

What is a Strategic Decarbonization Assessment?

Prepared for NYSERDA, Empire Building Challenge

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A Strategic Decarbonization Assessment is...

An energy audit (ASHRAE Standard 211)

- + A partial Property Condition Assessment (PCA)
- + A discounted cash-flow (DCF) analysis of different investment scenarios

All in one.

Why? Because the real estate industry will plan for decarbonization *the same way that it plans for everything else.*

- The SDA is built upon ASHRAE Standard 211 normative forms, looks forward and integrates uncertainty like a PCA, and uses DCF and scenarios to frame decisions.

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Where did the SDA come from?

The San Francisco Department of the Environment commissioned the SDA in preparation for an update to its Climate Action Plan and negotiations with local building owners on the timeline for decarbonization requirements.

The SDA was built by Arup and Ember Strategies.

SFE currently accepts the SDA as alternative compliance with City's energy audit ordinance.

<https://sfenvironment.org/energy/strategic-decarbonization-assessment>

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Decarb “Regulatory Framework” in [Proposed San Francisco Climate Action Plan](#)

- **100% Renewable Electricity:** San Francisco [requires commercial buildings to subscribe to a GHG-free electricity provider.](#)
- **Require a Plan:** Instead of energy audits, require each building to [develop a plan for decarbonization by 2035](#)
- **2035 Deadline:** ... existing large commercial buildings should be required to achieve zero emissions by 2035.
- **Public Tracking:** Use existing required annual benchmarking to track progress, celebrate leaders, and focus attention on laggards

What's wrong with energy audits? Nothing, but we need the right tool for this job.

Distinction	ASHRAE Standard 211; Level 2 Audit	Strategic Decarbonization Assessment
Question answered:	How can this building perform better, today ?	How should we re-engineer this building to perform in the future ?
Financial significance	Small: ~\$1s /sf. Find the most savings possible within the payback period.	Big: ~\$10s /sf. Find the most cost effective path to decarbonization
Primary audience	Facilities/Ops, Engineering	Asset Management
Time horizon	Short; payback constrained	Long; full capital cycle, 10+ yrs
Downside avoided	Wasted utility spend	Stranded asset, degraded value/NOI, increased CapEx/TCO

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Strategic Decarbonization Assessment Disclaimers:

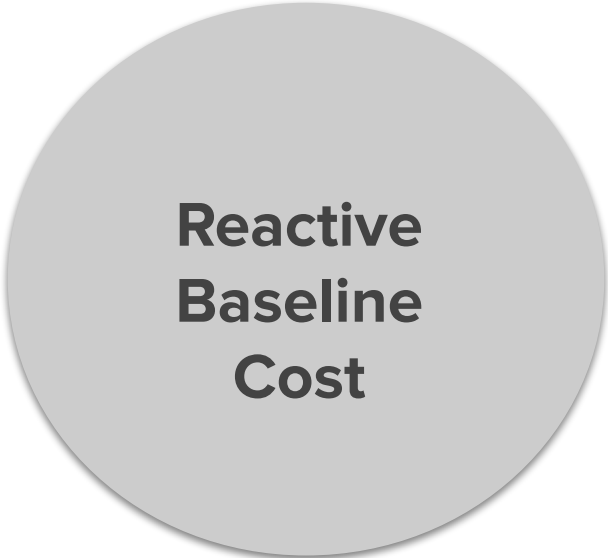
It's just a spreadsheet.

Uncertainty and complexity still exist.

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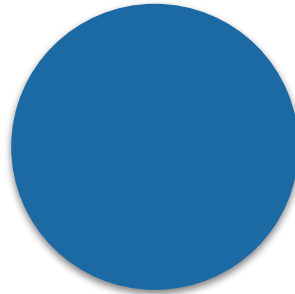
SDA creates decision scenarios, uses standard financial analysis



Reactive Baseline Cost

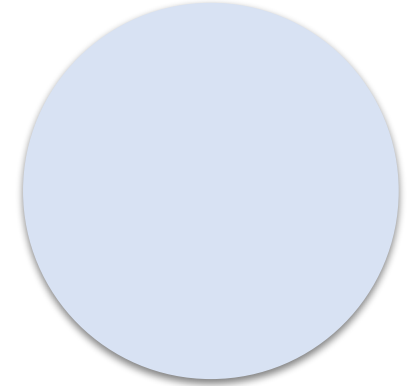
Tweaks but no re-engineering. Replace like-for-like at end-of-life. Small efficiency improvements. Max cost to avoid stranding. Full cost of re-engineering hits in advance of regulatory requirements.

Ideal Scenario Cost



Lowest marginal cost. Re-engineering, not replacements. Opportunistic, taking advantage of vacancies and other triggers. Maximize NOI while minimizing TCO. Strategically improve and reconfigure systems.

In Between

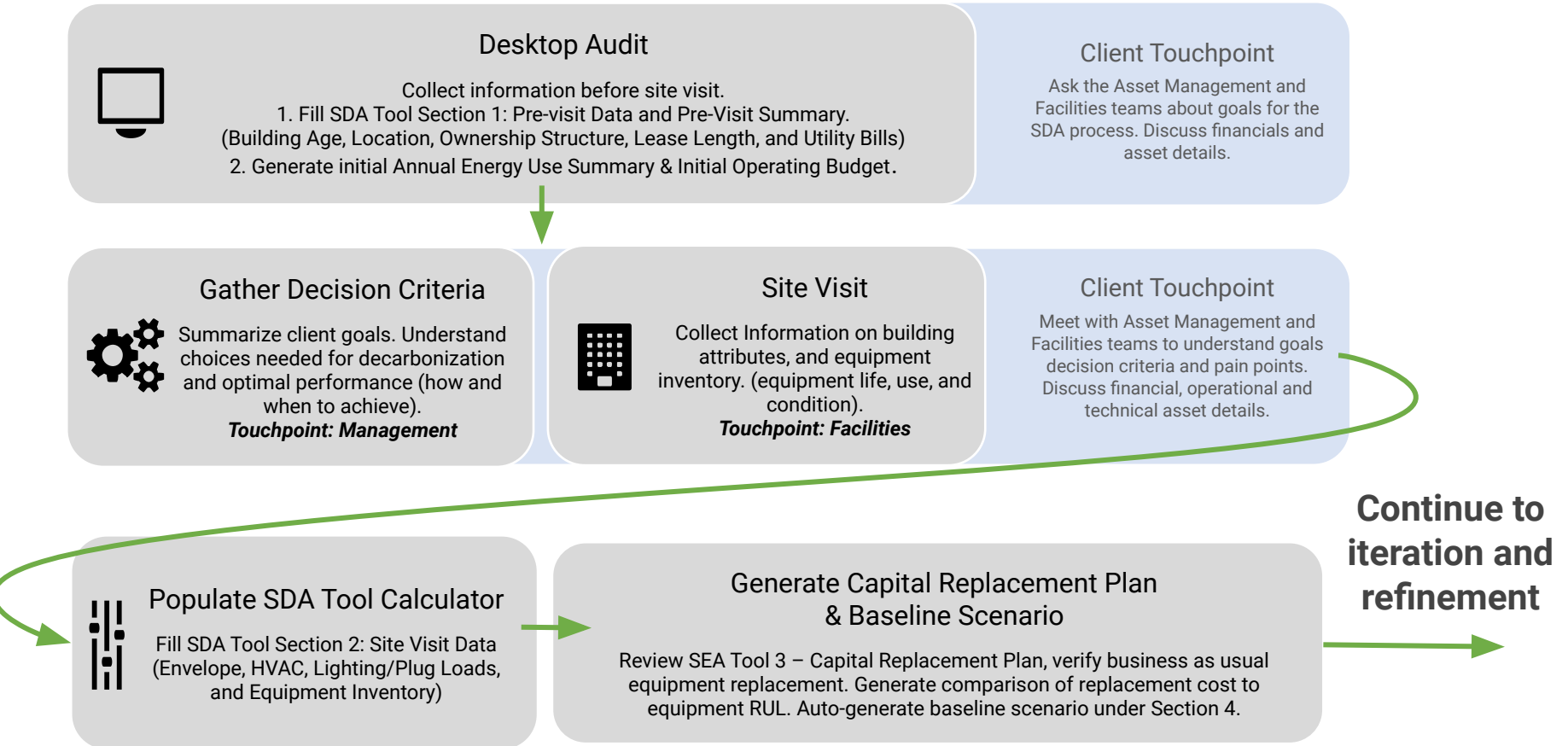


Rational and realistic proactive/reactive mix, designed for a specific owner based on real constraints.

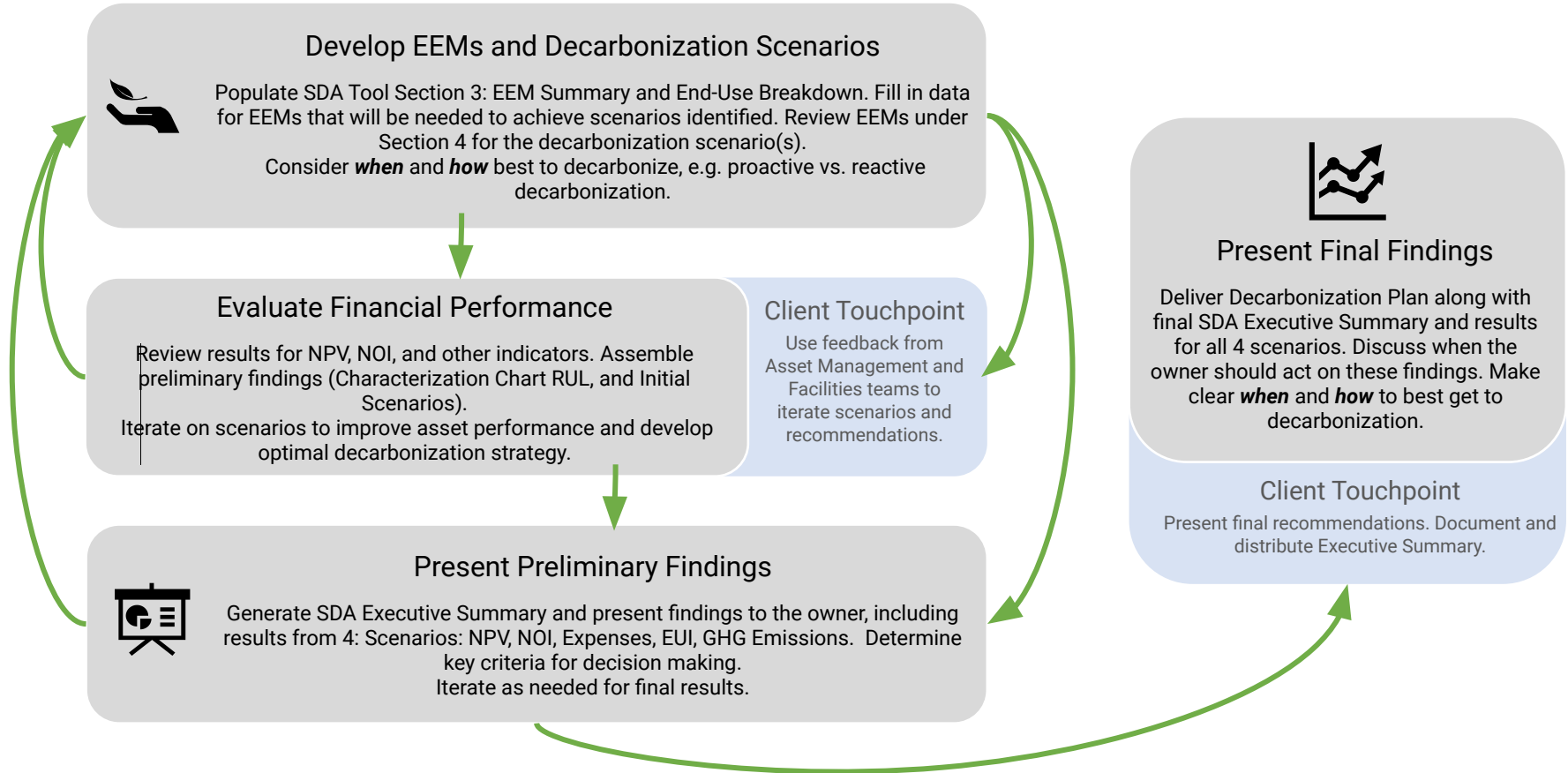
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SDA Process (Detailed Version): Data Collection and Engineering



SDA Process Cont. (Detailed Version): Iteration and Refinement



NYSERDA distinctions (beyond geographic)

The San Francisco SDA process adapts the energy audit process to support capital planning.

A decarb focused capital planning exercise can be more streamlined, aligning the engineering plan to fit the overall plan from the outset, including market positioning and leasing considerations.

Simplifications are sought.

Costs estimates: “Probable cost” + budget to study

AACE Class	ANSI Classification	Typical Use	Project Definition	Expected Range of Accuracy		Other Terms
				Low Expected Actual Cost	High Expected Actual Cost	
Class 5	Order-of-Magnitude	Strategic Planning; Concept Screening	0% to 2%	-50% to -20%	+30% to +100%	ROM; Ballpark; Blue Sky; Ratio
Class 4		Feasibility Study	1% to 15%	-30% to -15%	+20% to +50%	Feasibility; Top-down; Screening; Pre-design
Class 3	Budgetary	Budgeting	10% to 40%	-20% to -10%	+10% to +30%	Budget; Basic Engineering Phase; Semi-detailed
Class 2	Definitive	Bidding; Project Controls; Change Management	30% to 75%	-15% to -5%	+5% to +20%	Engineering; Bid; Detailed Control; Forced Detail
Class 1		Bidding; Project Controls; Change Management	65% to 100%	-10% to -3%	+3% to +15%	Bottoms Up; Full Detail; Firm Price

[Source: ProcessEngineer.com](http://ProcessEngineer.com)

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Sample SDA Inputs and Output Graphs

SDA Inputs and Assumptions Summary

Building Financial Characteristics	
Anticipated Holding Period	Medium
Office Classification (AA/A, B, C) - If Applicable	AA/A
Assessed value from tax records	\$160,000,000
Ownership type	Institutional
Management Type	3rd Party
Annual Rent	\$34,000,000
Net Lettable Area, or Rentable SF	\$340,000
Annual Maintenance Costs	\$1,505,000
Annual Utility Costs	\$1,355,000
Other Annual Income	\$0
Holding Period (Years)	20 years

Building Initial Energy and Carbon Characteristics	
Annual Electricity Consumption	4,225,000 kWh/year
Annual Natural Gas Consumption	37,000 therms/year
Total Annual Energy Consumption	18,115,700 kBtu/year
On-Site Generation	34120 kBtu/year
Total Annual Emisions	1210470 kg CO2 equivalent
Building EUI	47.8 kBtu/SF-year
Electric Building EUI	37.9 kBtu/SF-year
Gas Building EUI	9.7 kBtu/SF-year
Site EUI	47.7 kBtu/SF-year
Energy Cost Index ECI	\$2.398 \$/SF-year

Highlights must be updated for New York.

Building Financial Assumptions and Inputs	
Capitalization threshold	\$25,000
Cost Escalation Rate	3.5%
Management Fee	5.0%
Discount Rate	5.0%
Rentable to Gross SF	85.0%
Avg SF/office tenant	11390 SF/pp
Avg sf per office worker	360 SF/pp
Avg SF per maint worker	125000 SF/pp
Annual Vacancy rate	5.5%
Avg annual rent per SF	\$100 \$/SF
Cleaning	\$3.638 \$/SF
Repair / Maintenance	\$3.763 \$/SF
Utility	\$3.388 \$/SF
Security	\$1.425 \$/SF
Administrative	\$1.813 \$/SF
Fixed	\$8.725 \$/SF
Parking	\$0.725 \$/SF

Building Energy Assumptions and Inputs	
Electricity Escalation Rate	2.0%
Natural Gas Escalation Rate	2.0%
Other Fuel Escalation Rate	2.0%
Electricity Emissions Factor	0.24 kg CO2/kWh
Natural Gas Emissions Factor	5.31 kg CO2/therm
Other Fuel Emissions Factor	0.00 kg CO2/kBtu
Use of Site Carbon Fee? (Y/N)	No
Site Carbon Fee	\$10.0 \$/ton CO2eq
Carbon Fee Escalation Rate	2.0%

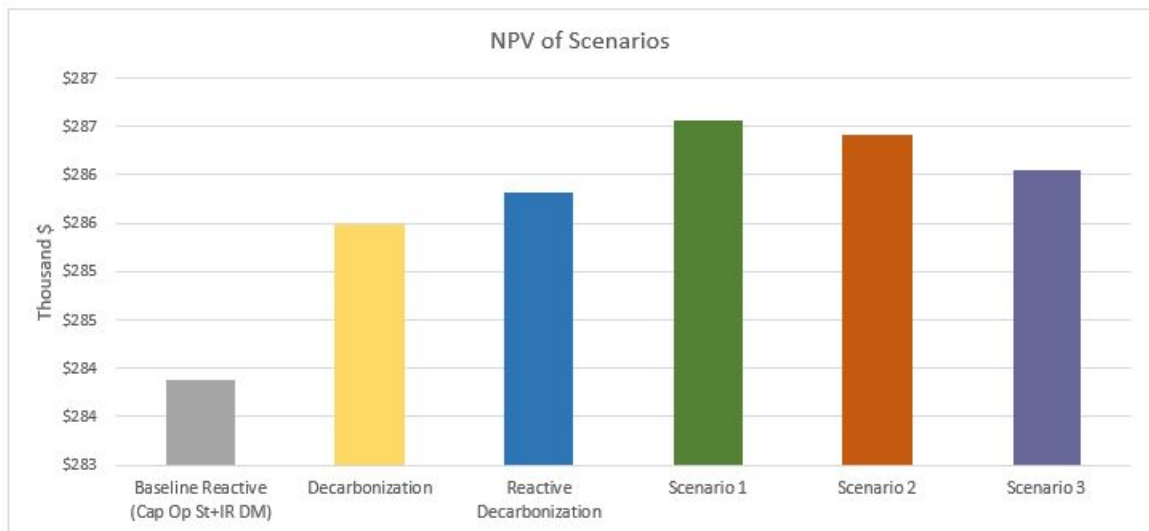
Highlights require EBC participants' insight.

Target Assumptions and Criteria	
Target Site EUI Mandate	48.0 kBtu/SF-year
Target EUI Annual "Ratchet"	1.0% %
Target Site Carbon Intensity	3.20 Tons CO2eq/yr-1000SF
Target Carbon Intensity Annual "Ratchet"	0.5% %
Year Target Mandates Begin	2021

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SDA Basic Scenario Visualization

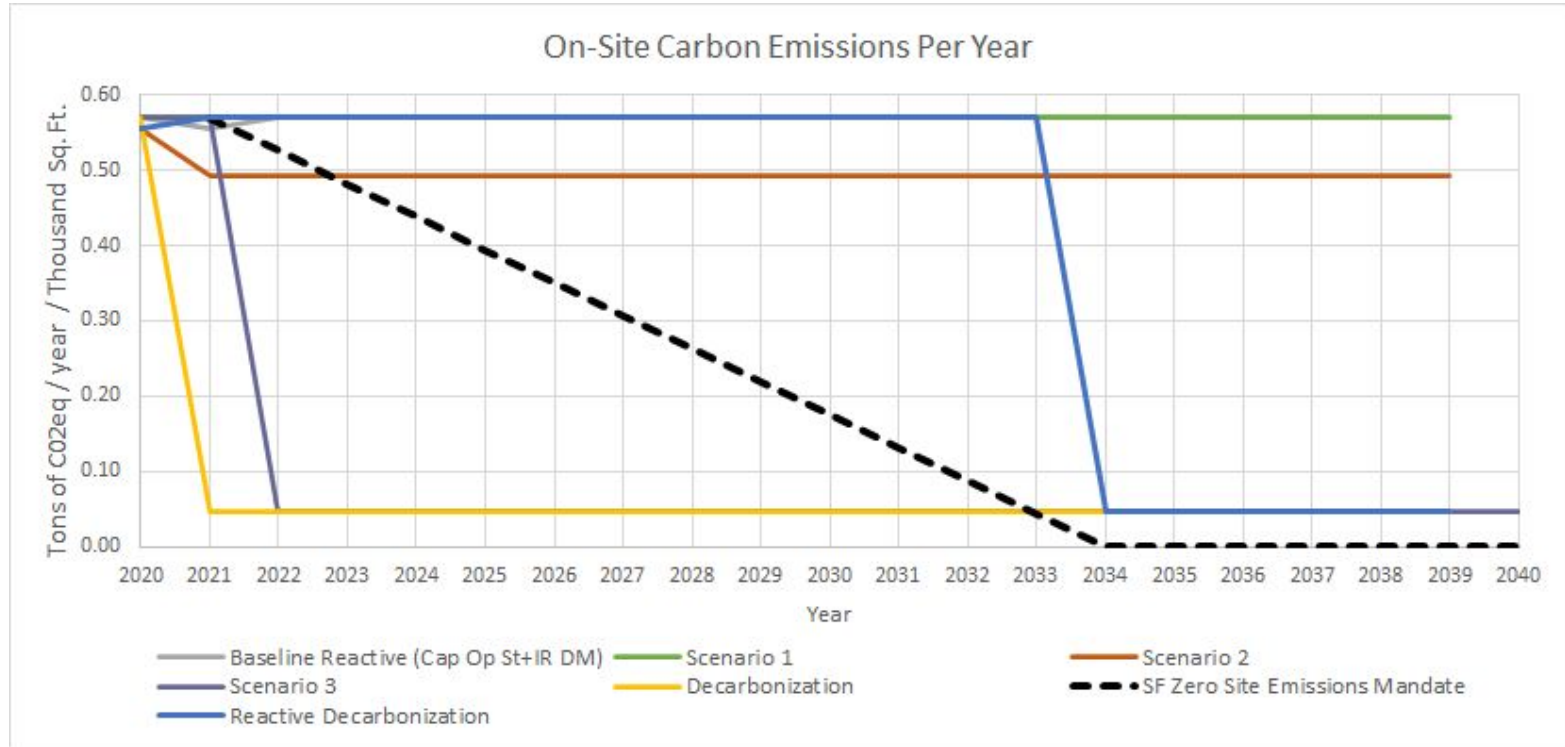
Scenario	Annual Savings	Total Cost	CapEx	OpEx	NPV	Progress to ZNC	Year Asset Stranded, Non-Compliant
	\$	\$	\$	\$	\$ x1000	%	
Baseline Scenario	\$47,920	\$2,700,000	\$2,700,000	\$0	\$284	3%	2022
Decarbonization	\$103,450	\$904,500	\$856,000	\$48,500	\$285	21%	2033
Reactive Decarbonization	\$103,450	\$103,450	\$103,450	\$103,450	\$286	21%	2022
Scenario 1	\$52,000	\$222,000	\$202,000	\$20,000	\$287	6%	2022
Scenario 2	\$38,500	\$279,000	\$225,000	\$54,000	\$286	3%	2023
Scenario 3	\$41,750	\$662,500	\$658,000	\$4,500	\$286	15%	2033



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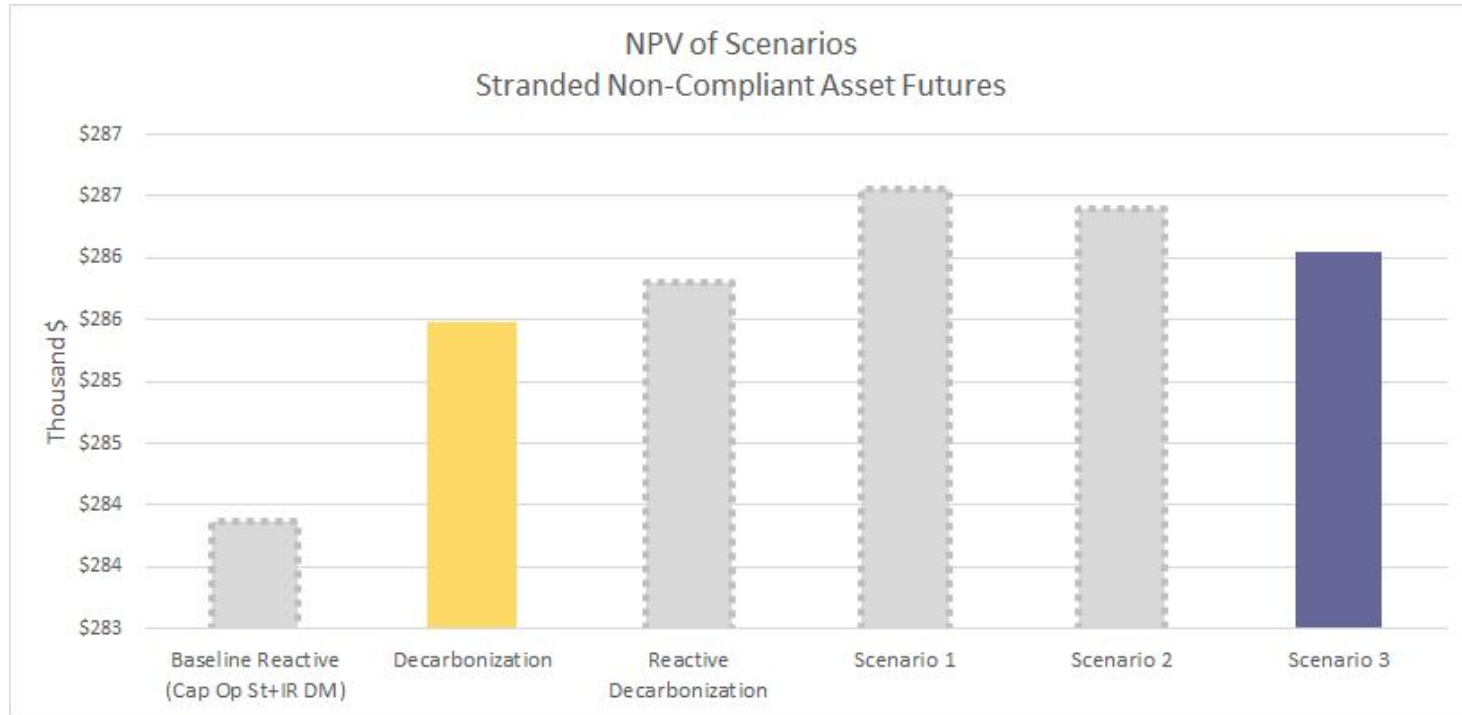
SDA Scenarios Carbon Trajectories



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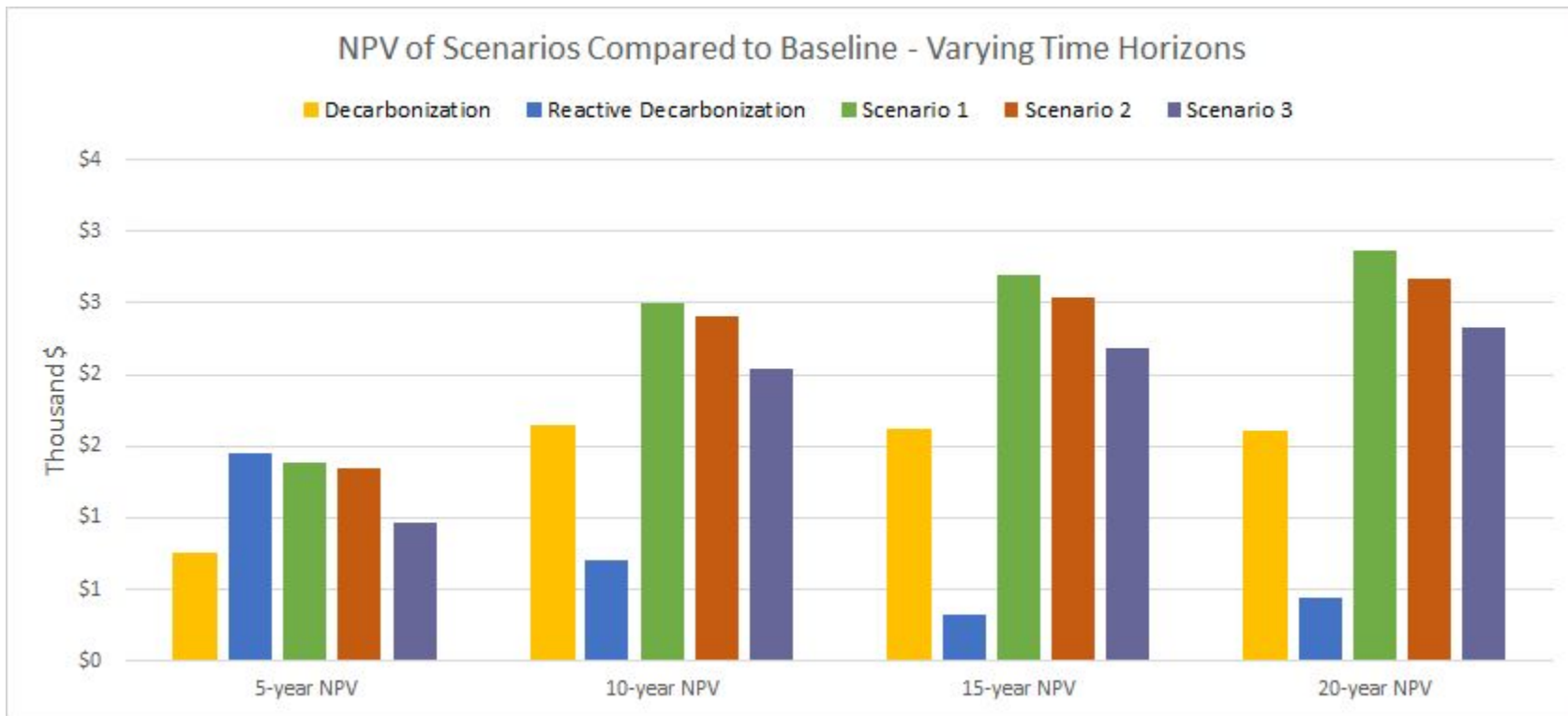
SDA Application of Carbon Regulations to Scenarios



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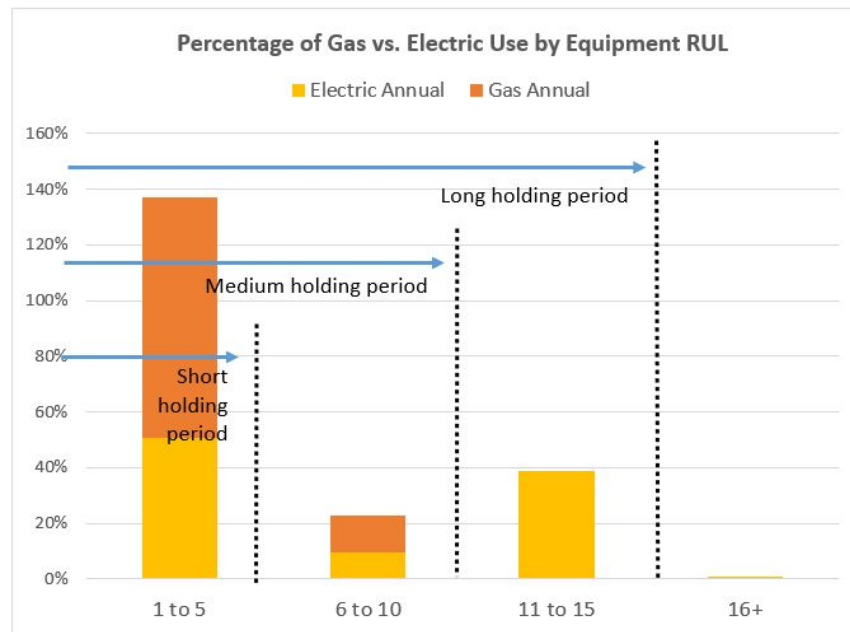
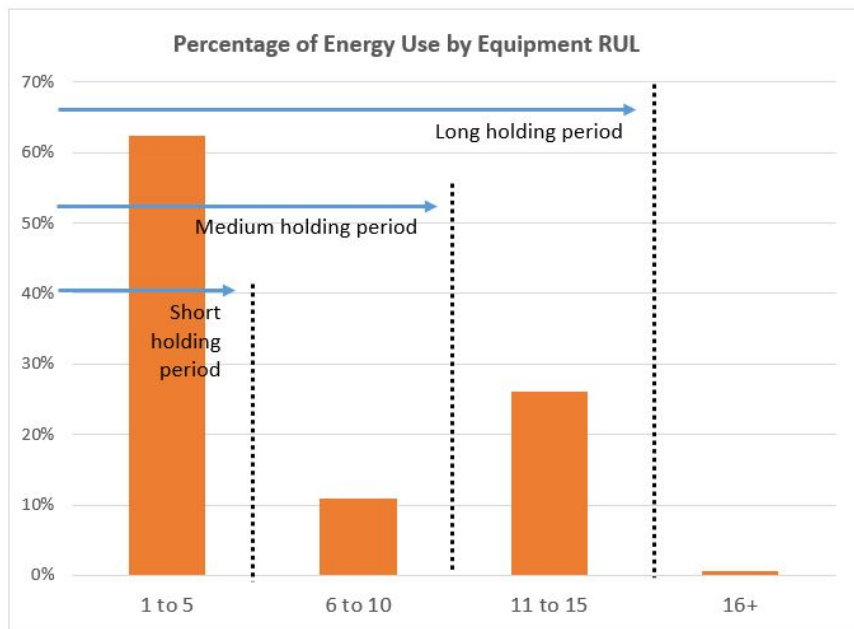
SDA's Multiple Time Horizon NPVs



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SDA Equipment Age and Fuel Sources



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