



California Biofuel/Biomethane Projects From Waste Residues

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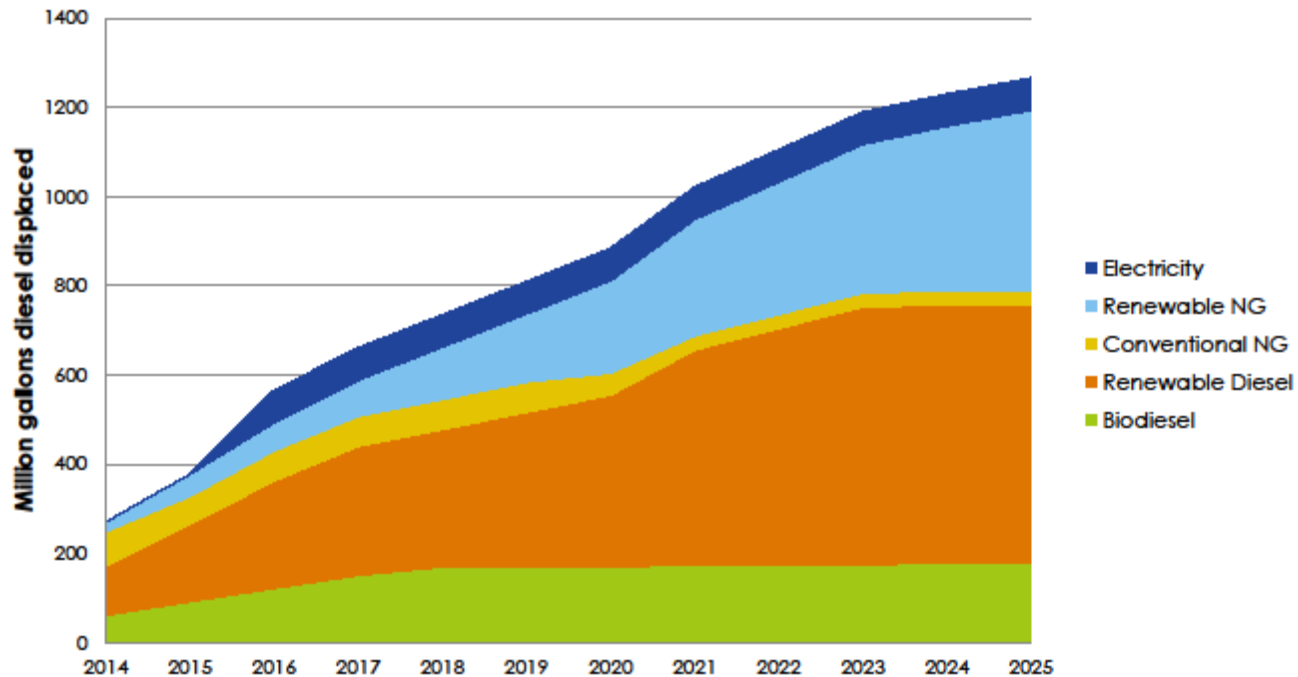
U.S. Department of Energy Workshop
Biofuels and Bioproducts From Wet and Gaseous Feedstocks: Market
Barriers and Opportunities
Berkeley, California
June 6, 2017



CALIFORNIA ENERGY COMMISSION



Illustrative Compliance Scenario: Diesel Displacement





Vehicles

28.1 millions cars
1.0 million trucks

GHG Emissions

441.5 MMT CO₂e (2014)
37% from transportation

Air Quality

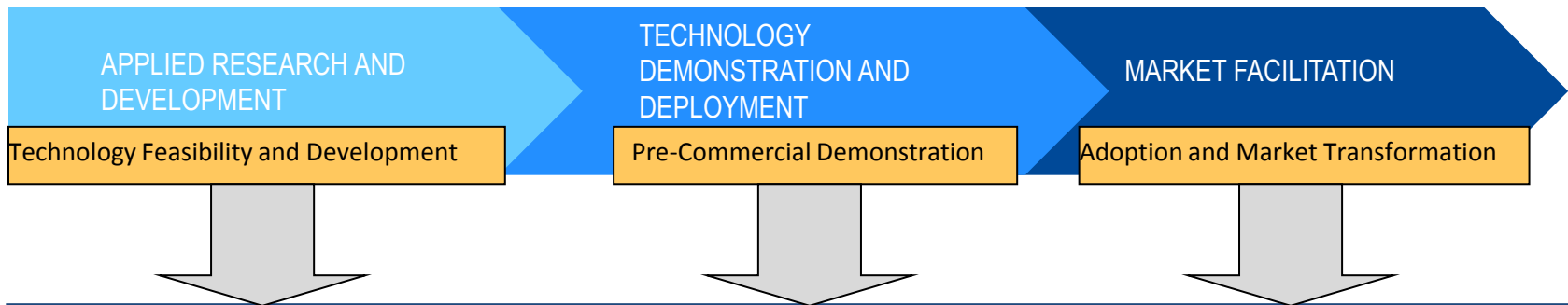
Severe Non-Attainment for Ozone
San Joaquin Valley & South Coast

Petroleum Consumption

14.5 billion gallons gasoline
3.6 billion gallons diesel



Transportation Fuel R&D Gaps



Low Carbon Fuels

CEC R&D Natural Gas Program
(Renewable Natural Gas only)

ARB – LCFS Subprogram
(Life-cycle assessment and fuel pathways)

CEC R&D Natural Gas Program
(Renewable Natural Gas only)

CEC ARFVTP
(Focus on higher volume production)

CEC ARFVTP
(Fuel production incentives)

Gaps:

- Drop-in transportation fuel R&D
- Bio-oil production (pilot-scale)





Selected CEC Biofuel/Biomethane Projects

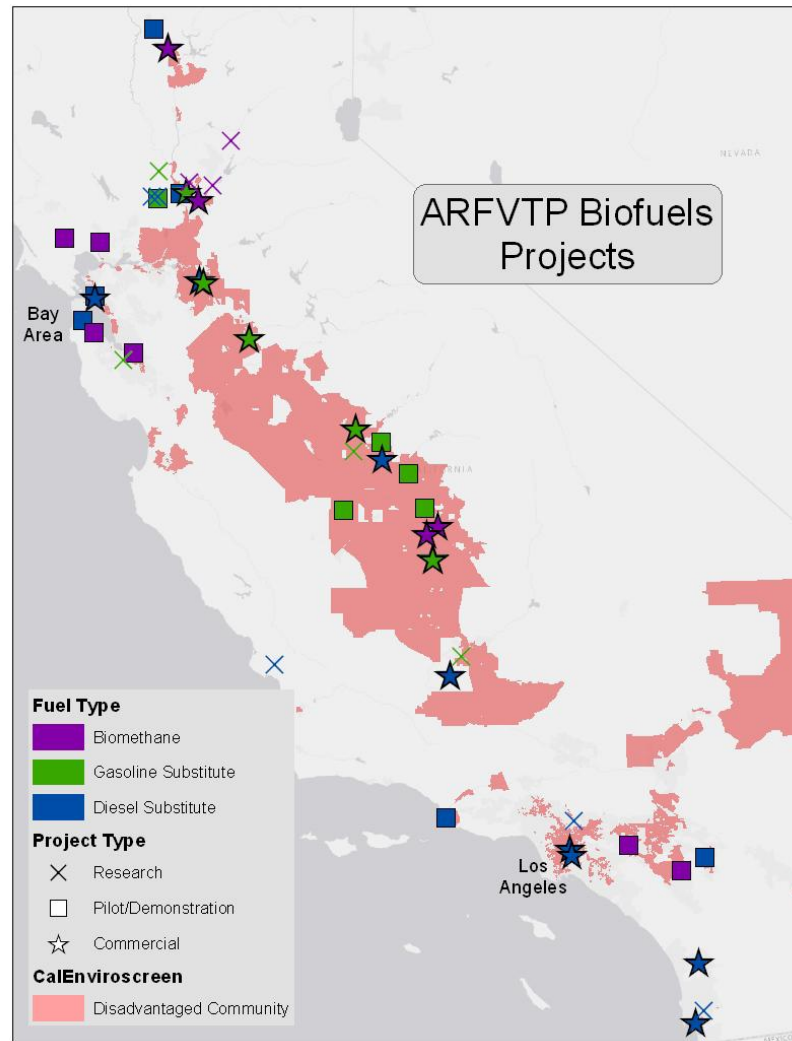
ARFVTP

- Calgren Renewables – Pixley
- California Bioenergy – Kern Dairy Cluster
- City of San Mateo – WWT
- Biodiesel Production Expansion
- AltAir – Renewable Diesel
- CR&R Organic Diversion

R&D

- Dairy Power Production Program – 10 power generation projects (2001)
- Biomass Gasification – Forest Wood Waste
- Biogas Electricity – Food Wastes
- Algae Biofuels
- Steam Hydrogasification
- Fast Pyrolysis and Autothermal Pyrolysis (Pending)

Biofuel Project Locations





\$748 million awarded to more than 585 projects

Awards include:

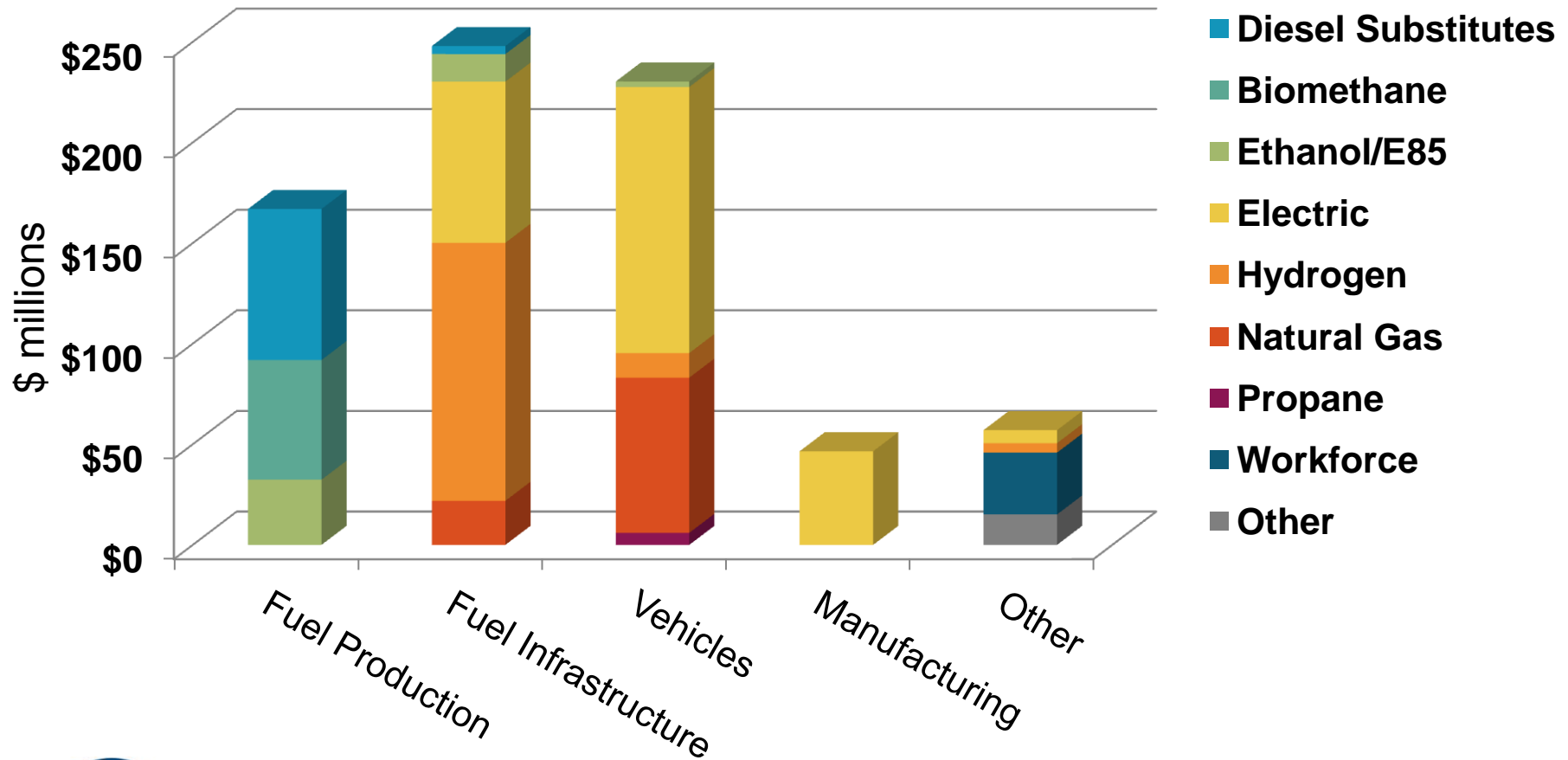
- 59 Biofuel Production Projects
- 64 Hydrogen Refueling Stations
- 21,000 Electric Vehicles Rebates
- 21 Manufacturing Projects
- 49 Advanced Technology Truck Demonstrations
- 7,796 EV Chargers
- 64 Natural Gas Fueling Stations
- 3,148 Natural Gas Vehicles
- 16,943 Workforce Trainees
- 40 Regional Readiness Grants

Significant reductions in GHG emissions, petroleum use, and air pollution expected from investments



As of March 1, 2017

Projects To-Date



As of March 1, 2017



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Business Decision Factor	Electricity Production	Transportation Fuel
Market growth technical potential	Produce up to 7,000 MW from waste residue reduction	Produce up to 2.1 billion gallons (dge) from waste residue reduction
Primary conversion technology	Biomethane/Biogas primarily uses anaerobic digesters	Biomethane/Biogas primarily uses anaerobic digesters
Market competition	Competes in market driven by Renewable Portfolio Standard – electricity auctions favor less expensive solar and wind options. BioMAT set aside generates demand for up to 250 MW of biomethane power	Competes in market driven by Low Carbon Fuel Standard and Renewable Fuel Standard credits through natural gas vehicle markets (mostly medium and heavy duty trucks and buses) – diesel engines and diesel fuels are direct competitor
Primary revenue source	Electricity sales represent 80percent of revenue	LCFS and RFS (RINs) generate 80percent of revenue
Investment factor	Long term power purchase contracts stimulate bulk of revenue and debt and equity financing	No significant long term feedstock or off taker contracts minimize sources of private financing
Project configuration to maximize replications	Some on-site electricity production – growth depends on affordable and timely process for electric grid interconnection	Community based transportation fuel use is plausible. Maximum growth depends on affordable and timely process for biomethane injection in natural gas pipelines