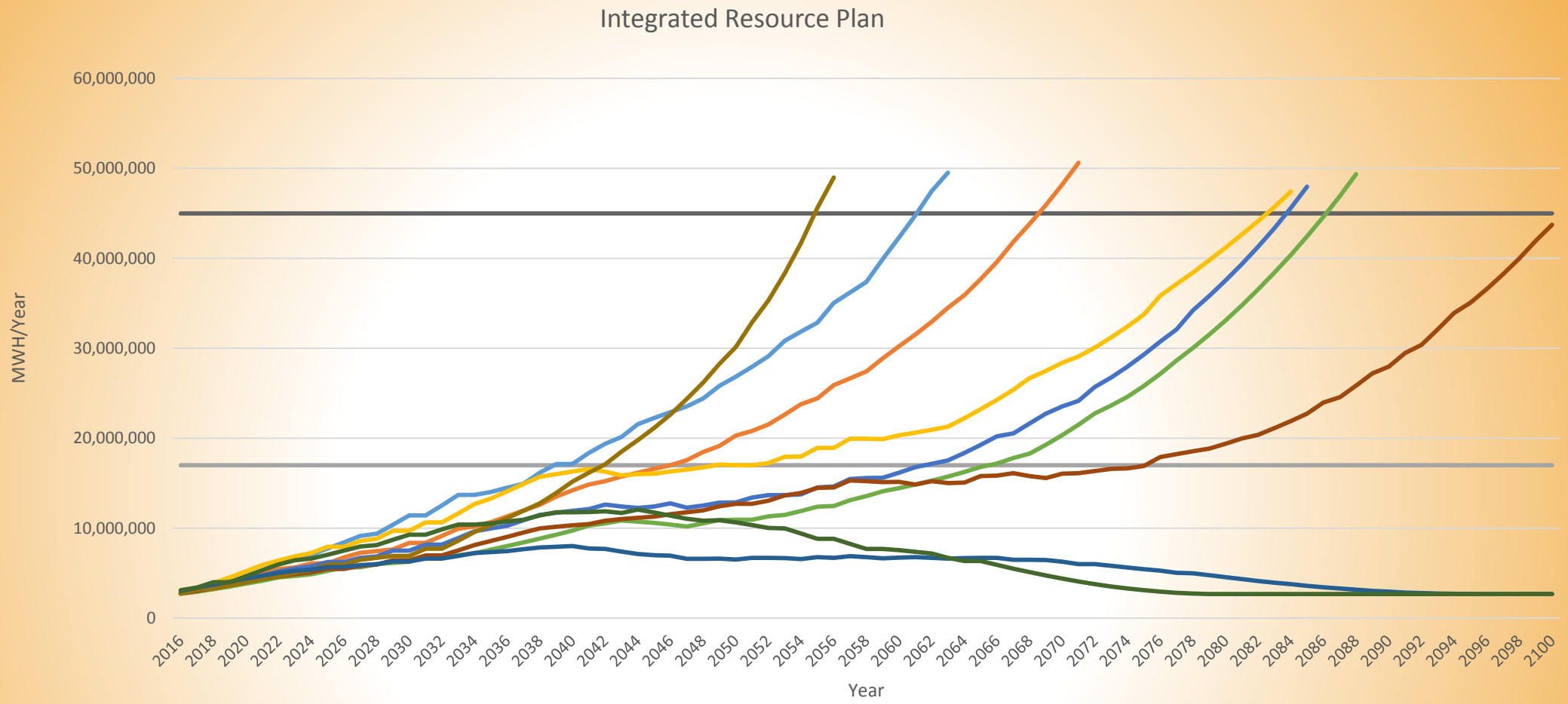
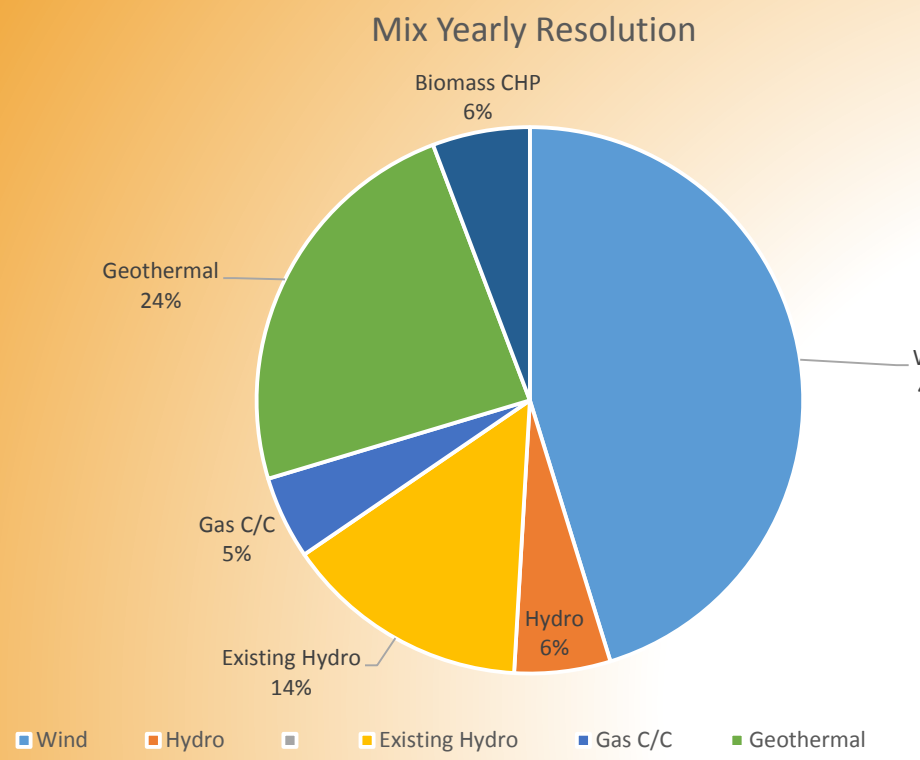
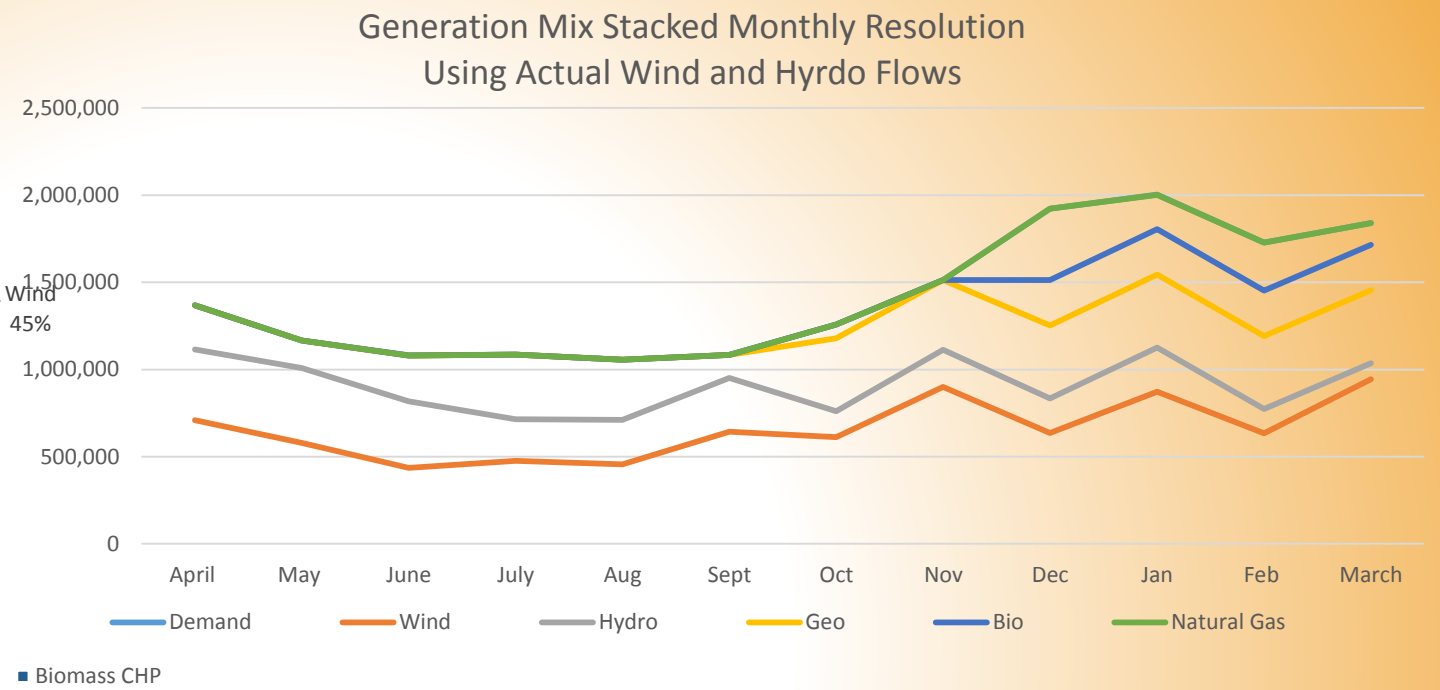
2100
Target 1 100% Renewabe Electricity MWh Per Year
Target 2 100% Renewable Energy MWh Per Year
$15 Per Ton MWh/Year CTIP
$15 Per Ton MWh/Year Investement Only
$15 Per Ton Decreasing Carbon Tax Revenue MWh/Year Investement Only
$15 Per Ton Decreasing Carbon Tax Revenue MWh/Year CTIP

MWh/Year


Integrated Resource Plan
MWH/Year
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
2016 2018 2020 2022 2024 2026 2028 2030 2032 2034 2036 2038 2040 2042 2044 2046 2048 2050 2052 2054 2056 2058 2060 2062 2064 2066 2068 2070 2072 2074 2076 2078 2080 2082 2084 2086 2088 2090 2092 2094 2096 2098 2100
Year
Stage 1 95% Electricty Renewable Portfolio Standard
Stage 2 100% Rewnewable Energy Renewable Portfolio Standard
2036 $30 Per Ton Accumulated MWH Per Year Including Existing Hydro
2045 $20 Per Ton Accumulated MWH Per Year Inc Existing Hydro
2055 $15 Per Ton Accumulated MWH Per Year Inc Existing Hydro
2058 $10 Per Ton Accumulated MWH Per Year Inc Existing Hydro
2056 $30 Per Ton 20% Increase in Capital Cost Accumulated MWH Per Year Inc Existing Hydro
2075 $15 Per Ton 20% Increase in Capital Cost Accumulated MWH Per Year Inc Existing Hydro
2075 $15 Per Ton 20% Decrease in Capital Cost Accumulated MWH Per Year Inc Existing Hydro
$15 Per Ton Accumulated MWh Per Year Including Existing Hydro Without ReInvestment
$30 Per Ton Accumulated MWh Per Year Including Existing Hydro Without ReInvestment





	Wind	New Hydro		Existing Hydro	Gas C/C	Geothermal	Biomass CHP	Storage	Pump Storage	Total MWh	Firm Capacity	Total Capacity
MWh/Year	8,402,586	1,056,342		2,700,000	912,014	4,432,882	1,071,054	0	0	18,574,878	NA	NA
% of Generation	45	6		15	5	24	6	0	0	NA	NA	NA
Capacity MW	2741	241		880	1388	633	489	1440	116	NA	5187	7927