

The interface between project design, regulatory compliance, and public outreach at MIT



Seth Kinderman, MIT

A.J. Jablonowski, PE,
Epsilon Associates, Inc.



MIT's Central Utility Plant Upgrade Project

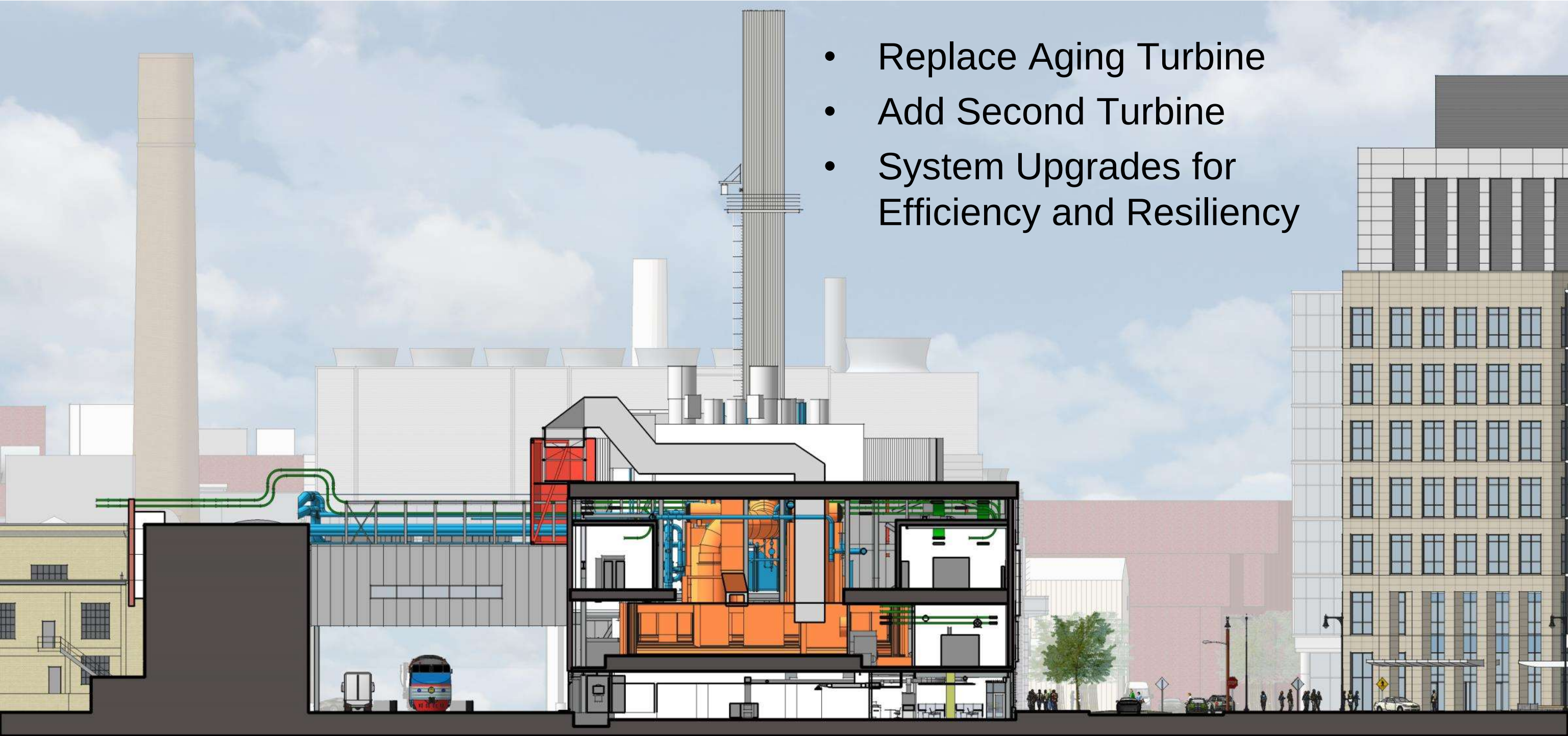


- Support campus growth
 - expanding the CHP system
 - improving the resiliency of the district energy system
- Case study - environmental permitting process
 - interface between project design, regulatory compliance, and public outreach

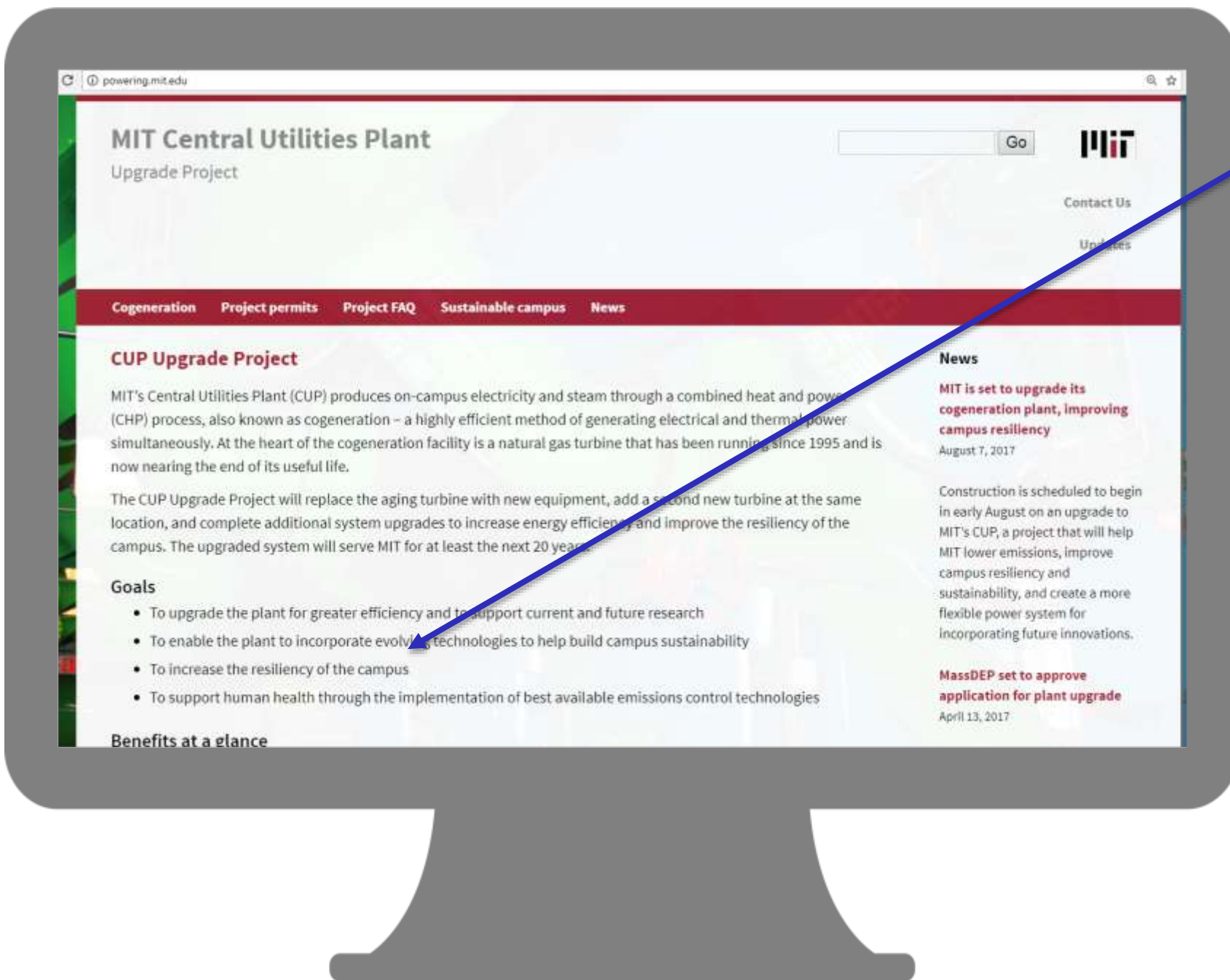
Specific steps to allow for system resiliency while documenting best available control technology and accurately informing an interested community of the project benefits.

The Project

- Replace Aging Turbine
- Add Second Turbine
- System Upgrades for Efficiency and Resiliency



Project Goals



- To upgrade the plant for greater efficiency and to support current and future research
- To enable the plant to incorporate evolving technologies to help build campus sustainability
- To increase the resiliency of the campus
- To support human health through the implementation of best available emissions control technologies



Process Conflicts

Project Design:

Finalize major source equipment selection as late as possible, to allow vendor competition and contract negotiation.

Start the permitting process as soon as possible to meet project construction deadlines.

Get a full understanding of environmental requirements before purchase decisions are made.

Allow full flexibility for operators to react to any situation, with no restrictions.

Environmental Permitting:

Finalize major source equipment selection as early as possible, to allow review of impacts & documentation that the selected option is better than the alternatives.

Avoid changes to project design that would require re-analysis of impacts.

Restrict operation to avoid specific regulatory triggers.

Public Outreach:

Avoid changes to project design that would require “walking back” any public statement of project benefits.

Make sure project has completed key public outreach steps before any public filings are made.

Make defensible, easy-to-understand statements regarding the project benefits (e.g. “MIT will never use oil” “Air quality will improve”).



Challenge: advance permitting while design in flux

Comparison of MIT Proposals	
Original Proposal	New Proposal
1. Revise permit cap (440t+110t=550t/yr)	1. Cap Plant permit (+/- 300t/yr)
2. Most economic fuel	2. Fuel selection primarily based on emissions
3. Interruptible gas supply	3. Firm gas supply
4. Significant use of oil	4. Equivalent 48hr annual oil usage
5. Tier 4 Diesel black start w/2500hrs	5. Gas fired cogen unit
6. Limits on most efficient boilers	6. Operate most efficient units first
7. Maintain #6 oil	7. Swap #6 oil for #2 ULSD

Preapp Meeting 5-27-15

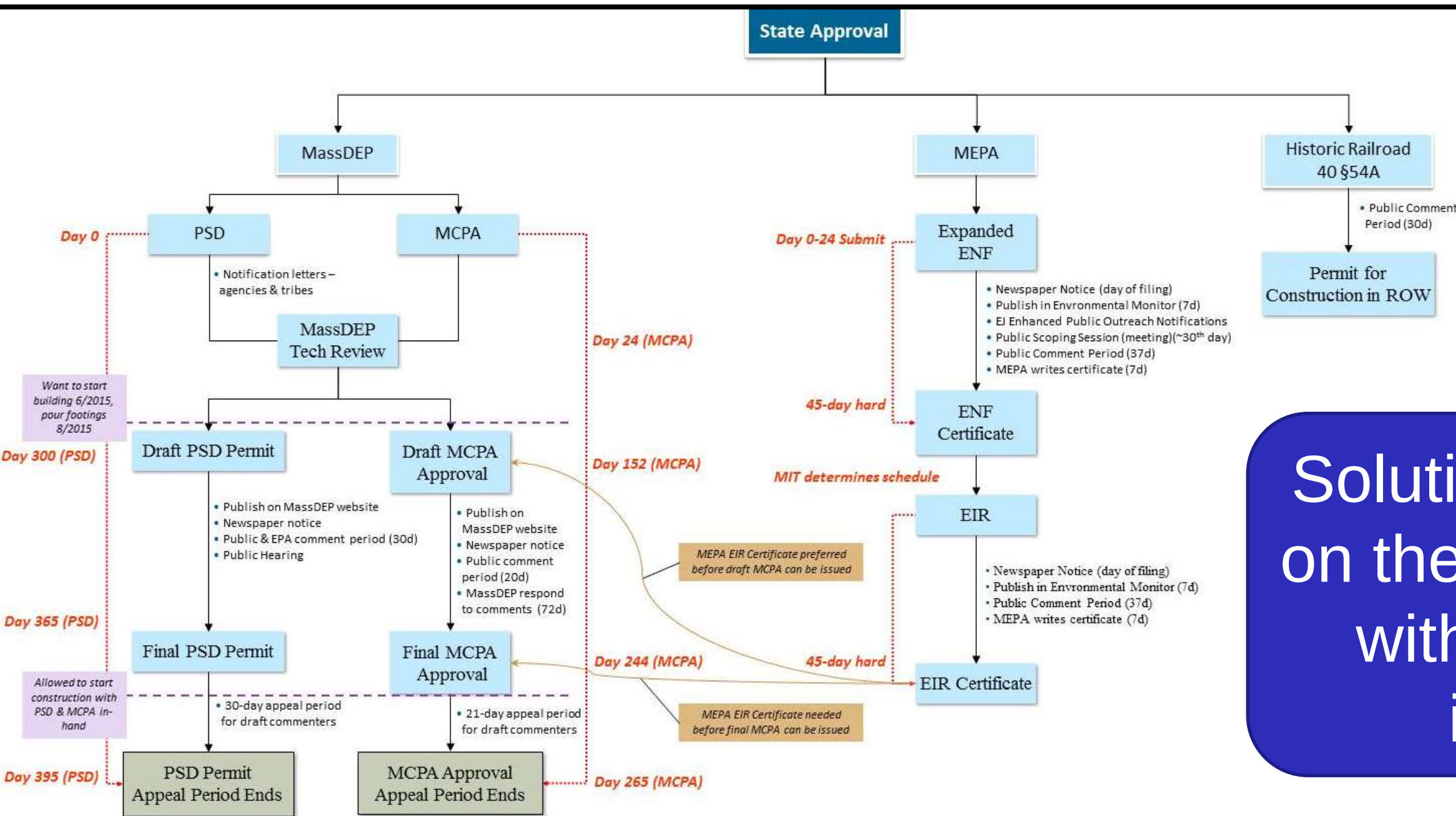
Lessons Learned:

- Keep project simple
- Get buy-in from all internal parties

Example Slide from
Third MassDEP
Preapplication Meeting



Challenge: timeline says need to file applications/final turbine not selected



Solution: file based on the configuration with the higher impacts.

Challenge: document switch to smaller turbine with slightly lower nameplate efficiency

CT Model	Total Run Time (2 CTs)	Total Generated Electric	Total Purchased Electric	Total CT Gas Usage	Total DB Gas Usage
	(hrs/year)	(MWh/yr)	(MWh/yr)	(MMBtu/yr)	(MMBtu/yr)
Solar T250	14,219	273,964	85,882	2,537,725	324,375
GE LM2500	11,695	234,421	125,115	2,353,174	337,896
Notes	The T250 turbines can remain operating for more hours of the year, generating more electricity.		This results in lower electricity purchases, and lower GHG emissions from grid electricity.	More fuel is fired in the CTs, and less in the duct burners, allowing for more cogeneration.	

Solution: present modeling results showing overall GHG improvement to the smaller turbine, because MIT can run the cogen more hours/year at expected loads.



Challenge: conflicting metrics showing GHG improvements

On Website

Benefits at a glance

- Regulated pollutant emissions reduced 25%
- Greenhouse gas emissions reduced 10%, offsetting increased emissions due to growth

Overall campus projection

CHP comparison to a baseline of separate electricity use and thermal generation

On Environmental Impact Report

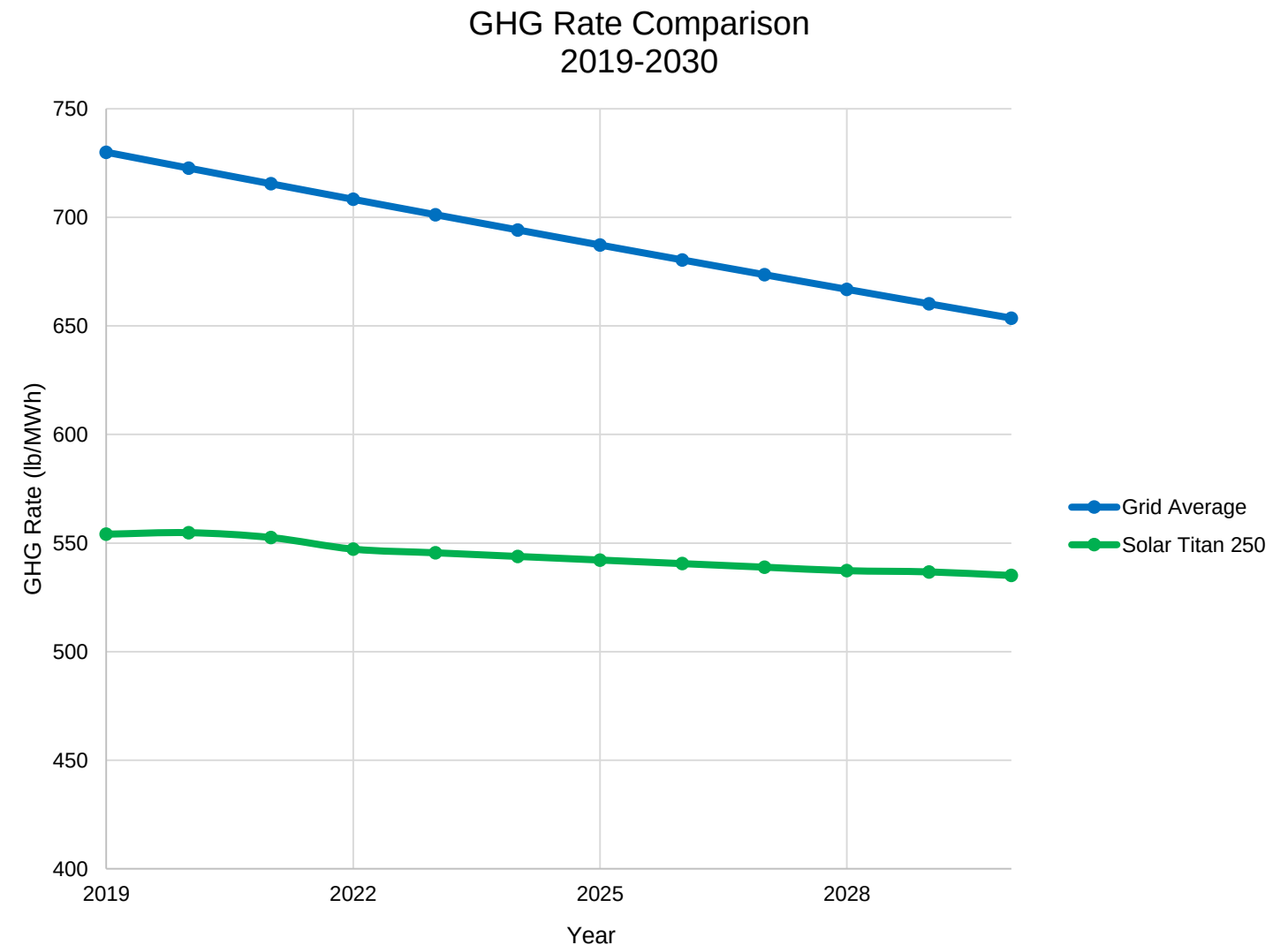
The Project will generate an expected actual 148,000 tons/year of CO₂, whereas it will displace 106,000 tons/year of CO₂ from conventional steam generation and 129,000 tons/year of CO₂ from the offsite generation of grid electricity. This equates to an 37% GHG reduction on a source energy basis.

Solution: careful documentation of basis of each public statement.



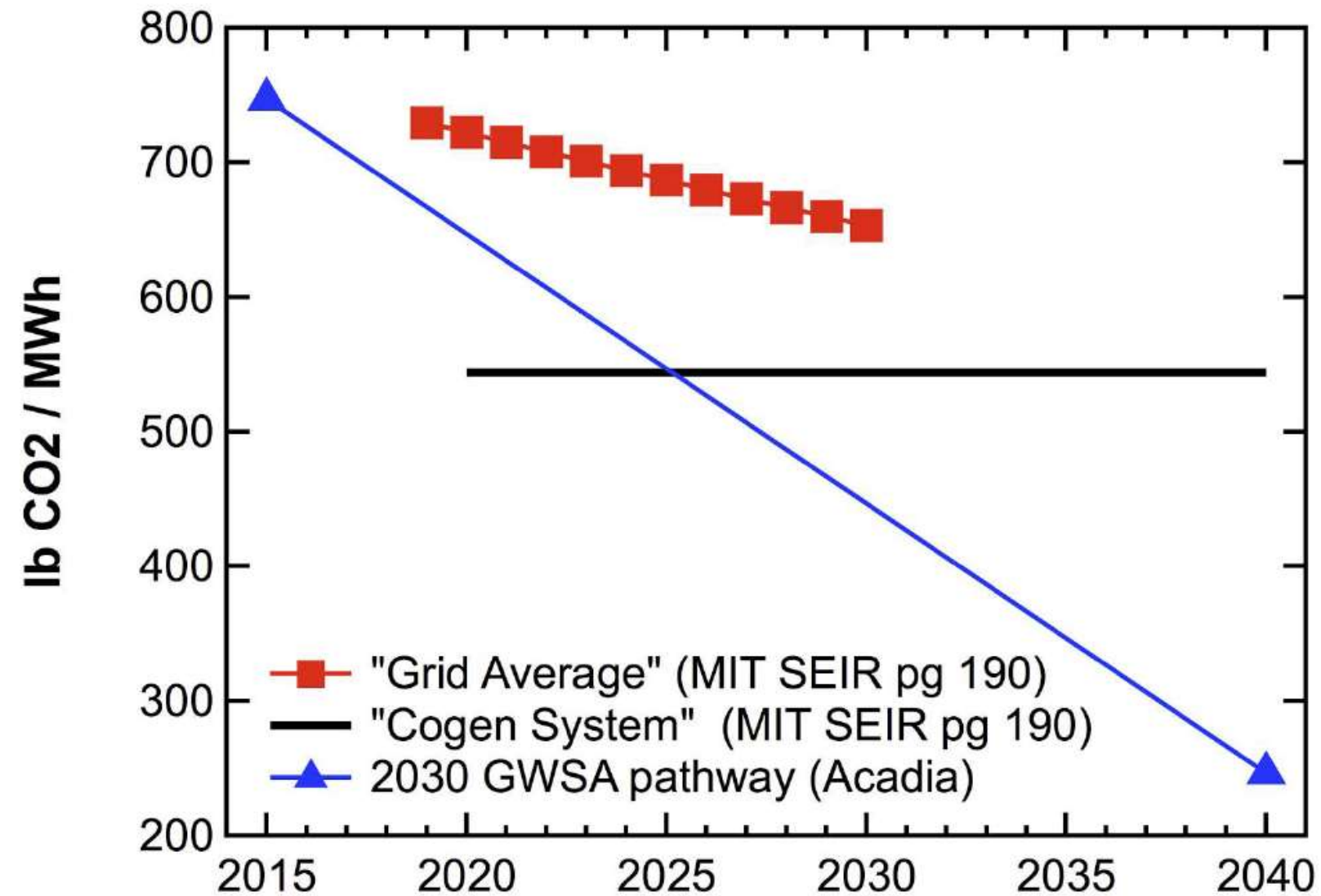
Challenge: City of Cambridge question on GHG benefit given expected decarbonization of electric grid

Solution: Show separate analysis documenting CHP system GHG emission rate lower than Massachusetts projections for life of project.



Challenge: student-led question on GHG benefit assuming massive decarbonization of electric grid

Solution: emphasize reliability & thermal benefits of project; note that MIT can turn off the CHP if that's what ends up being better in the long run.

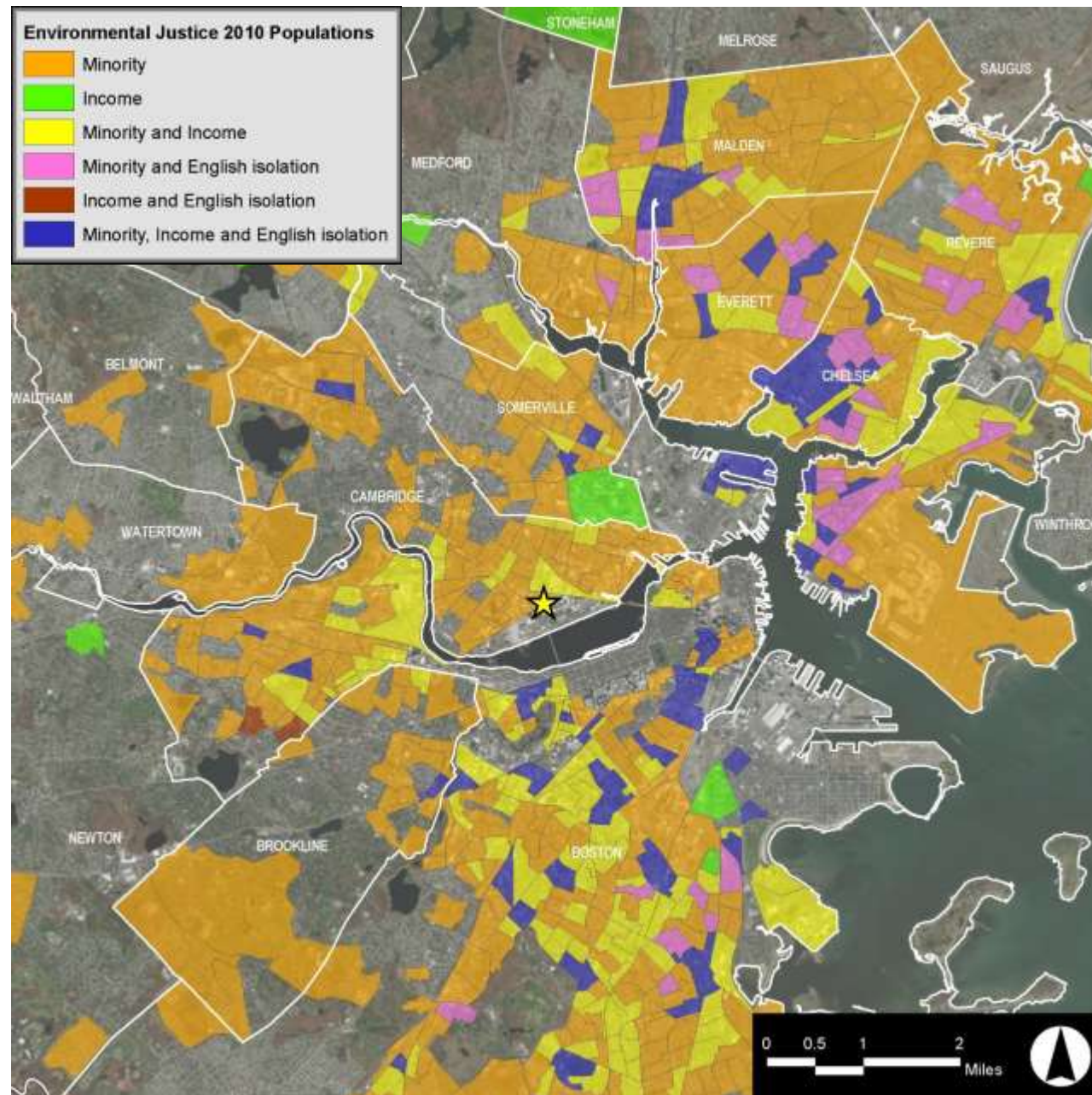


Challenge: addressing comments in the permitting process unrelated to the project



Solution: Gently push back on the forum for the comments while engaging the commenters separately.

Challenge: avoid showing disproportionate adverse impacts in Environmental Justice (EJ) areas while permitting construction of new source near EJ areas



- Per 1994 federal executive order: identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations.
- EPA said applies to PSD air permit.
- When located in an EJ neighborhood, any new impact could be construed as disproportionately impacting EJ population.



Solution: impacts are not adverse

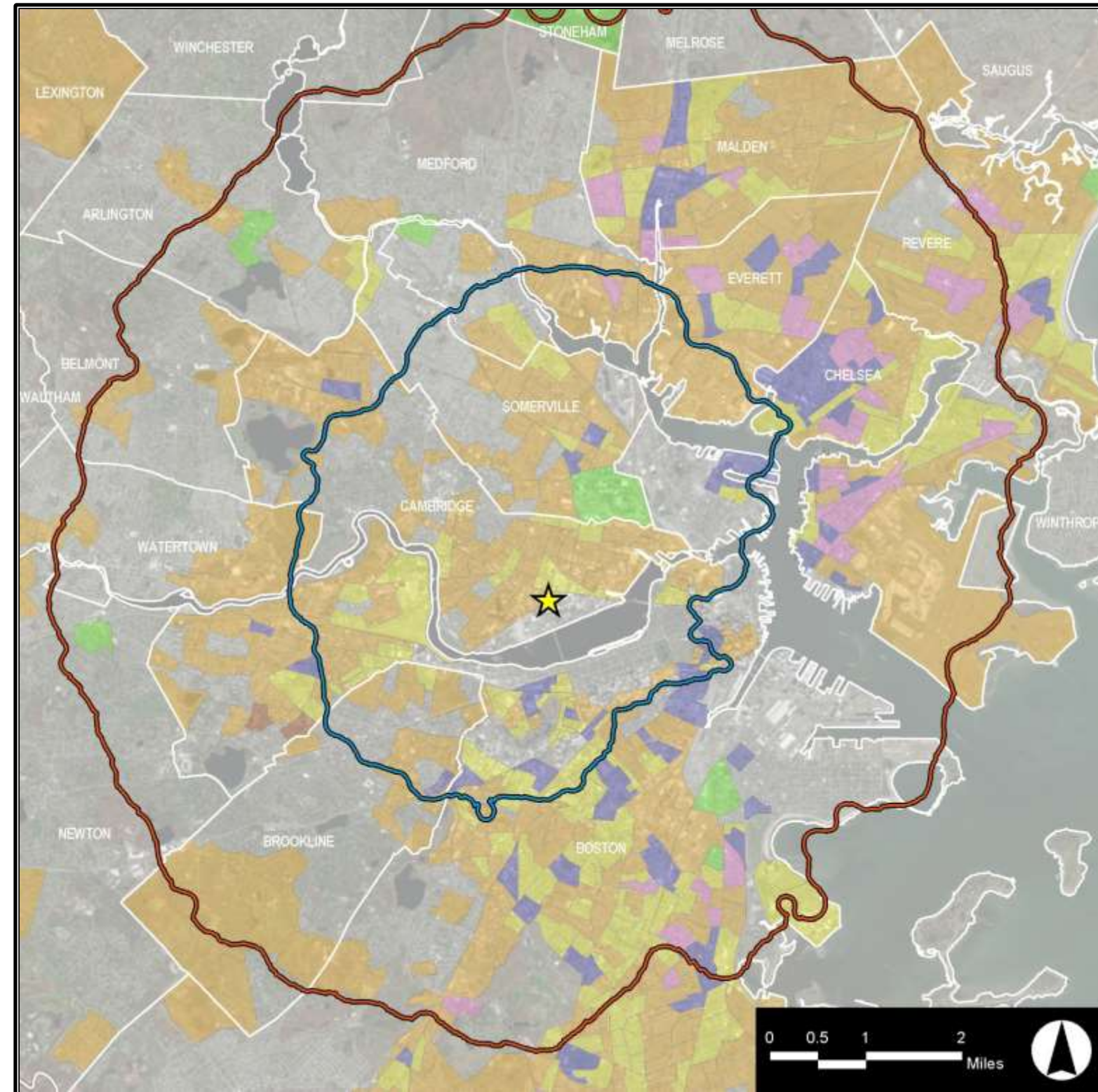
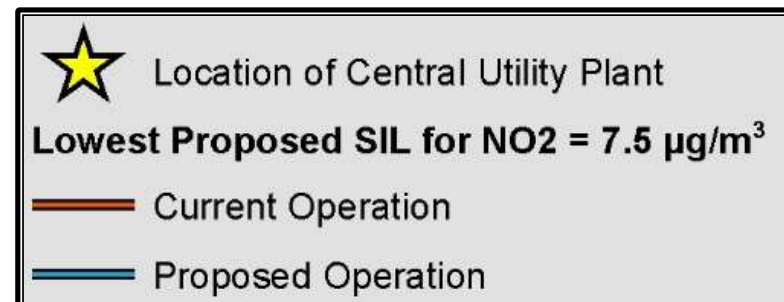
- Air permitting: Computer modeling to demonstrate that the worst-case impacts do not cause or significantly contribute to the exceedance of any health-based standard.

Table D-17: AERMOD Model Results for the Full MIT Facility with Interactive Sources for Operational Scenarios 1 & 2 Compared to the NAAQS

Poll.	Avg. Period	Form	Total Conc. ($\mu\text{g}/\text{m}^3$)	AERMOD Predicted Contribution ($\mu\text{g}/\text{m}^3$)							Bkgrnd Conc. ($\mu\text{g}/\text{m}^3$)	NAAQS ($\mu\text{g}/\text{m}^3$)	% of NAAQS	Period	Receptor Location (m)
				MIT	Kendall Station	Harvard	MATE P	Mystic Station	Kneeland St.	Logan Airport					(UTME, UTMN, Elev.)
PM ₁₀	24-hr	H6H	76.7	23.6	0.0032	0.0092	0.014	0.0099	N/A	N/A	53	150	51%	5/23/11 hr 24	327500.08, 4692162.84, 2.73
PM _{2.5}	24-hr	H8H	34.4	18.1	0.014	0.40	0.010	0.014	N/A	N/A	15.9	35	98%	2010-2014	327550.08, 4692062.84, 2.73
	Annual	H	11.0	2.34	0.18	0.51	0.05	0.21	N/A	N/A	7.7	12	92%	2010-2014	327550.088, 4692062.84, 2.73
NO ₂	1-hr ⁽¹⁾	H8H	139.7	54.3	0.129	0.106	0.058	0.033	0.043	0.038	85.0	188	74%	2010-2014	327550.08, 4692062.84, 2.73
	Annual ⁽²⁾	H	54.4	4.1	1.0	1.0	0.8	0.6	0.5	0.3	46.2	100	46.2%	2010	327550.08, 4692112.84, 2.73

Solution: impacts are not disproportionate

Separate modeling of expected actual impacts to show not disproportionate.



Challenge: allow oil use without the misperception that MIT intends to fire oil

- Attempted solution: State that ULSD firing would only be during force majeure, which closely resembles MassDEP's definition of an "emergency", and MassDEP regs say "The Permittee shall be shielded from enforcement action brought for noncompliance with technology based emission limitations specified in this Permit as a result of an emergency."
- MassDEP indicated that if we installed ULSD backup, the loss of natural gas wasn't "reasonably unforeseeable".
- Final Air permit conditions: ULSD as a limited backup fuel including no more than 48 hours per consecutive twelve month period (C12MP) for testing and no more than 168 hours per C12MP including testing and during periods when natural gas is unavailable or unable to be burned in the equipment.



Challenge: getting schedule certainty through the permitting process, and last-minute curve balls from

MassDEP

October 2015 – Page-through of application at MassDEP offices before submission

December 2015 – Application submitted

May 2016 – First major resubmittal

December 2016 – Final resubmittal incorporating all of MassDEP's comments

March 2017 – Draft approval includes tighter new CO and VOC emission limits not discussed with MassDEP

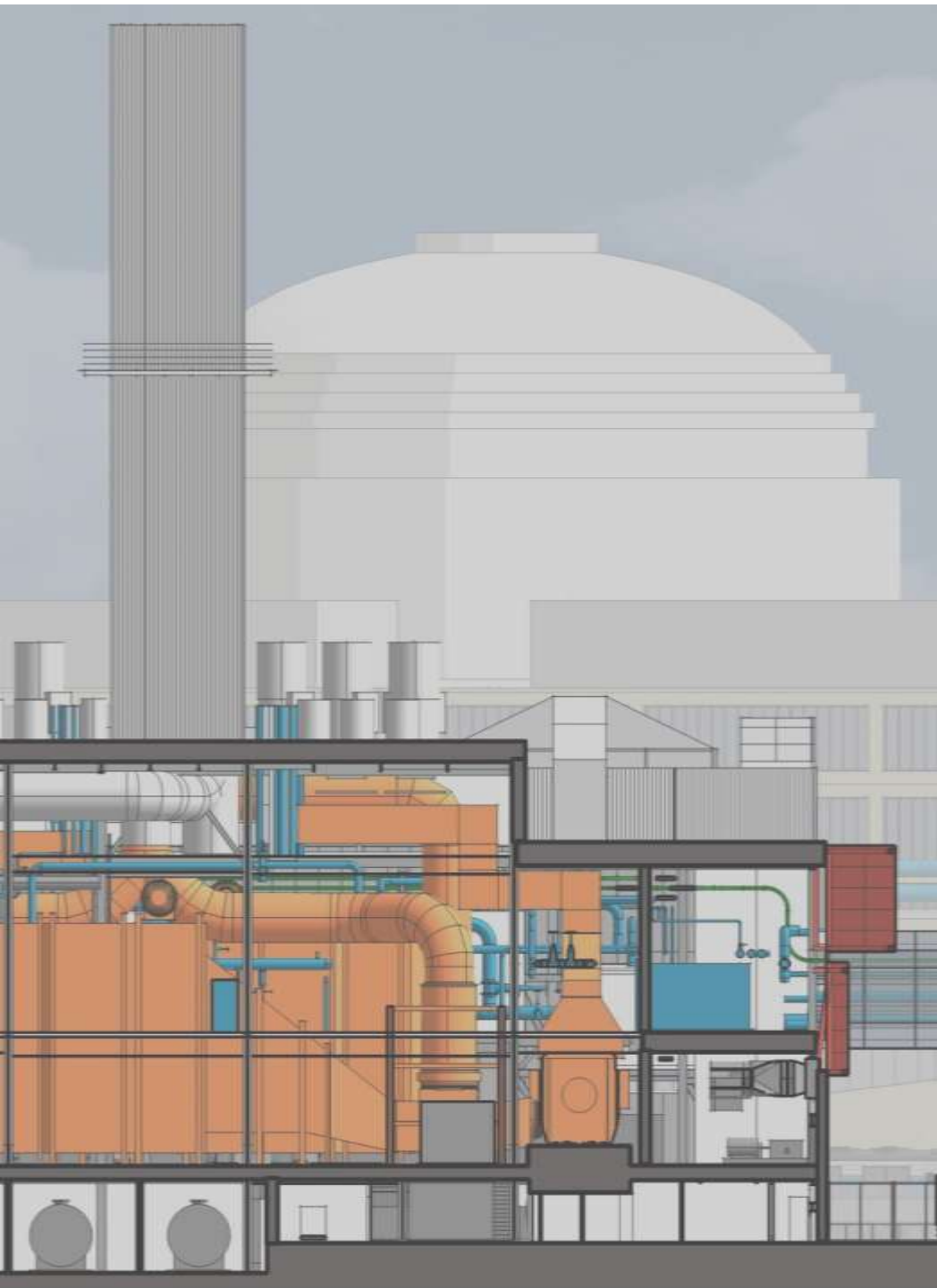
~March 2016 “Final” turbine selection

~ August 2016 HRSG bid reviews with emission limits

Coordination between MIT's environmental and engineering teams allowed enough safety margin in the equipment bid specifications to address MassDEP's last-minute reduction in emission limits.

Summary & Lessons Learned

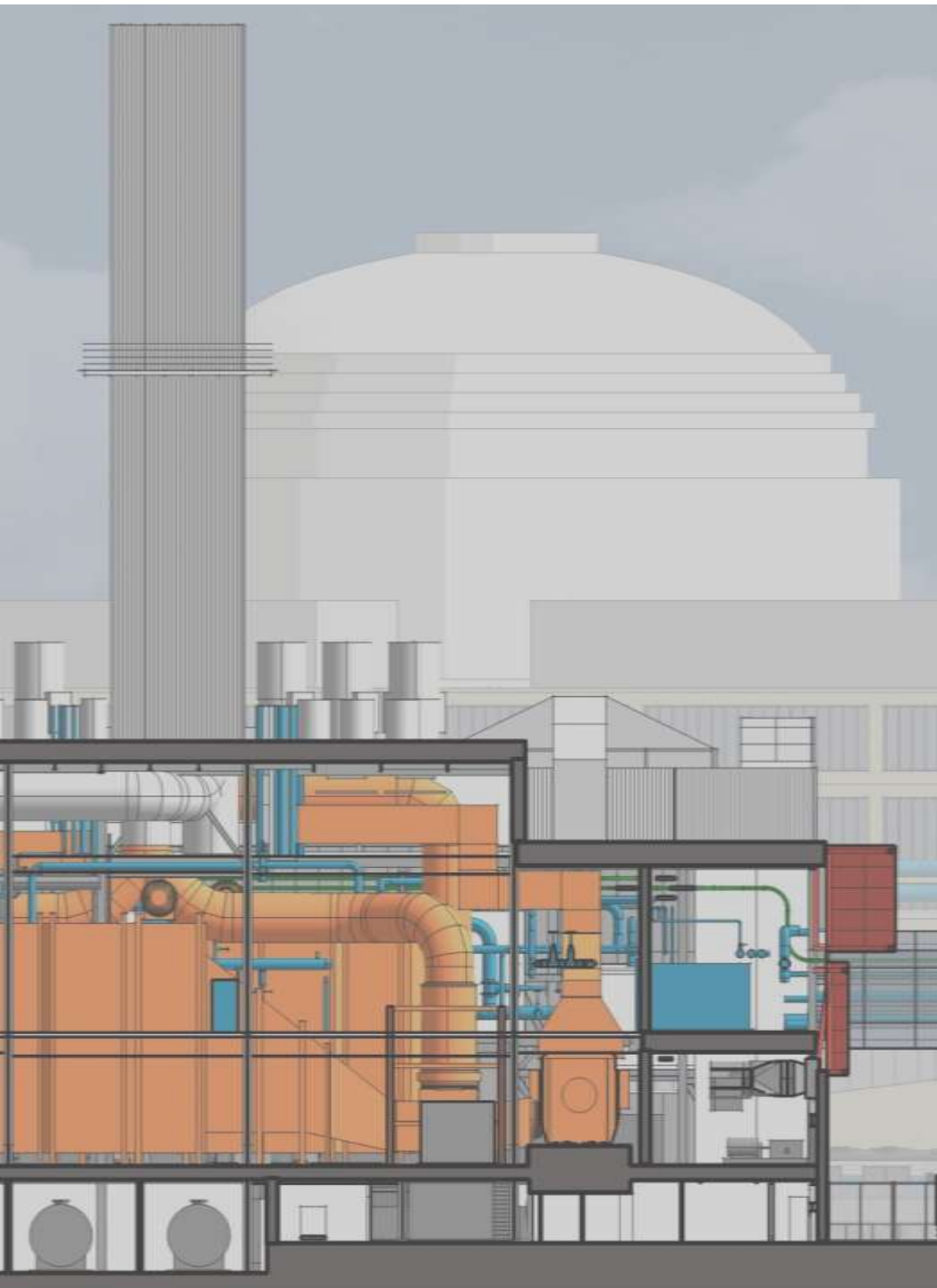
- Keep project goals simple
- Involve interested parties early
- Careful coordination backing up public statements
- Underpromise & overperform in the regulatory process



Thank You

Seth Kinderman
Plant Engineering Manager
M.I.T.
Central Utilities Plant - Bldg 42
59 Vassar Street
Cambridge, MA 02139
617-258-6221
skinderm@mit.edu

A.J. Jablonowski, P.E.
Principal
Epsilon Associates, Inc.
3 Mill & Main Place - Suite 250
Maynard, MA 01754
978-461-6202
ajablonowski@epsilonassociates.com



Renderings by Ellenzweig

