AGENDA: 3

Technology Implementation Office (TIO) Welcome

Steering Committee Meeting

March 2, 2018

Key Areas for Steering Committee Input

- What are your suggestions for promising climate technologies that we should be investigating?
- Once we select those technologies how do we evaluate their benefits relative to each other?
- What strategies can the Air District use to maximize effectiveness and sustainability of our new financing program?
- How do we raise the profile and visibility of office in a manner that allows us to identify new partnerships?

AGENDA: 5

Overview of Air District and Technology Implementation Office (TIO)

Steering Committee Meeting

March 2, 2018

Outline

- Steering Committee Roles
- Air District Overview
- TIO Team
- TIO Mission
- Bay Area Facilities and GHG Emissions Sources
- Technology Options and Assessment
- Stationary Incentive Program
- Mobile Incentives Programs

TIO Steering Committee Members

Bud Beebe	California Hydrogen Business Council, Sacramento Municipal Utility District (retired)
Cindy Chavez	Air District Board of Directors, Santa Clara County Supervisor
Mark Cupta	Prelude Ventures
Ahmad Ganji	San Francisco State Industrial Assessment Center
Dave Hudson	Air District Board of Chairperson, Councilmember City of San Ramon
Janea Scott	California Energy Commission

Role of Steering Committee Members

Recommendations and Support on:

- TIO vision and strategy
- Execution of the strategy and resolving challenges
- Technology readiness, business readiness, market and emissions reduction impact
- Strategies to maximize effectiveness of TIO budget and financing programs
- Raising profile and visibility of office and identifying new partnerships

≥2 year term

1st year of TIO: quarterly meetings, 2nd year: semiannual meetings

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Steering Committee Roles

Air District Overview

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Mobile Incentives Programs

Bay Area Air Quality Management District

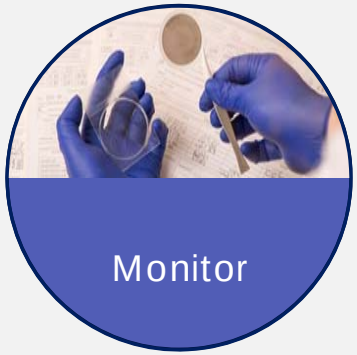
- Established in 1955
- 9 Bay Area Counties
- 7 million Residents
- 5,340 Square Miles

Our Mission:

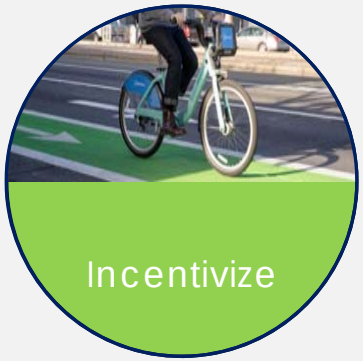
To protect and improve public health, air quality, and the global climate

BAAQMD Roles


Regulate & Enforce


Monitor

Outreach


Incentivize

Outline

Steering Committee Roles

Air District Overview

TIO Team

TIO Mission

Bay Area Facilities and GHG Emissions Sources

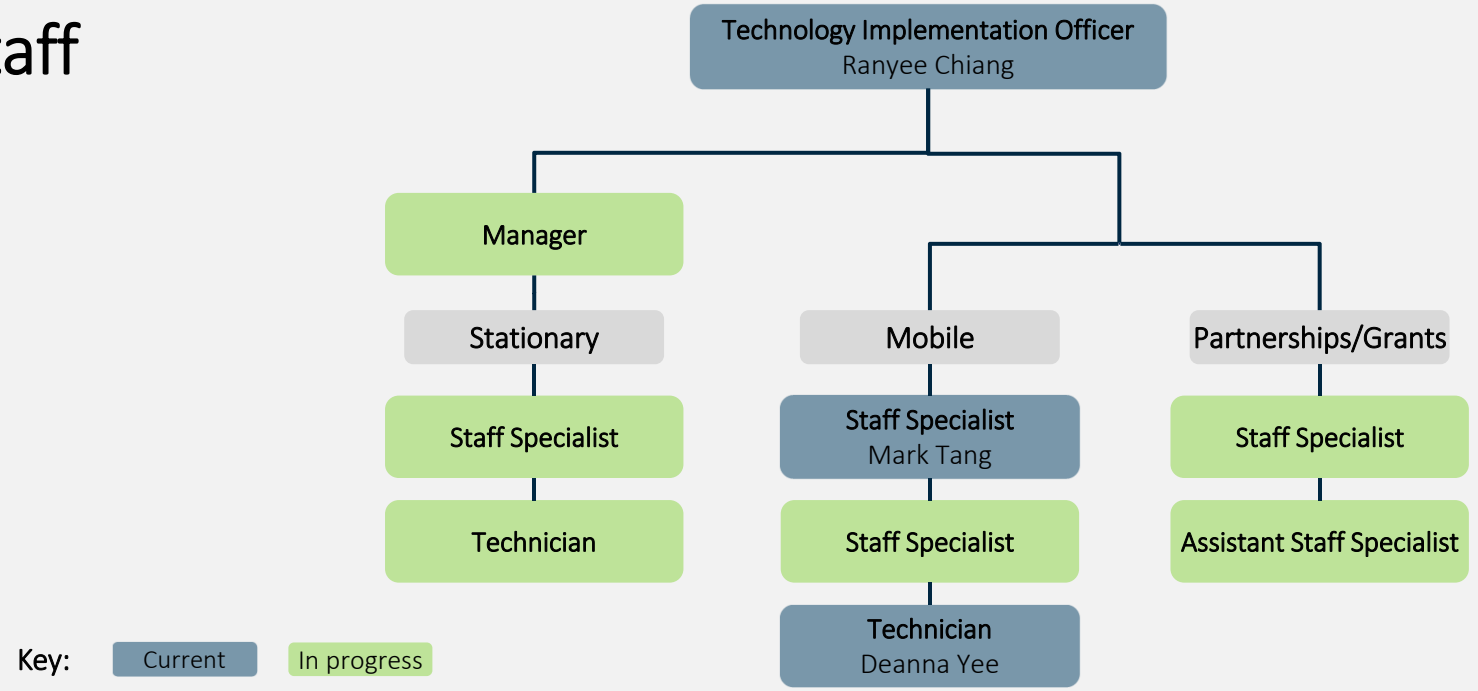
Technology Options and Assessment

Stationary Incentive Program

Mobile Incentives Programs

TIO Team

Staff



Key Collaborations

Engineering, Planning, Rules, Strategic Incentives Divisions

Outline

Steering Committee Roles

Air District Overview

TIO Team

TIO Mission

Technology Options and Assessment

Bay Area Facilities and GHG Emissions Sources

Stationary Incentive Program

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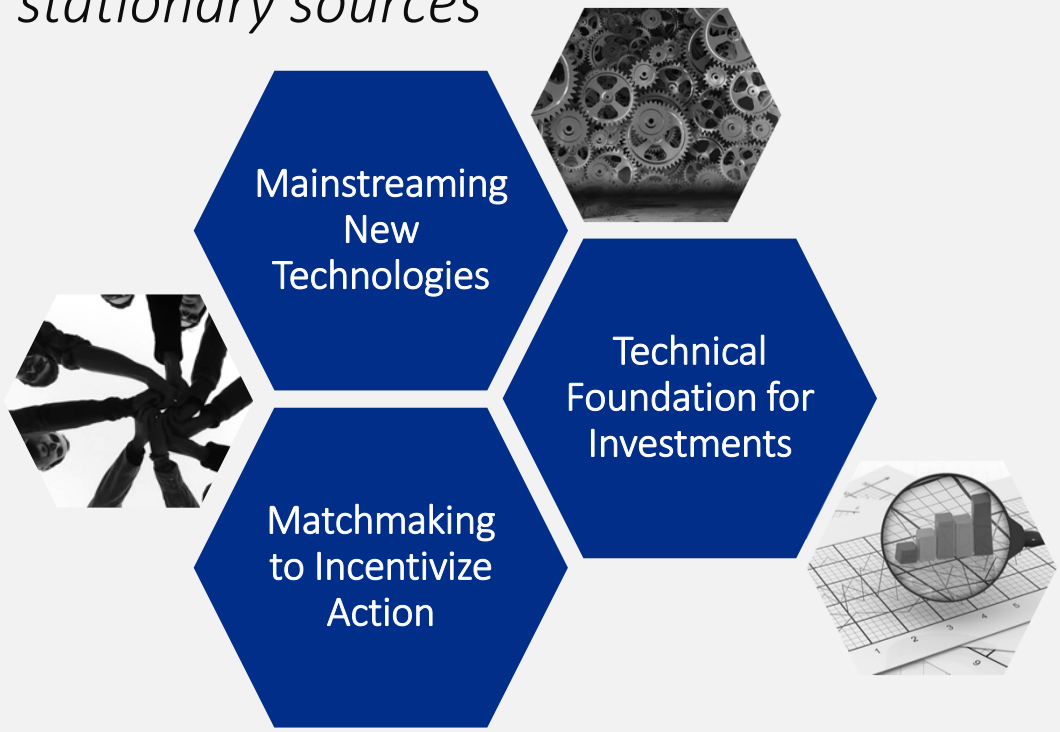
Technology Implementation Office

Mission Statement

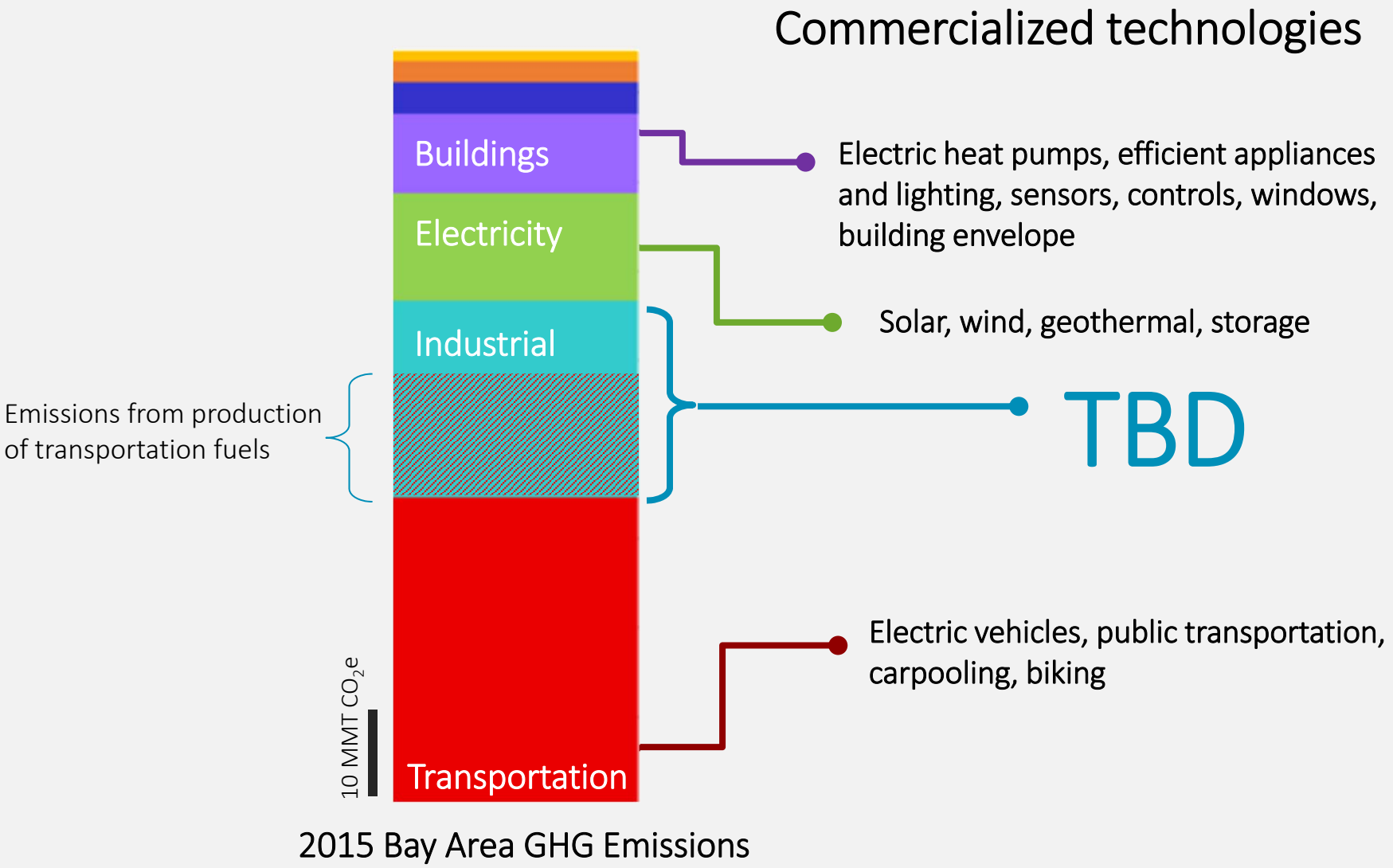
Catalyze innovation to combat climate change by incentivizing disruptive, low-cost technologies that reduce greenhouse gas emissions for mobile and stationary sources

3 priorities

identified through stakeholder engagement w/ researchers, technologists, incubators, utilities, facilities, partner agencies, financing authorities



Currently commercialized technologies not enough to address all GHG emissions



2015 Bay Area GHG Emissions

We also need to mainstream technologies beyond the Bay Area

Bay Area GHG emissions are

1.3%

of US emissions

0.2%

of global emissions

Outline

Steering Committee Roles

Air District Overview

TIO Team

TIO Mission

Bay Area Facilities and GHG Emissions Sources

Technology Options and Assessment

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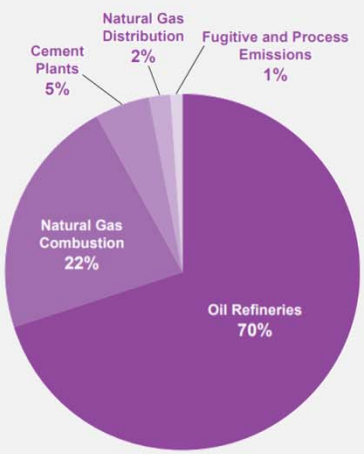
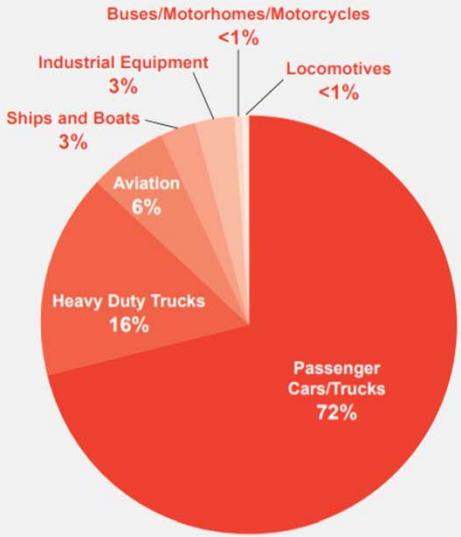
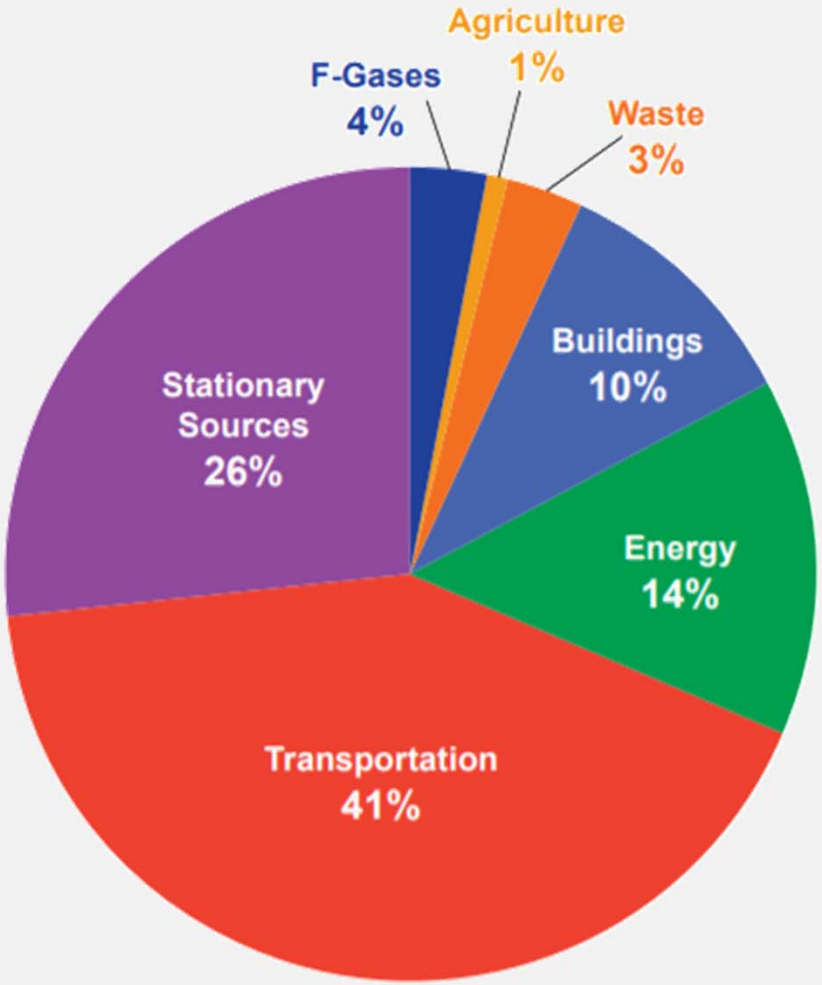
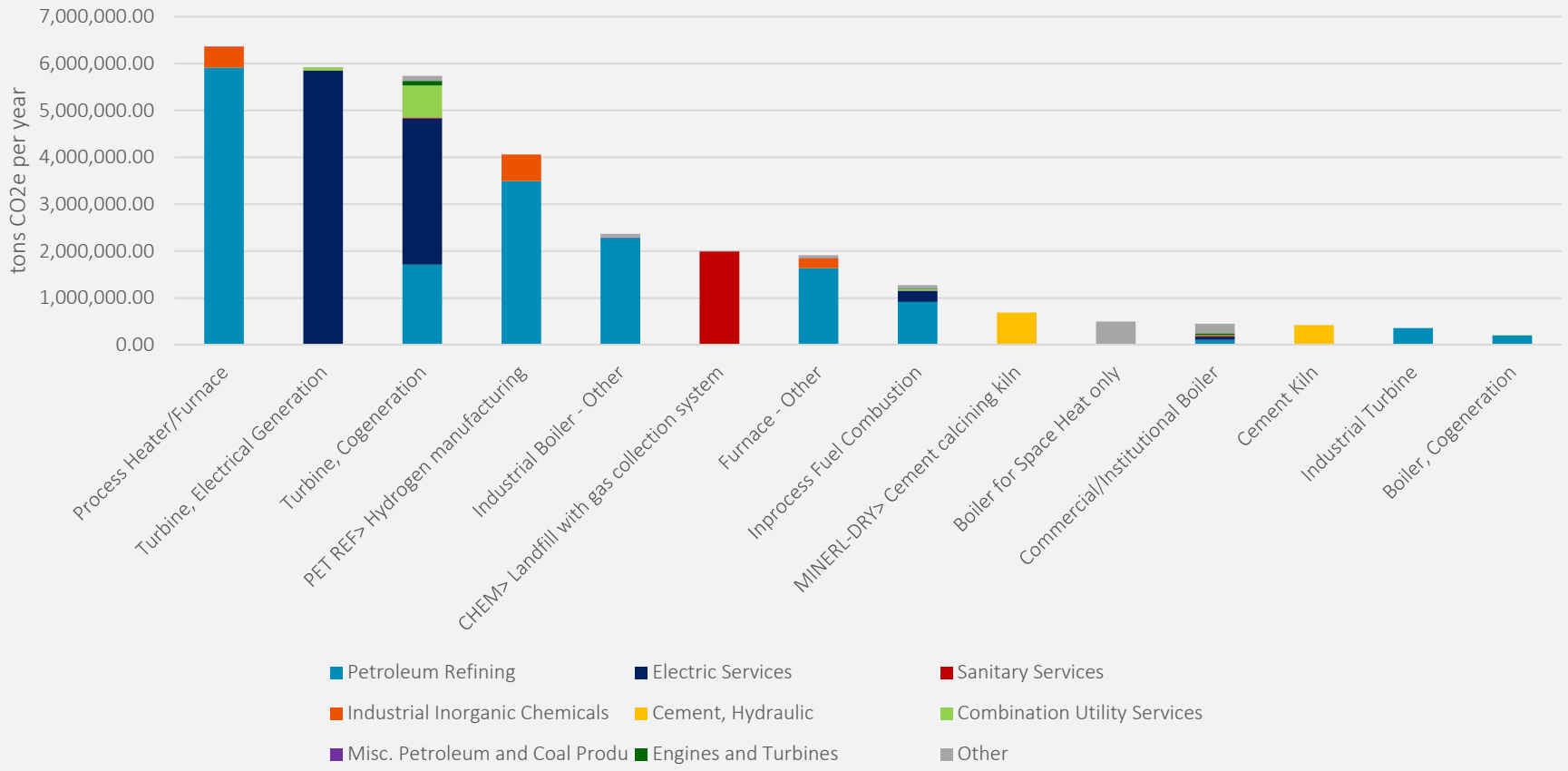
Overview of Bay Area GHG emissions







Which technology categories are relevant across multiple industries?



Steering Committee Input – Emissions Sources

- Criteria to prioritize emissions sources?
- Criteria to prioritize industries?
  - GHG reductions
  - Technology replicability and scalability
  - Complement regulations and climate policy (including Cap and Trade)

AGENDA: 6

Technology Opportunities and Assessment

Steering Committee Meeting

March 2, 2018

Outline

Steering Committee Roles

Air District Overview

TIO Team

TIO Mission

Bay Area Facilities and GHG Emissions Sources

Technology Options and Assessment

Stationary Incentive Program

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Technology Options

- Energy efficiency
- Alternatives to gas turbines and diesel ICEs (e.g. gas microturbines, hydrogen FCs)
- Cooling and heating (e.g. geothermal, electric heat pumps)
- Carbon sequestration and use
- Methane capture and use
- Waste-to-energy

- Zero emissions vehicles and infrastructure (lifecycle)
- Autonomous electric vehicles
- Renewable fuels (e.g. renewable diesel, renewable natural gas)

Cross-cutting

- Smart/connected technologies (sensors, leveraging mobile networks, big data, artificial intelligence, Internet of Things, industrial IoT, software or applications)
- Battery storage for renewable power

Technology Assessment

Search

- Request for Information (Sep – Dec 2017)
  - Seeking input from technology developer community
- Internal Air District GHG Technology Review
  - What new technologies are submitted for permitting?

Assess

- Technology Assessment (Feb – May 2018)
  - Integrate technology assessments across multiple industries, studies
  - Combine technology, costs, and assessment of technical and economic barriers

Technology Assessment to Identify Technologies Poised for Impact and Scale

4 month project

>75 technologies reviewed

Technology Readiness Levels

- **TRL 7:** full scale demonstration in relevant environment
- **TRL 8:** actual system tested and demonstrated
- **TRL 9:** actual system operated over full range of expected conditions

Results will be shared with other agencies, investors

Assessment Criteria

- Technology Readiness Level
- Technological barriers, dependencies, risks
- Economic barriers, dependencies, risks
- Relevance to Bay Area (and beyond) emissions
- Feasible emissions reductions
- Additional environmental, social, economic benefits
- Costs (installation, operation, payback periods)
- Opportunities to catalyze systems change

Steering Committee Input – Technologies

- Additional technologies to consider?
- Priority criteria for evaluating technologies?

  Technology Readiness Level

  Technological barriers, dependencies, risks

  Economic barriers, dependencies, risks

  Relevance to Bay Area (and beyond) emissions

  Feasible emissions reductions

  Additional environmental, social, economic benefits

  Costs (installation, operation, payback periods)

  Opportunities to catalyze systems change

AGENDA: 7

Overview of Air District Incentive Programs

Steering Committee Meeting

March 2, 2018

Outline

Steering Committee Roles

Air District Overview

TIO Team

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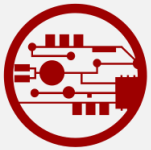
Results of Stakeholder Input: 3 Isolated Communities

Technology Developers and Companies



Stationary Facilities

Financing Authorities

Benefits to Partners with Air District TIO

Technology Developers and Companies

Accelerated awareness and mainstreaming of new technologies

Financing Authorities

Expanded customer base

Co-funding to cover higher risk or newer technologies

Increased confidence in project technical viability and payback periods to enable more investment

Stationary Facilities

Information about technology and financing opportunities

Access loans for technology upgrades

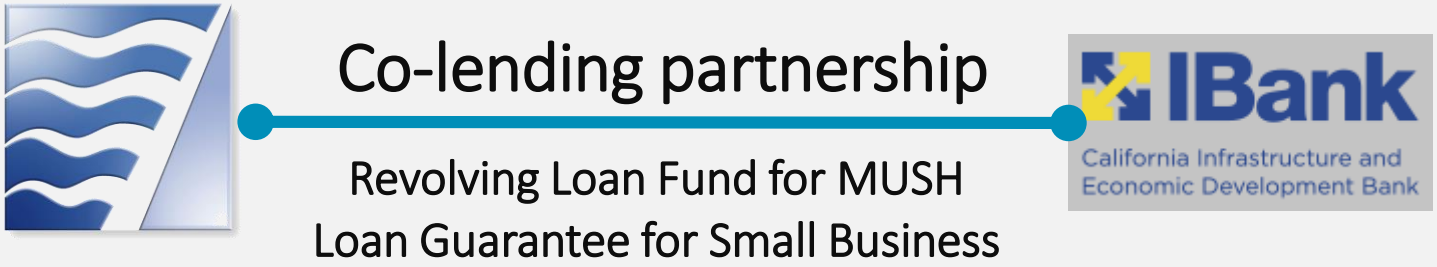
Getting out in front of permitting and regulatory requirements

Examples of Existing Finance Programs for Renewable Energy and Energy Efficiency

IBank California Infrastructure and Economic Development Bank	Loan (2% - 3% interest) or publicly offered tax-exempt bonds	Municipal, university, school, hospital (MUSH)	Only commercially proven technology
IBank California Infrastructure and Economic Development Bank	Loan guarantee to attract private investors	Small business	Only commercially proven technology
Office of the State Treasurer California	Loan guarantee to attract private investors	Small business, non-profits, commercial	Only commercially proven technology
State of California Energy Commission	Loan (0% or 1% interest)	Municipal, university, school, hospital	Requires proven energy/cost savings
PG&E	Loan (0% interest) with on-bill repayment	PG&E commercial customers	Only efficiency

TIO will share information about these financing opportunities and support matchmaking

Example of TIO Finance Program



- Fund newer technologies
- Connect to additional customers, including through matchmaking, technical assistance, and reducing interest rates
- Leverage Air District technical expertise
- First In First Out
- *$4M initial fund*

- Expand current programs
  - California Lending for Energy and Environmental Needs (CLEEN)
  - Small Business Loan Guarantee Program (SBLGP)
- Leverage guidelines and administration
- Reporting on funds and project
- *Could leverage up to $40M*

Conducted initial discussions; Finalize partnership negotiations in 2018

Considerations and Criteria

Key Components of Public Financing

- Customers: understand what customers need
- Fiscal Stability: understand and accept or mitigate risk
- Public Good: maximum good or targeted

Other Standard Models

- Public Revolving loan fund programs
- Public/Private partnerships

Steering Committee Input – Financing Program

- Important considerations for financing partnership
- Phased approach? Short-term and long-term focus?

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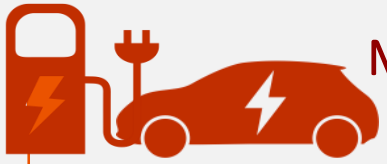
3 TIO Pillars and Next Steps

Stationary

- Technology demonstration projects (FYE 2017)
- Incentive program(s) for permitted facilities (to be finalized 2018)



Mobile

- EV Infrastructure
- EV Fleets
- EV and transportation incentives for low income consumers (EFMP+Up)

Partnerships

- Partnerships with other agencies, lenders, investors
- Connect facilities, technologies, and available financing
- Outreach to increase uptake and impact of incentives
- Evaluation and scale up

BAAQMD Electric Vehicle Incentive Programs

Charge!

- ✓ *Apartments*
- ✓ *Workplaces*
- ✓ *Transit Agencies*
- ✓ *Key Destinations*

Funding for up to…

1,200 New Level 2 Chargers

75 New DC Fast Chargers

Open until March 9

Zero-emissions Vehicle Fleets

- ✓ *Passenger Cars*
- ✓ *Motorcycles*
- ✓ *Transit & School Buses*
- ✓ *Heavy-duty Trucks*

2,000 New Passenger Electric Vehicles

150 New Electric Trucks and Buses

Coming in 2018

CARB Enhanced Fleet Modernization Program Plus Up ($5M over 2 years)

WHO

- Low-income residents (≤400% of Federal Poverty Level, e.g. <$97K for 4 person household)
- Environmentally disadvantaged areas

WHAT

$2,500 - $9,500 to replace older vehicle with

- newer, cleaner vehicle (e.g. hybrid, plug-in hybrid, electric)
- $ for transit pass

WHEN

- Finalizing agreement with Air Resources Board
- ~6 mos to set up program (dealerships, application, database, scrappers)
- Small pilot before full launch

CMAQ EV Partnerships, Outreach, Evaluation ($5M over 5 years)

Congestion Mitigation and Air Quality Improvement Program

- Data, research, and analysis on zero- and low-carbon intensity fuels, vehicles, infrastructure, including trends, impacts, and opportunities
- Case studies, reports, infographics, web and social media presence
- Coordinate Bay Area EV stakeholders
- Outreach and education

METROPOLITAN TRANSPORTATION COMMISSION

Steering Committee Input – Mobile Programs and Partnerships

- Suggestions to bridge across stationary and mobile technologies
- Opportunities for outreach about mobile or stationary programs
- Suggestions for useful partners? Advisors?

Next TIO Steering Committee Meeting

Thursday, June 21, 2018, at 1 p.m.

BAAQMD Office, 375 Beale St, Suite 600, San Francisco, CA

Agenda will include:

- Deep dive on technology assessment results
- Update on financing partnership negotiation
- Updates on light-duty EV programs
- TIO engagement at Global Climate Action Summit in September

Appendix Slides

RFI Example 1 of 5

Company: Arensis, Inc.

Technology Description: Multifunctional microgrid with combined heat and power (CHP) unit for electricity and thermal energy production

- Automated turn-key ready waste2energy unit; provides baseload power, heat, and cooling
- Uses locally available biomass as feedstock to produce 50 kW/h electricity and 120kW/h thermal energy
- 24/7 remote controlled, runs on highly secure proprietary cloud software
- CHP units can be combined with conventional energy sources (e.g. solar, hydro, wind, batteries) to create balanced microgrid

Smart/connected technologies

Equipment/Hardware

Cost: $5 million

Payback Period: 2 – 3 years

Technology Readiness: Pre-commercial

GHG Impact: CO_2 ,NO_x reduction

Market Barriers: Permits, securing steady feedstock supply. Partnership development and investment into pilot project still needed.

RFI Example 2 of 5

Company: Sunvapor, Inc.

Equipment/Hardware

Technology Description: Solar thermal collector for industrial steam generation

- Constructed with sustainable, low-embodied energy materials
- Solar steam plant 4x more efficient than photovoltaics at generating heat leading to lower cost of heat and land usage
- Provide industrial steam under Heat Purchase Agreement; customers do not need to make capital investment
- Low-cost thermal energy storage system cheaper than batteries

Technology Readiness: Pilot/Demonstration

GHG Impact: CO_2, CH_4, N_2O, PM, NO_x, toxic air contaminants reduction

Costs: GPTC Collector: $5.5-7/MMBtu, (12-year steam purchase agreement)
Conventional collectors: $14-19/MMBtu
PG & E (natural gas): $8.7/MMBtu

Payback Period: 2 – 3 years

RFI Example 3 of 5

Company: SkyCool Systems

Equipment/Hardware

Technology Description: Fluid cooling panels for air conditioning and refrigeration systems

- Enables passive sub-cooling of water/glycol mixture by utilizing radiative sky cooling, an electricity free, non-evaporative approach to sub-ambient cooling
- Uses advanced photonic material that rejects heat directly into space by emitting blackbody radiation in a wavelength band that is transparent to atmosphere
- Panels mount on rooftop of building and connect to air conditioning or refrigeration device's heat exchanger after the condenser

Technology Readiness: Pilot/Demonstration

GHG Impact: CO_2 and HFC/PFC reductions, 10-40% increase in cooling system efficiency

Costs: ?

Payback Period: 5 years

RFI Example 4 of 5

Company: CodeCycle LLC

Software/application/algorithm

Technology Description: Web and mobile platform that streamlines Title 24 (commercial lighting) compliance process, resulting in improved building efficiency for new and existing buildings

- Online Design Assistance Tool to evaluate code compliance in real-time and provide early feedback on Title 24 requirements
- iPad Inspection Application provides inspectors with building-specific navigation and balances high-priority questions with available time

Technology Readiness: Pilot/Demonstration

Cost: $0.12/square foot, new and existing buildings

GHG Impact: Building compliance improvements CO_2, PM, NO_x reduction

Benefits: 15-year lifetime of savings after 1st year of operation

Market Barriers: *Code compliance software platform is a new concept on the market; competition with traditional consultants. Additional funding needed to expand coverage to all of Title 24 (commercial and residential).*

RFI Example 5 of 5

Company: FreeWire Technologies

Equipment/Hardware

Technology Description: Second-life battery product and mobile battery system for EV charging, diesel generator replacement

- highly integrated and beautifully designed
- standardization for cost-effectiveness w/o sacrificing form, functionality
- 2 sizes, 40kWh or 80kWh and power output of 15kW AC or 50kW DC
- LTE, 3G, Wi-Fi, Bluetooth connectivity, dual-core Intel Edge processing
- integrated drive system and liquid cooled power converter, that runs ultra-quiet (47dB)

Technology Readiness: Commercially-available

Costs: Baseline technology: $61K over 5 years
Mobi Gen: $52K over 5 years

GHG Impact: Diesel generators
34% CO_2 reduction

Payback Period: 2 – 3 years

Market Barriers: *Costs:* Once production scales, expect costs to significantly drop. Consumers hesitant to switch from their inefficient and expensive systems to something new. *Regulation:* Established energy policy leaves very little opportunity for new products and use cases. Second-life batteries ineligible for some incentives and programs