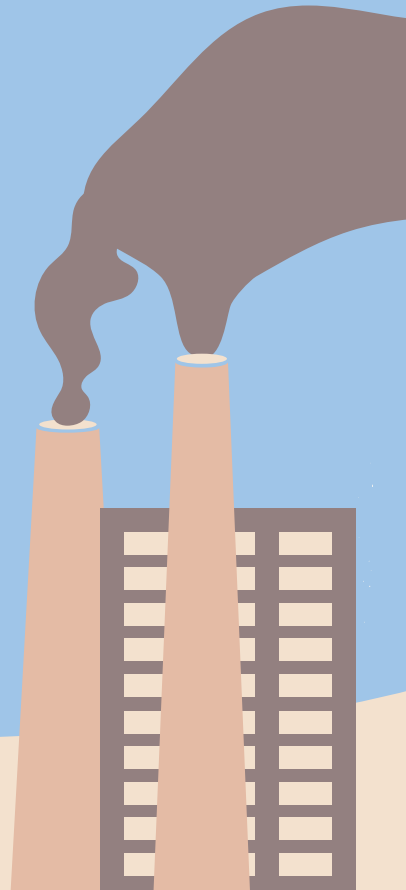
Stockton Industry and Air Pollution: Design Process

Hallie McManus, Kushaan Bahl, Marcus D'Avignon, Matthew Grehm



OUR TEAM

Hallie McManus

4th year, CEE

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3rd year, CBE

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3rd year, CEE

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4th year, CEE

DESIGN PROCESS

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Mission Statement

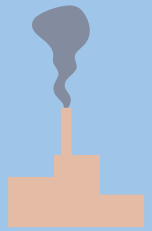
MISSION

We, the members of the CE105 Spring 2021 Industry Research Team, aim above all else to serve the needs of the Stockton community. We will focus on addressing industrial facility emissions, particularly at the Port of Stockton, through regulatory measures, technical solutions, and engaged partnerships between all parties.

PREFERRED STATE

PORT

No more port, or an accountable port that works with the community

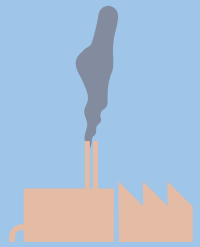


IMPROVED AIR

Attainment in Stockton, improved health outcomes

REGULATION

Increased enforcement and more stringent regulations



INDUSTRY ACCOUNTABILITY

Higher fines and carbon tax

ANALYSIS & SOLUTIONS

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PROPOSED PROJECTS

SHIP INVENTORY

Analyze ships and goods entering Stockton

PORT EMISSIONS ANALYSIS

Perform emissions breakdown

DTE ANALYSIS

Emission reduction plan

HEALTH BENEFITS ANALYSIS

Compare CERP strategies

TRAINS VS. TRUCKS

Compare pollution impacts of each

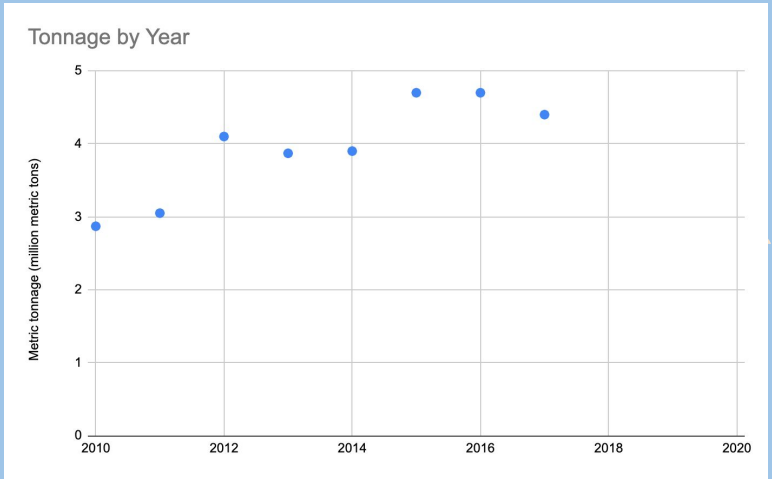
WIND ANALYSIS

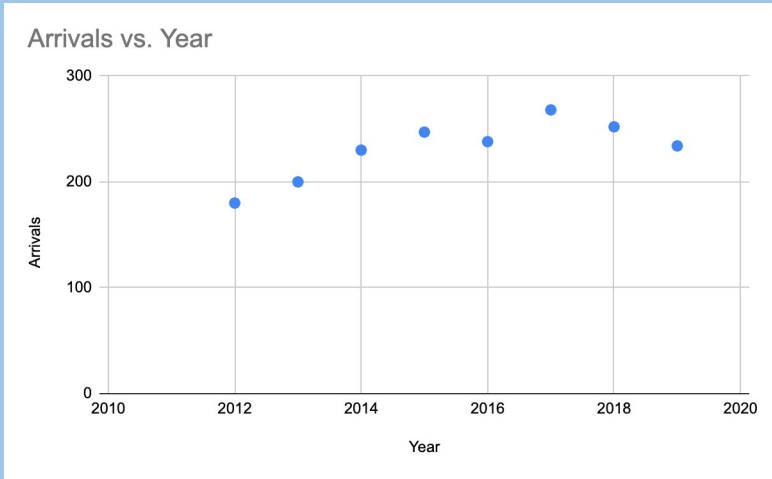
Plotting point sources of emissions

Ship Data

30% increase in ship traffic & tonnage over last 10 years but....

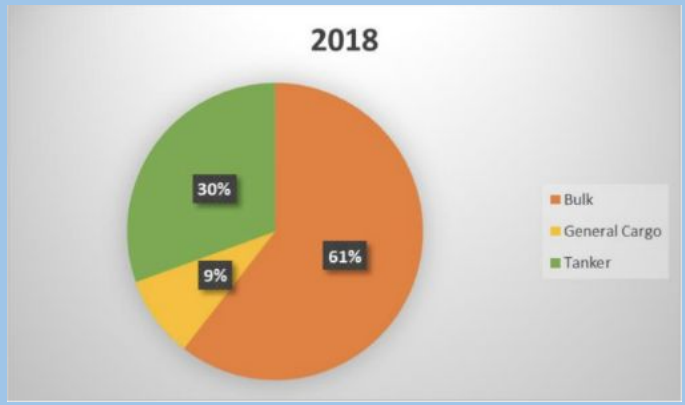
Steady decline in last 5 years





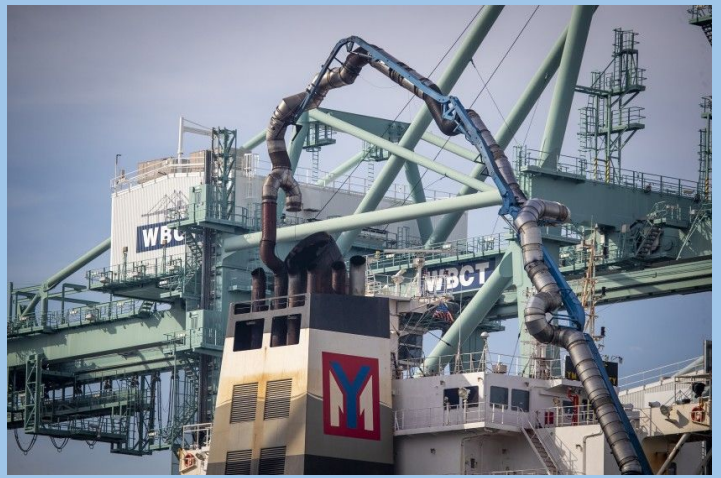
Shipping Visualized

Bulk carrier at berth



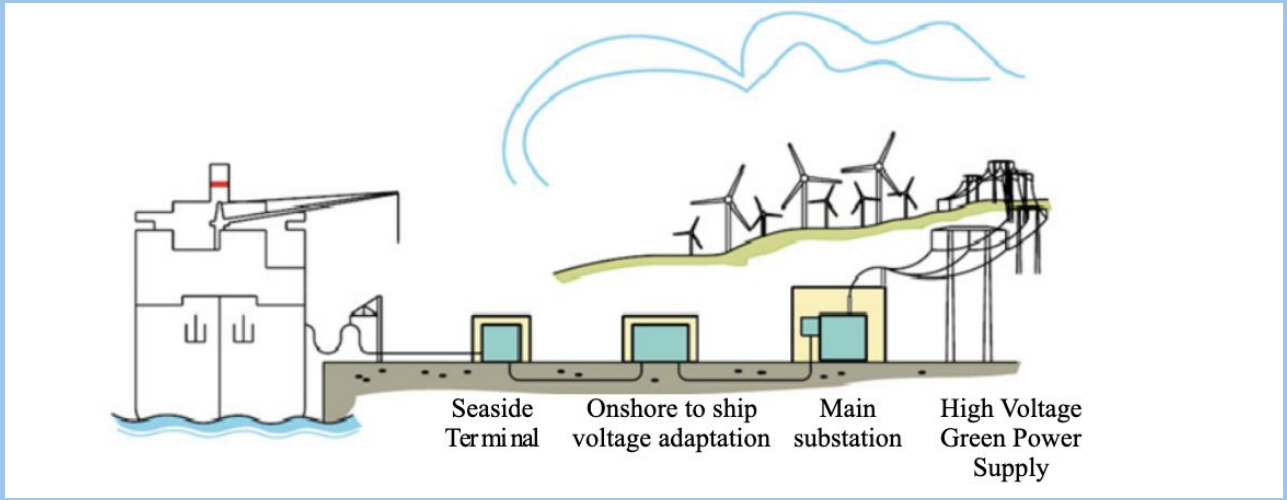
Bonnet

Emissions capture from the source



Shore Power

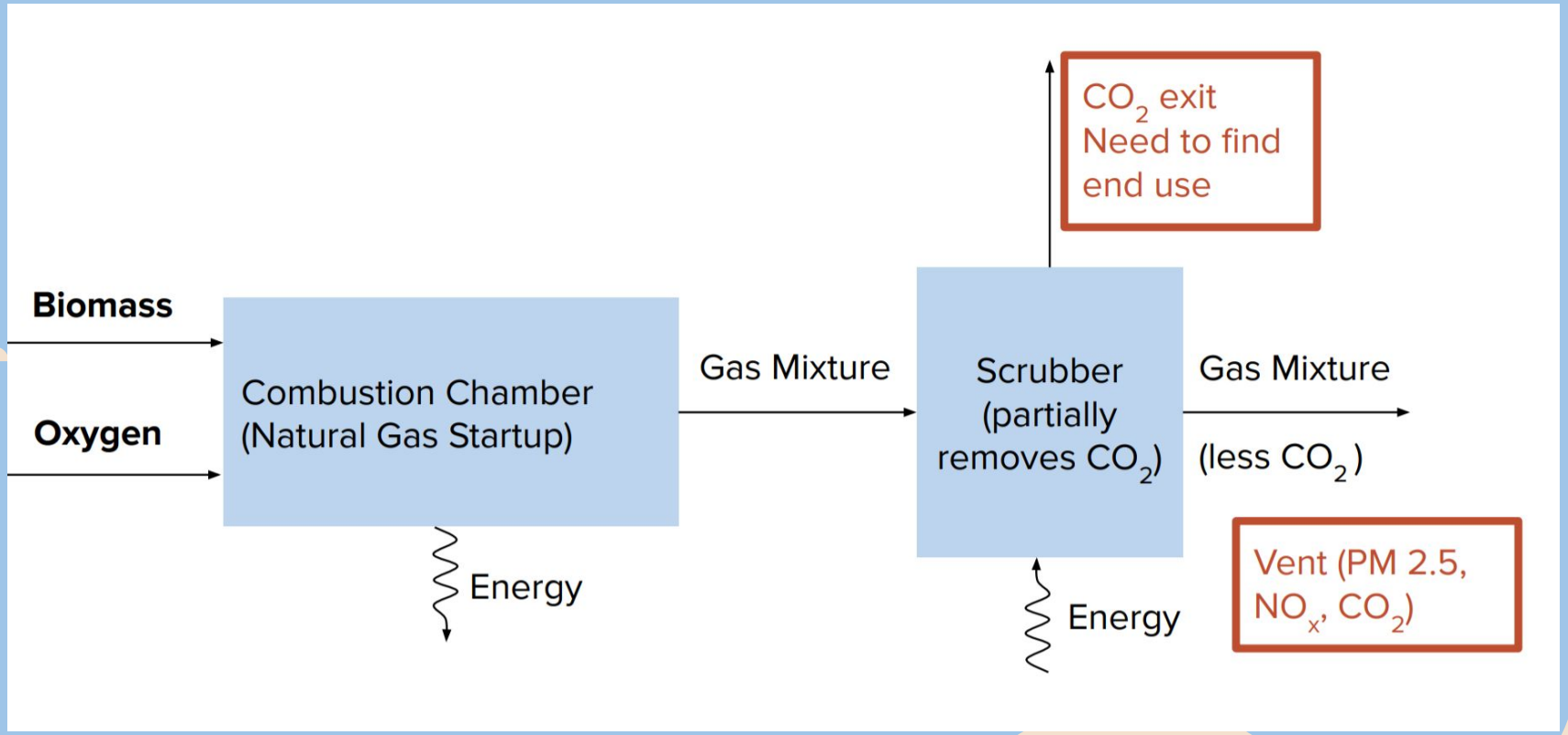
Clean-energy microgrid plugin



Shipping Solutions

	On-Shore Power	Bonnet	Reduction
Pros	• Cut all port emissions in half • Solar/wind microgrid to reduce port power consumption • ~$3 million per terminal	• Immediate reduction in all OGV emissions • Existing technology • Enables sustained growth rate of port economy	• No external costs of equipment • Overall reduction for all categories
Cons	• Requires changes outside of Port control • Short term loss of ship traffic • Potentially long process of installation	• Difficulty of use • Cost of installation ($2 billion) • “Band-aid” solution	• Loss of revenue for port • Economic impacts for industry

DTE Process Diagram



DTE Technological Solutions

Current Technology

- Electrostatic Precipitator
- Water Sprayer as scrubber
- Does not capture all emissions
- BACT in 2011

DTE Technological Solutions

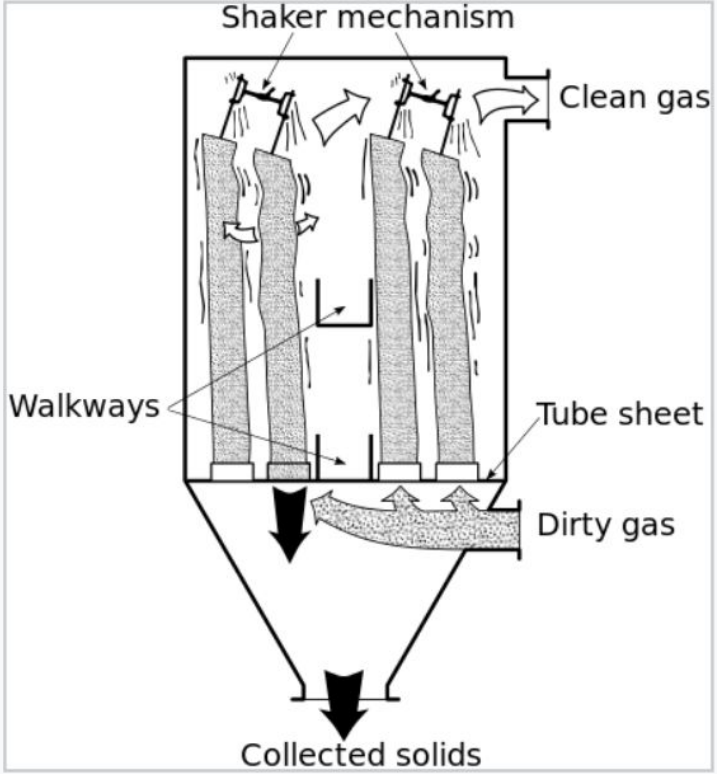
Proposed Technology

- ***Baghouse***
- 99% Efficient at PM2.5/10 capture
- Could be within CERP budget
    - Calculations in progress

DTE Technological Solutions

Baghouse (continued)

- ***Baghouse***
- Cloth filters trap PM and cleaned gas is released
- Can function up to 500°F
- Can capture fine particulates with proper filters



Mechanical Shaker Baghouse

CURRENT REGULATIONS

Rule 4352

Limit the emissions of NOx and CO from biomass power facilities

Rule 4692 & 4693

Limit VOC and PM10 emissions from commercial cooking operations

Ocean Going Vessel Fuel Regulations

Reduce PM, diesel PM, NOx, and sulfur oxide from ocean-going vessels.

Cargo Handling Equipment (CHE)

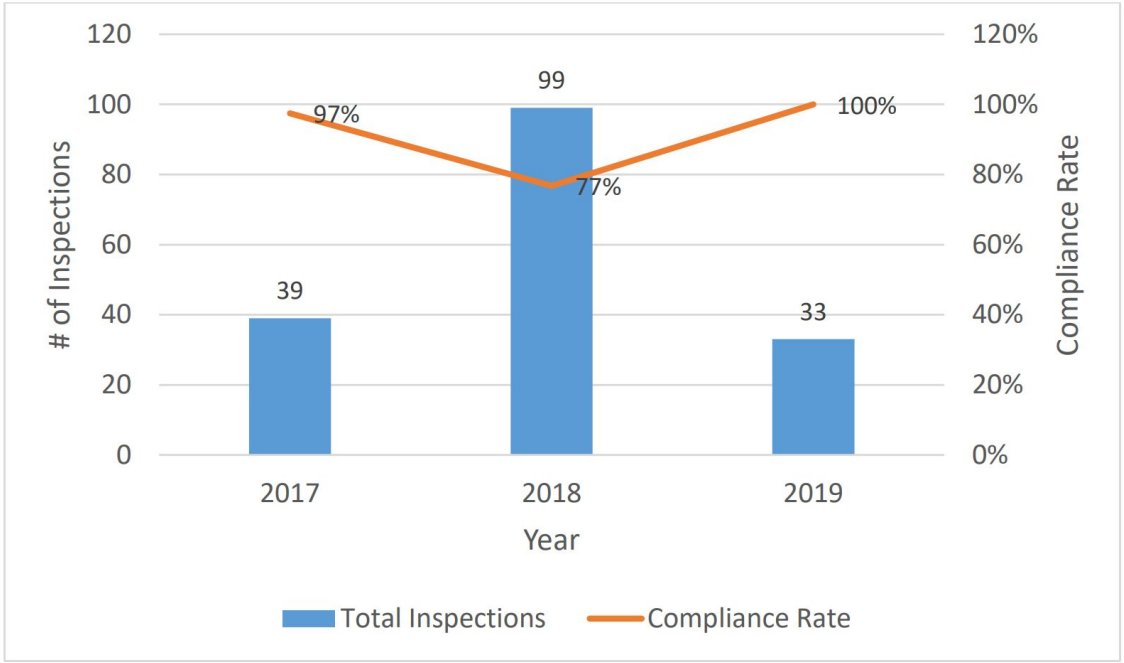
Reduce toxic and criteria emissions.

Commercial Harbor Craft (CHC)

Reduce emissions of diesel PM, NOx, and Reactive Organic Gases from diesel engines

Present State

Figure 5-7 Year-to-Year Comparison of Marine Enforcement in Stockton



Regulatory Solutions

1. Increased enforcement for stationary sources
    a. Frequency of inspections
    b. Higher fines for violating regulations
    c. Intentional enforcement actions
2. Expanded network of Air Monitors to better capture pollution from stationary sources
3. Evaluation of Best Available Retrofit Control Technology (BARCT)
4. Decreased reliance on complaint process to keep industry accountable
    a. Increased accessibility to complaints (multi-lingual responders)
    b. Community information regarding process
    c. Complaint confirmation bias

Analysis of Current Regulatory Actions

1. Analyze enforcement data in Appendix F of CERP
    a. Facility inspections
    b. Complaint data
    c. Enforcement action data
2. Determine gaps and biases in enforcement actions
3. Determine biases in complaint process
    a. What is preventing complaints from being confirmed?
4. Mapping current monitors and emitting sources to figure out optimal locations for monitors

EVALUATION CRITERIA

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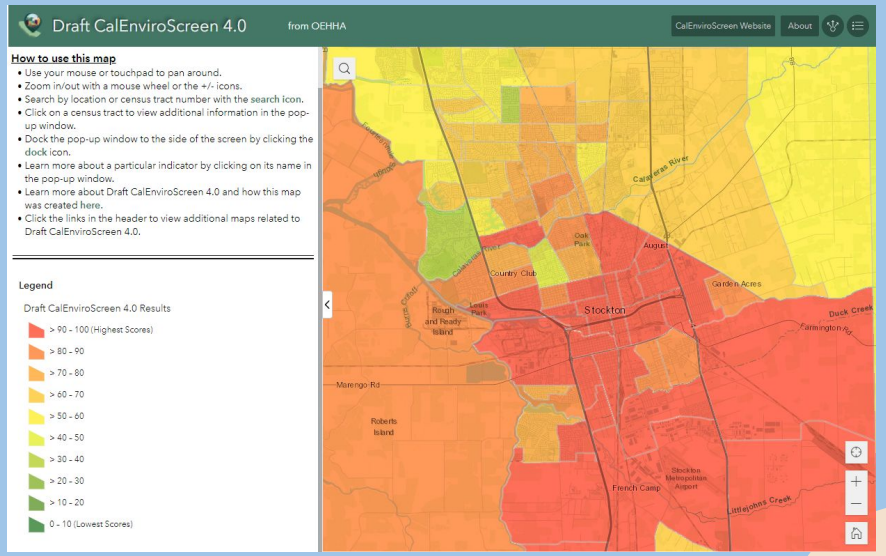
Evaluation Criteria: Technological

- Efficacy of pollutant reduction
  - Specifically, port measures
- Temporary or Permanent?
- Timeline of Implementation
- Success observed with similar solutions elsewhere?

Evaluation Criteria: Financing

- CERP Budget: $10.8 million
- Possible measures related to industry:
  - $2 M mobile equipment
  - $1 M tug boats
  - $2 M bonnet
- Also, air filter measures
  - $2.64 M schools
  - $1 M residential
- How much benefit per dollar spent? How evenly is that benefit distributed among community members?



Evaluation Criteria: Community

- Community effects/EJ Assessment:
- Health impacts (e.g., asthma rates)
- Community relations (with port, industry, Air District...)

Table of Solutions

Potential Implementation Action	Goal	Affected Parties	Measurable Outcome
Installation of Air Filters	Reduce indoor exposure rates to PM2.5...	School Districts, Hospitals, Other Sensitive Receptors	Decreased indoor air concentrations of PM2.5; decreased asthma rates
Stricter Regulations on Industrial Facilities	Reduced stationary source emissions of PM, NOx, CH4...	DTE, other industrial facilities. Community Members.	Decreased emission rates, increased inspection compliance.
Ship Bonnet	Reduction of OGV emissions	Port	NOx, PM2.5, CO2 emissions reduction. MARPOL and CARB emissions limits

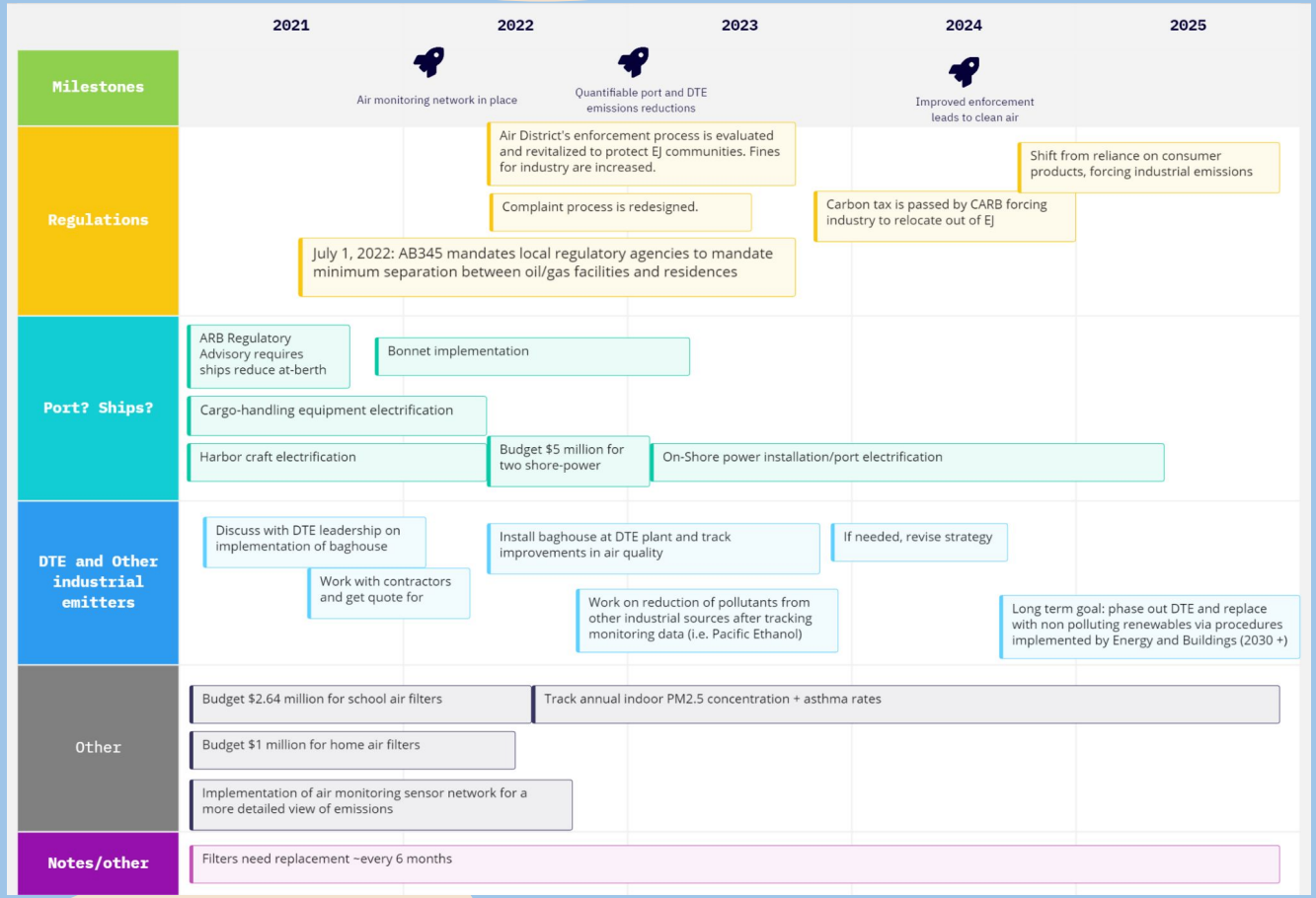
Table of Solutions (ctd)

Port Electrification Incentives	Offering incentives for electrified ships, fines for violations	Port, shipping companies	Decrease in PM 2.5, NOx
DTE pollutant capture	Reduction in PM 2.5 (mainly from smoke)	DTE, port	Decrease in PM 2.5, NOx
Truck Appointment System at Port*	Reduced queuing and truck idling at port, generating fewer emissions	Trucks/companies outside Stockton, port	Decrease in PM 2.5, NOx

*After further research, it was determined not to investigate truck appointment systems further. Historical regulatory efforts, specifically AB2650, have realized little benefit for reduced emissions. Given existing difficulties in enforcing industrial regulations, this proposal is perhaps better suited for a later point in time.

Giuliano, Genevieve, and Thomas O'Brien. "Reducing Port-Related Truck Emissions: The Terminal Gate Appointment System at the Ports of Los Angeles and Long Beach." *Transportation Research Part D: Transport and Environment* 12, no. 7 (October 1, 2007): 460–73. https://doi.org/10.1016/j.trd.2007.06.004.

Implementation Timeline



leads to clean air

Regulations

- Air District's enforcement process is evaluated and revitalized to protect EJ communities. Fines for industry are increased.
- Shift from reliance on consumer products, forcing industrial emissions
- Complaint process is redesigned.
- Carbon tax is passed by CARB forcing industry to relocate out of EJ
- July 1, 2022: AB345 mandates local regulatory agencies to mandate minimum separation between oil/gas facilities and residences

Port? Ships?

- ARB Regulatory Advisory requires ships reduce at-berth
- Bonnet implementation
- Cargo-handling equipment electrification
- Harbor craft electrification
- Budget $5 million for two shore-power
- On-Shore power installation/port electrification

DTE and Other industrial emitters

- Discuss with DTE leadership on implementation of baghouse
- Install baghouse at DTE plant and track improvements in air quality
- If needed, revise strategy
- Work with contractors and get quote for
- Work on reduction of pollutants from other industrial sources after tracking monitoring data (i.e. Pacific Ethanol)
- Long term goal: phase out DTE and replace with non polluting renewables via procedures implemented by Energy and Buildings (2030 +)

Other

- Budget $2.64 million for school air filters
- Track annual indoor PM2.5 concentration + asthma rates
- Budget $1 million for home air filters
- Implementation of air monitoring sensor network for a more detailed view of emissions

Notes/other

- Filters need replacement ~every 6 months

NEXT STEPS

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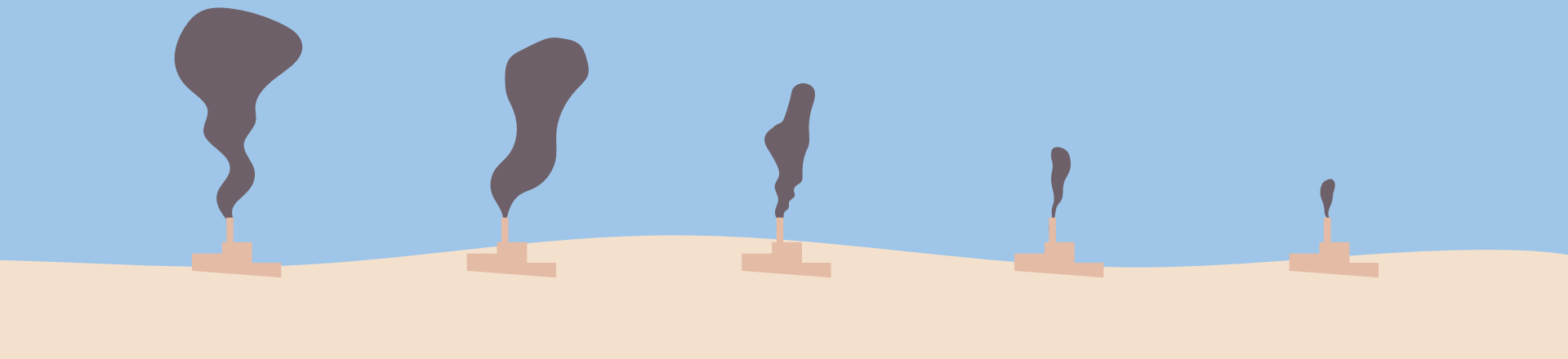
GOING FORWARD

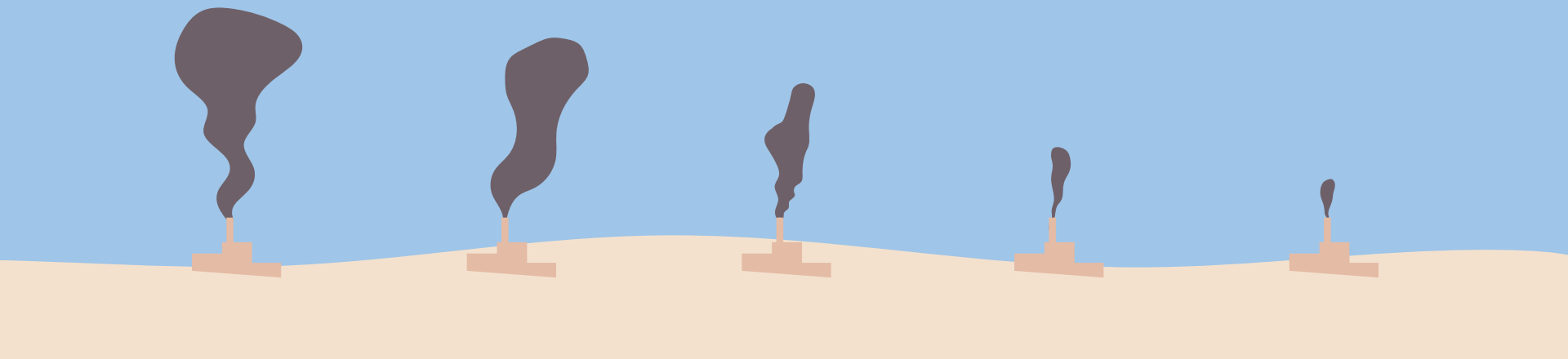
Direction of continued work

- Quantifying solutions based on criteria
- Calculating cost of technical solutions
- Figuring out best use of 5M port budget
- Analysis of enforcement actions, inspections, and complaint process

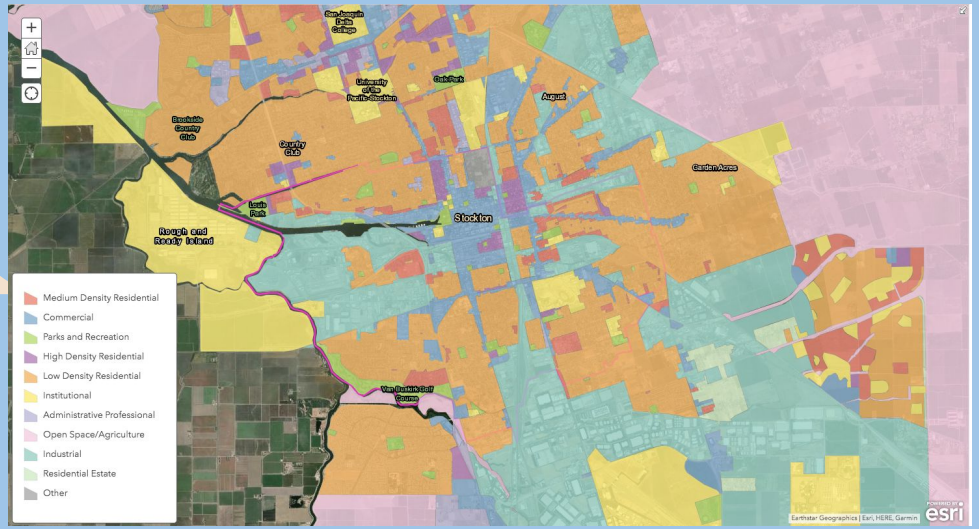
Questions?

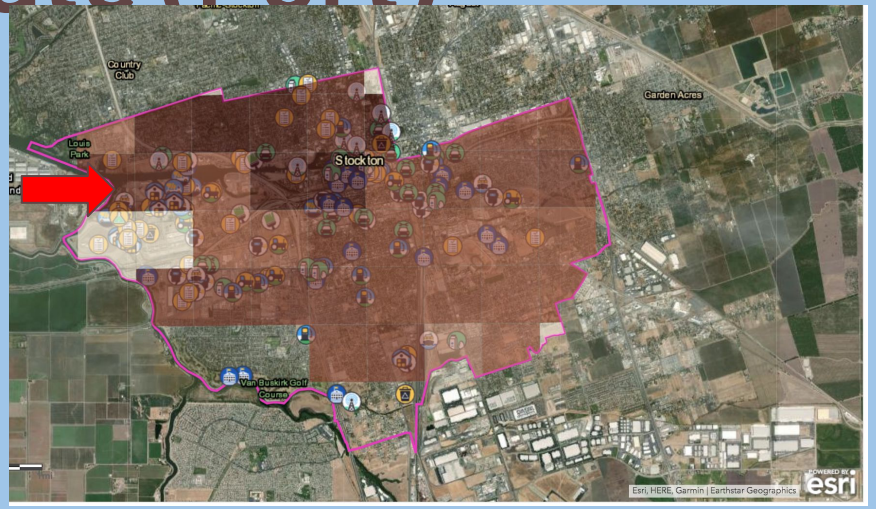


Appendix



Problem State (Port)





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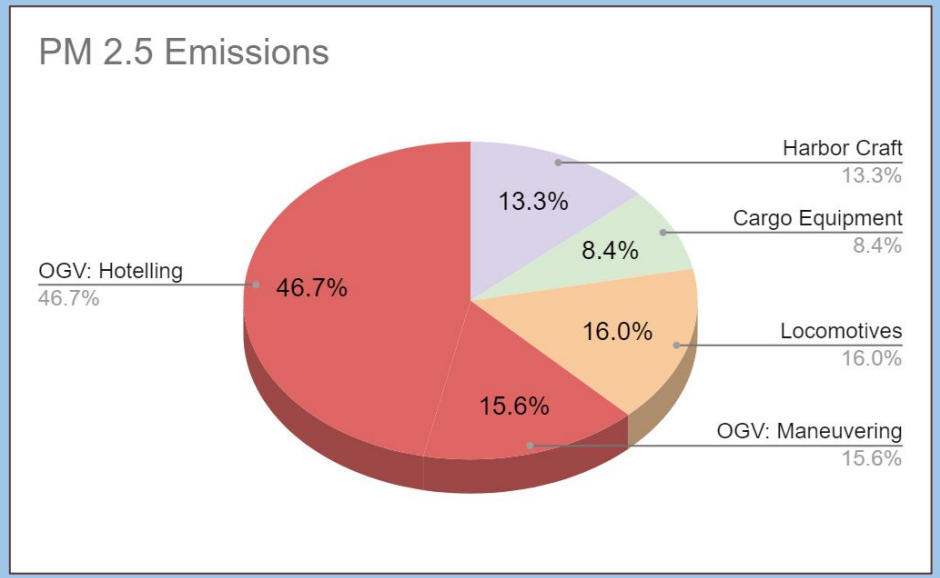


GHG Inventory

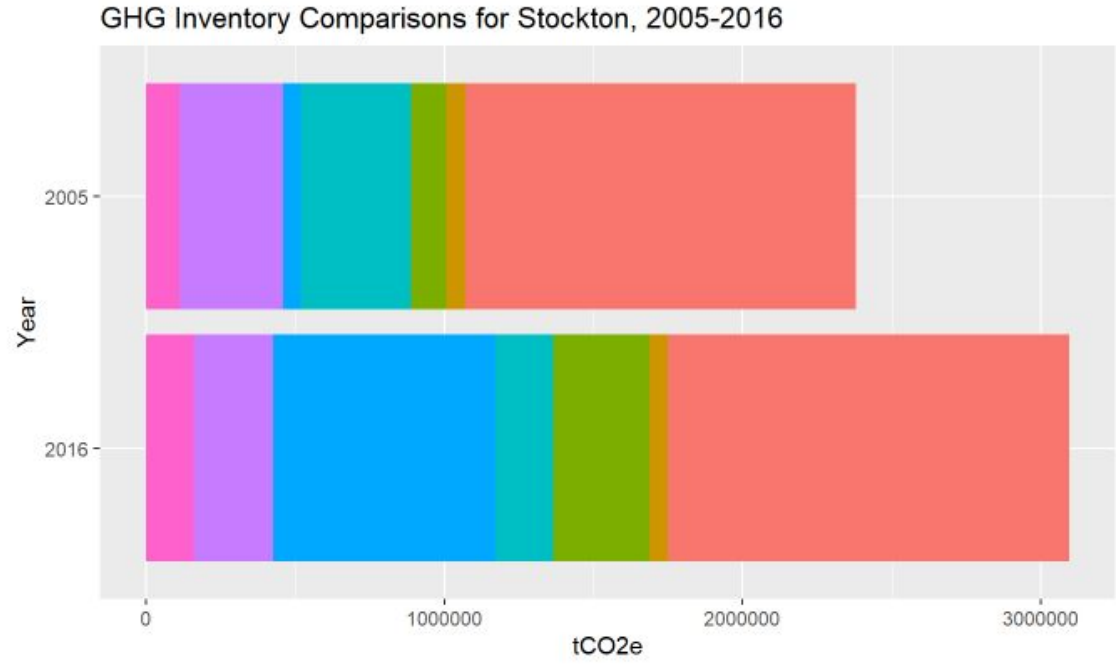
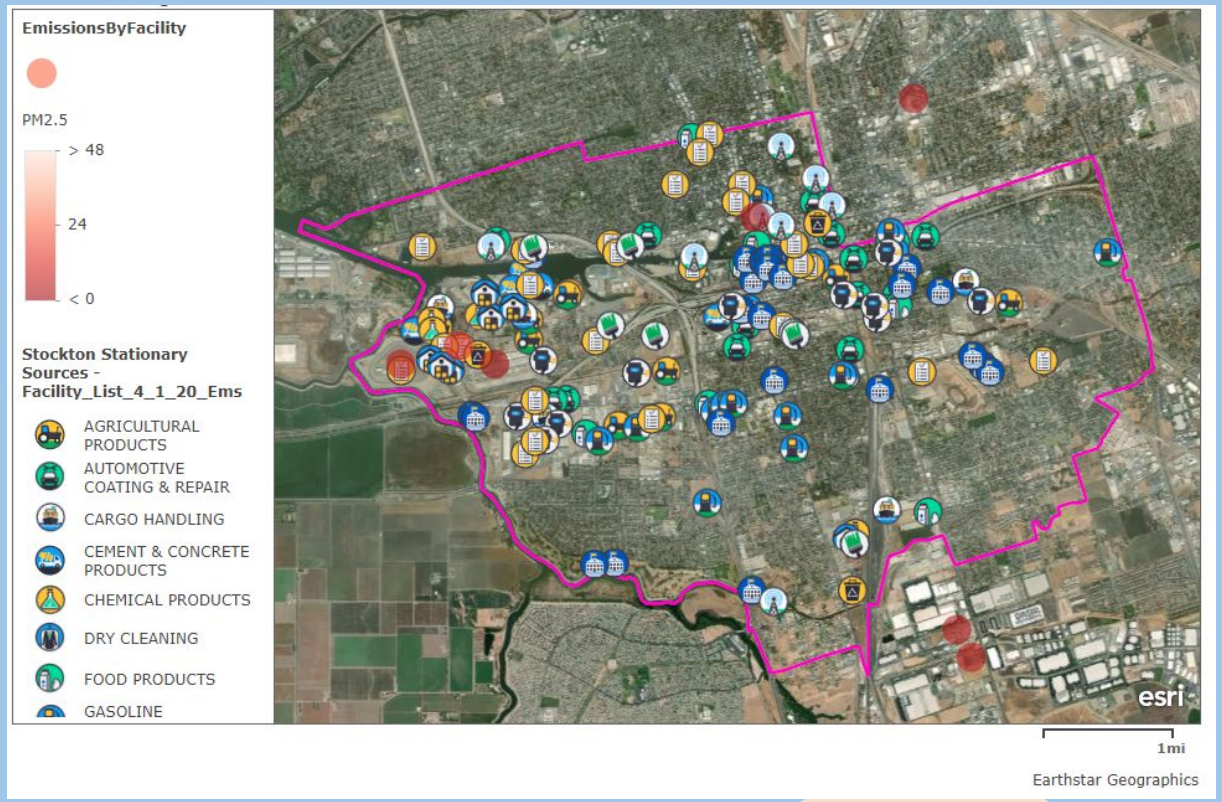
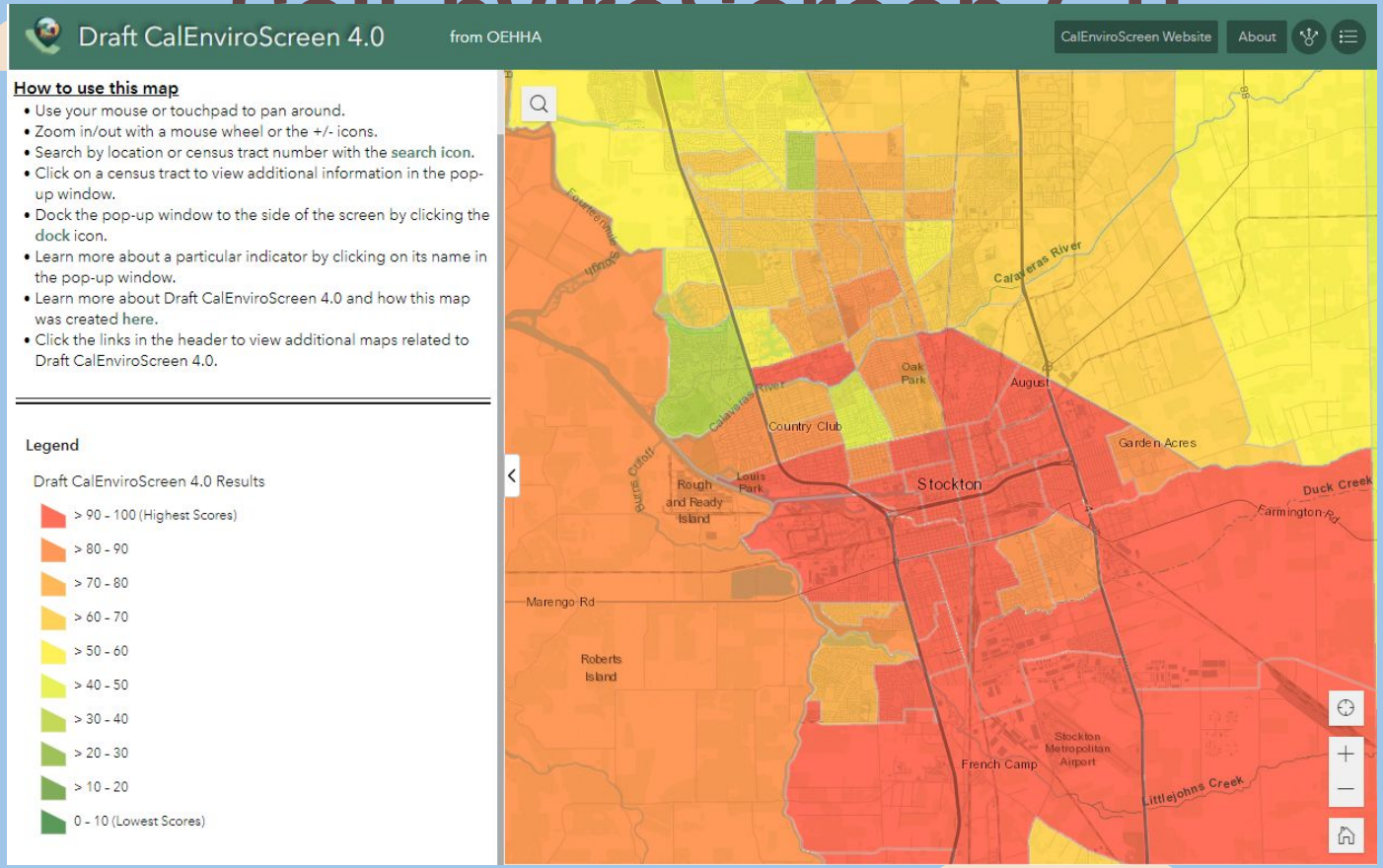


Figure 2.9: Inventory comparisons for Stockton 2005-2016, from ICLEI.

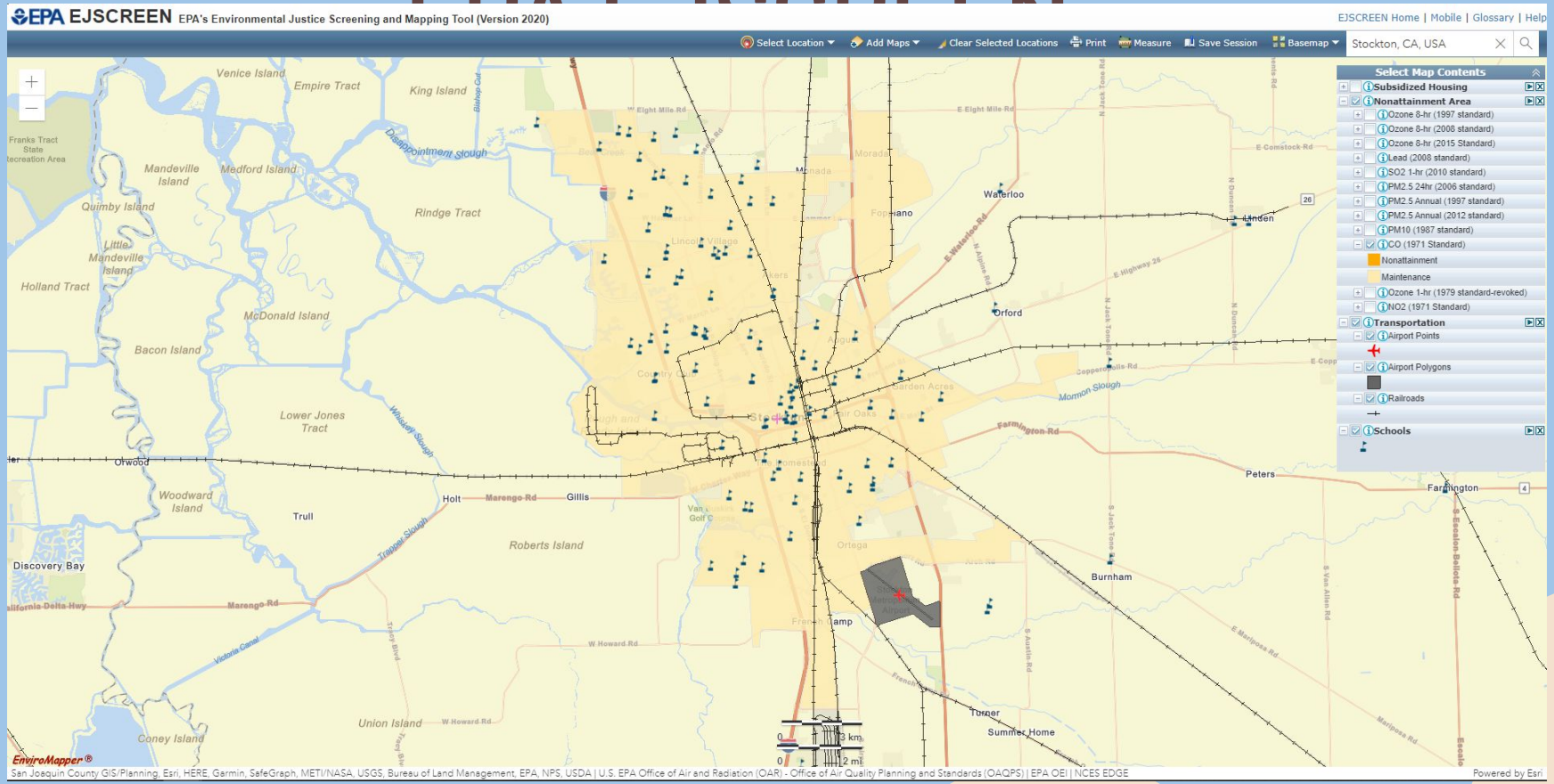
Industry Emissions



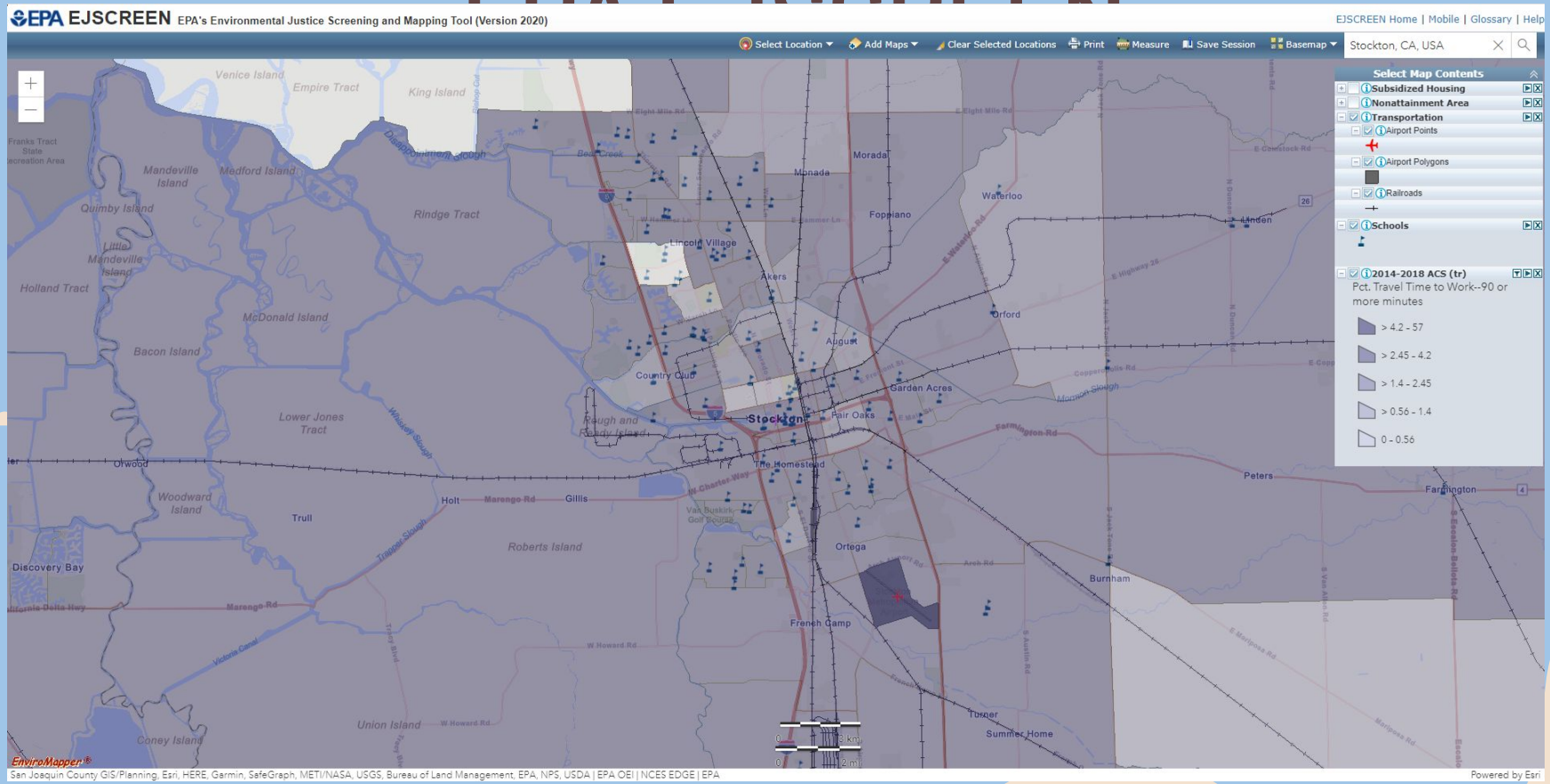
CalEnviroScreen 4.0



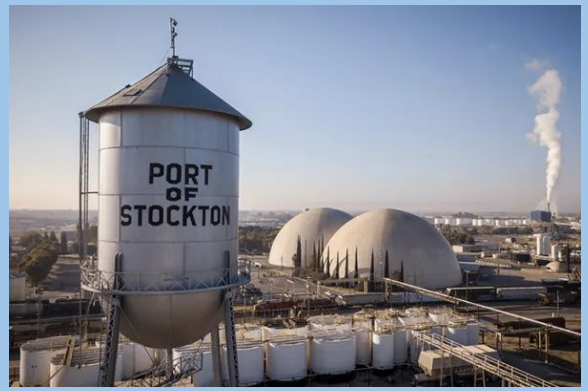
EPA EJSCREEN



EPA EJSCREEN



Air District Options - Health Analysis



DTE Preliminary Research

- Began operation in **2014**, replaced a coal-fired plant
- Burns **biomass** (wood) from agricultural/urban sources
- High emissions allowed due to permits

Action Alternatives

Installation of Air Filters

Improved Enforcement of Facility Regulations

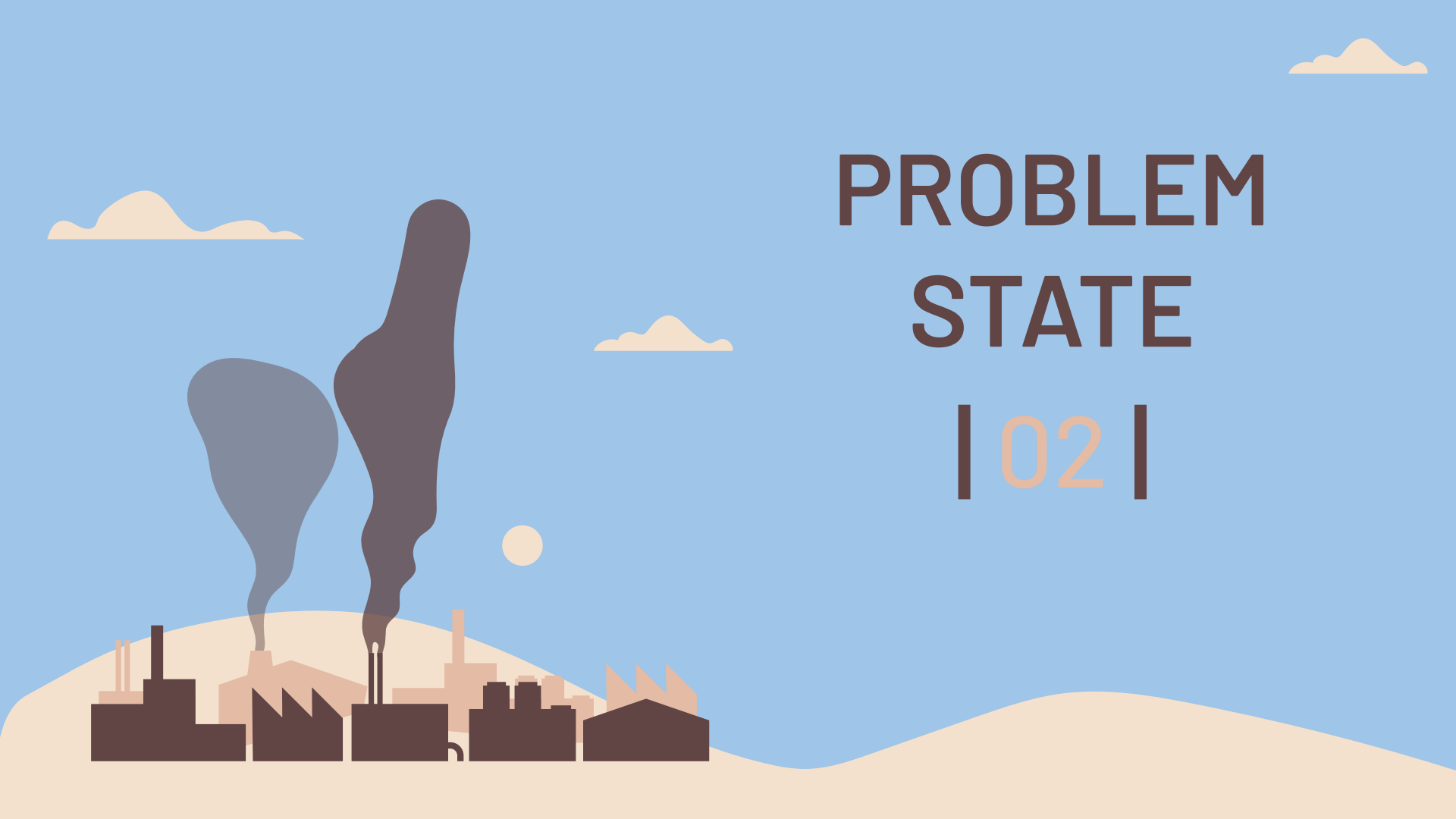
Ship Bonnet

- Cost and timeline of implementation

Port Electrification Voluntary Incentives

XXX?

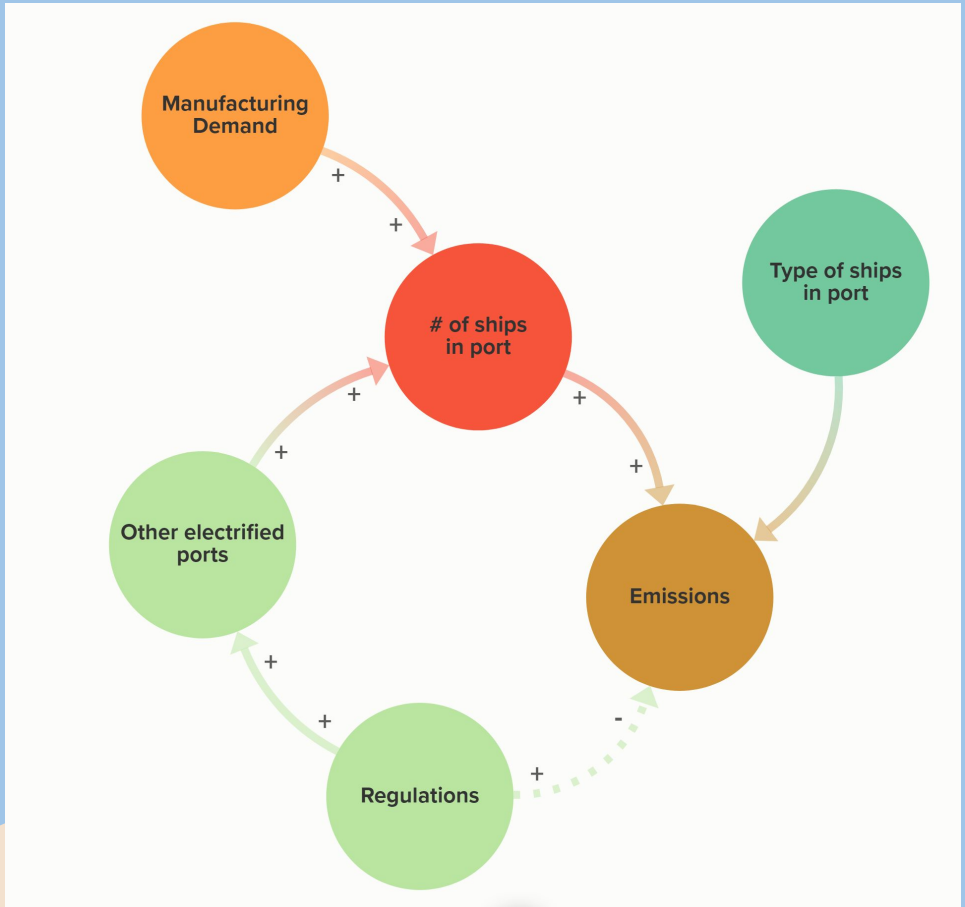
XXX?



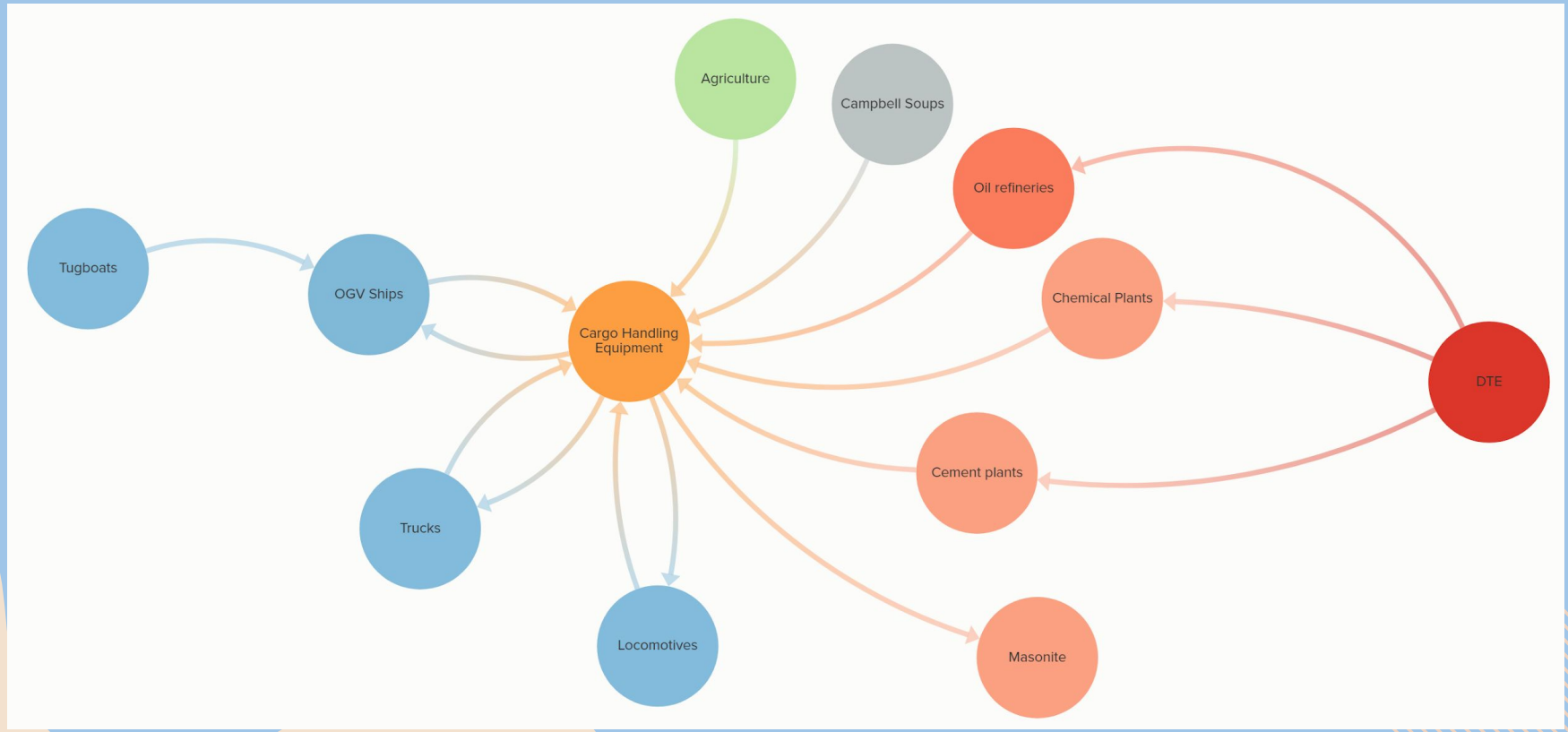
PROBLEM STATE

02

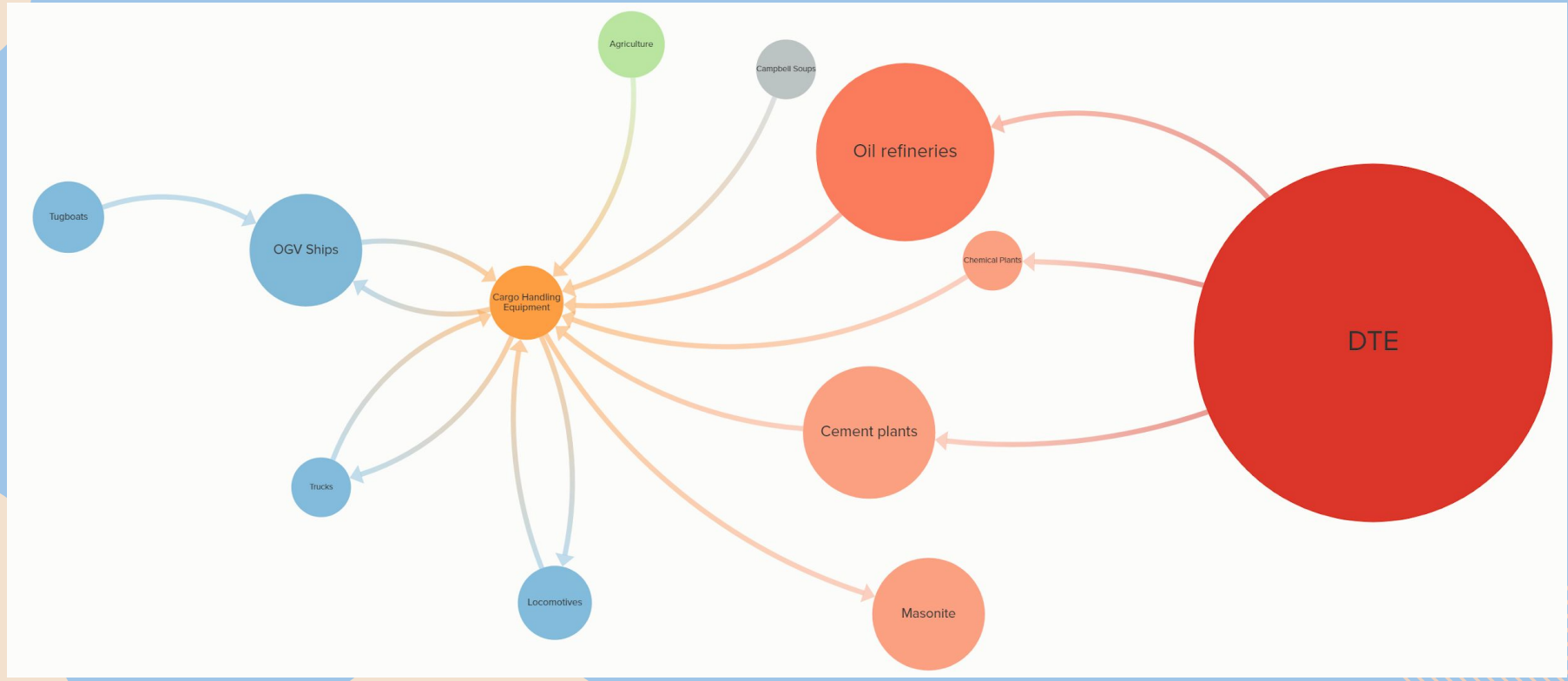
Port Systems Map



Emission Sources Map



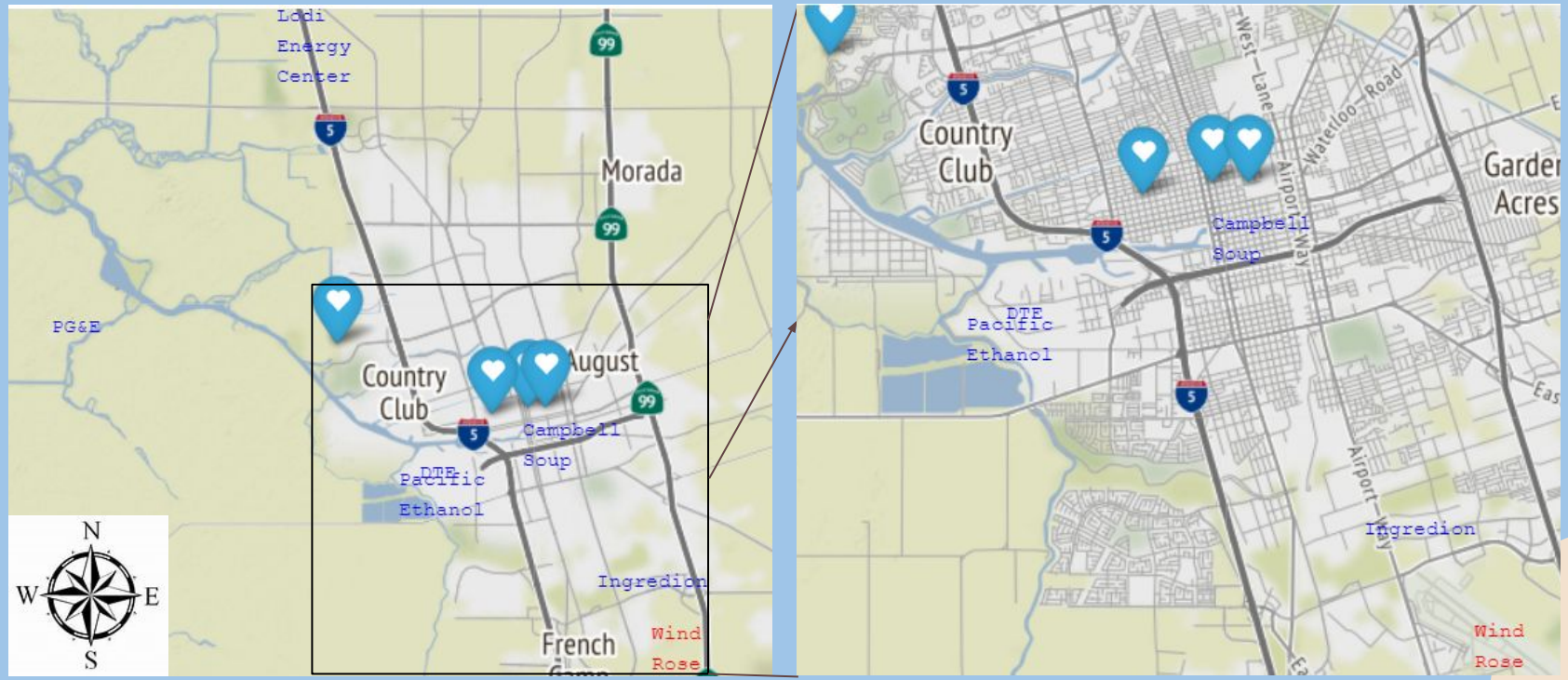
Emissions Map Sized by PM 2.5



PRESENT STATE

| 03 |

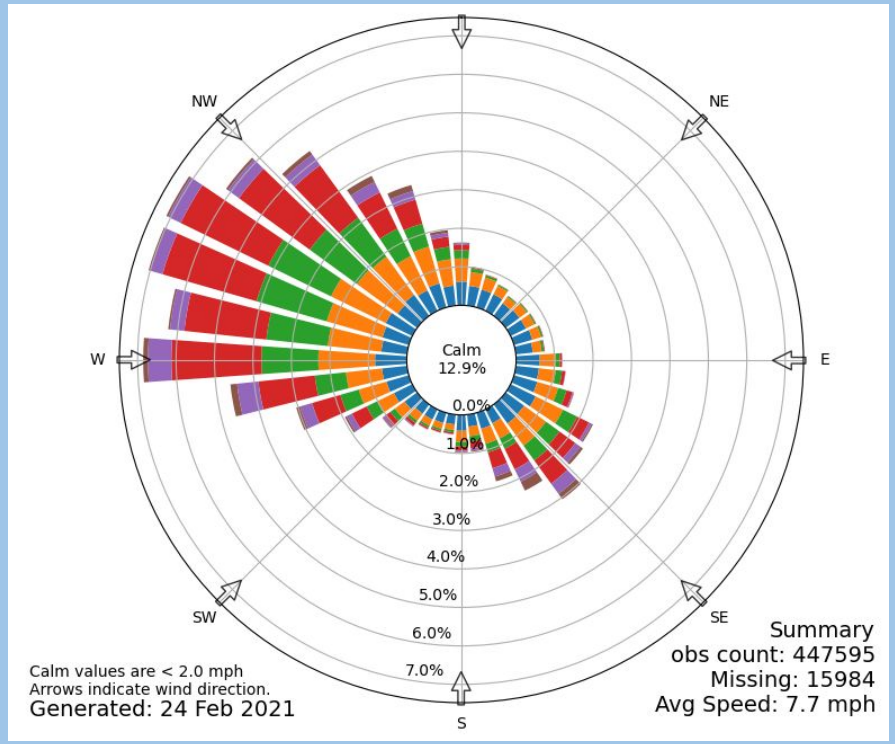
Another Look at Emissions

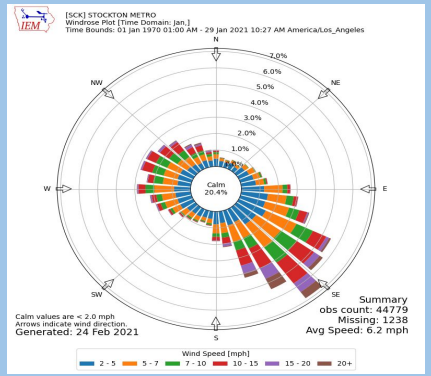


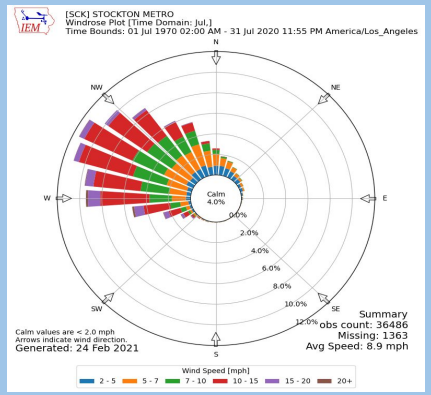
Data obtained from CARB air mapping tool https://ww3.arb.ca.gov/ei/tools/pollution_map/.

north-arrow-drawing-13.png (600×594) (getdrawings.com)

Another Look at Emissions







Data obtained at https://mesonet.agron.iastate.edu/sites/windrose.phtml?station=SCK&network=CA_ASOS

Present State

Table 5-3 Marine Enforcement in Stockton: 2017-2019

Program	Total Inspections	Violations
CHE	121	23
CHC	21	0
OGV	29	1
Total	**171**	**24**

Complaint Process

San Joaquin Valley Air Pollution Control District

Stationary Sources - Smoke, Dust, Odors or Other Contaminants

Phone: 1-800-870-1037

Valley Air Smart Phone App

Online: https://www.valleyair.org/busind/comply/onlinecomplaint.htm

California Air Resources Board

Automobiles, Trucks, Off-road Equipment, or Other Vehicles

Phone: 1-800-END-SMOG

Online: https://calepa.ca.gov/enforcement/complaints/