

RICO Presentation  
July 29, 2014

# WASTE TO ENERGY & ENERGY STORAGE

*The Industries and  
Workforce Needs*

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LAEDC

# Outline



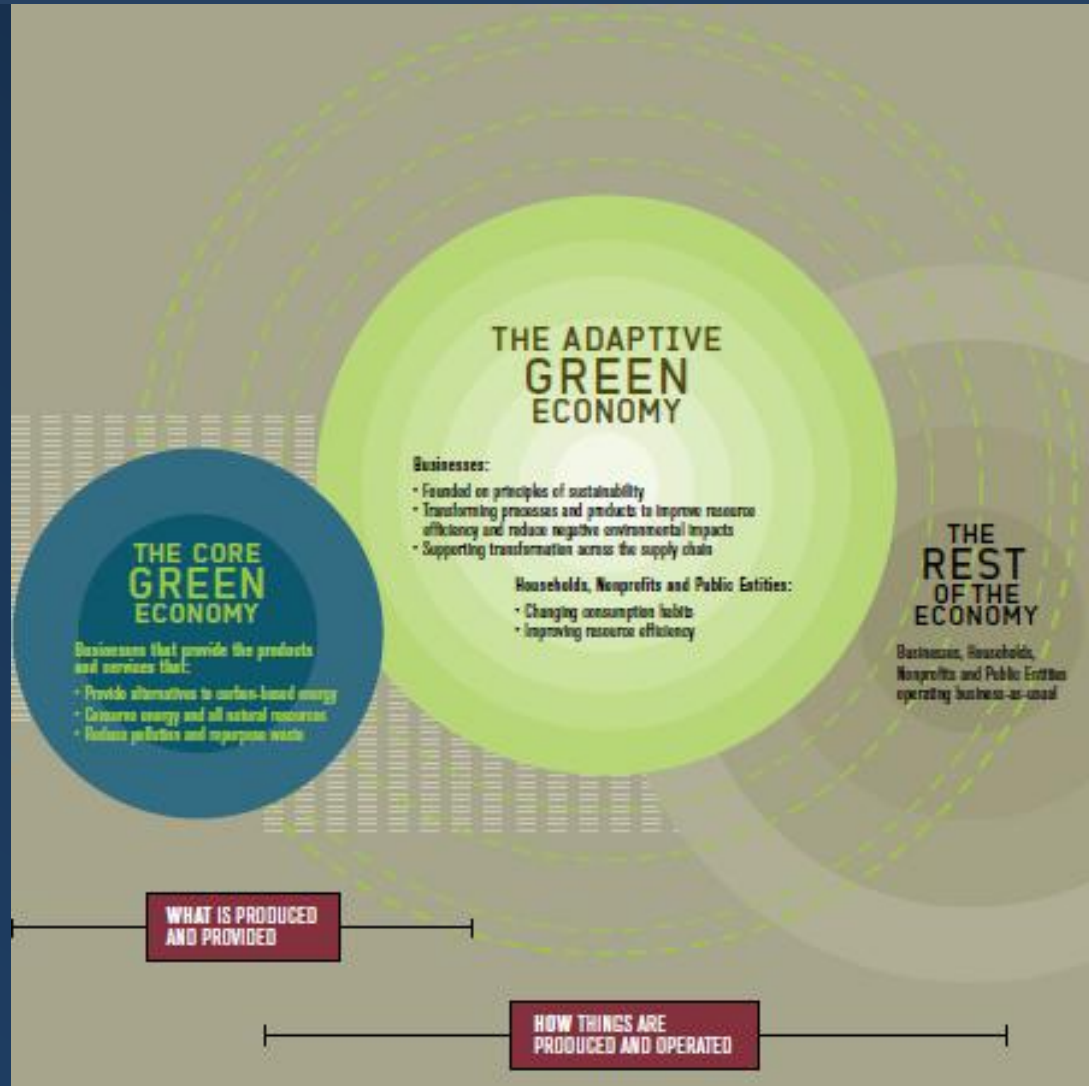
## ▶ What is “Waste-to-Energy”?

- ▶ Operational and pilot plants in California
- ▶ Potential market
- ▶ Workforce requirements
- ▶ Challenges

## ▶ What is Energy Storage?

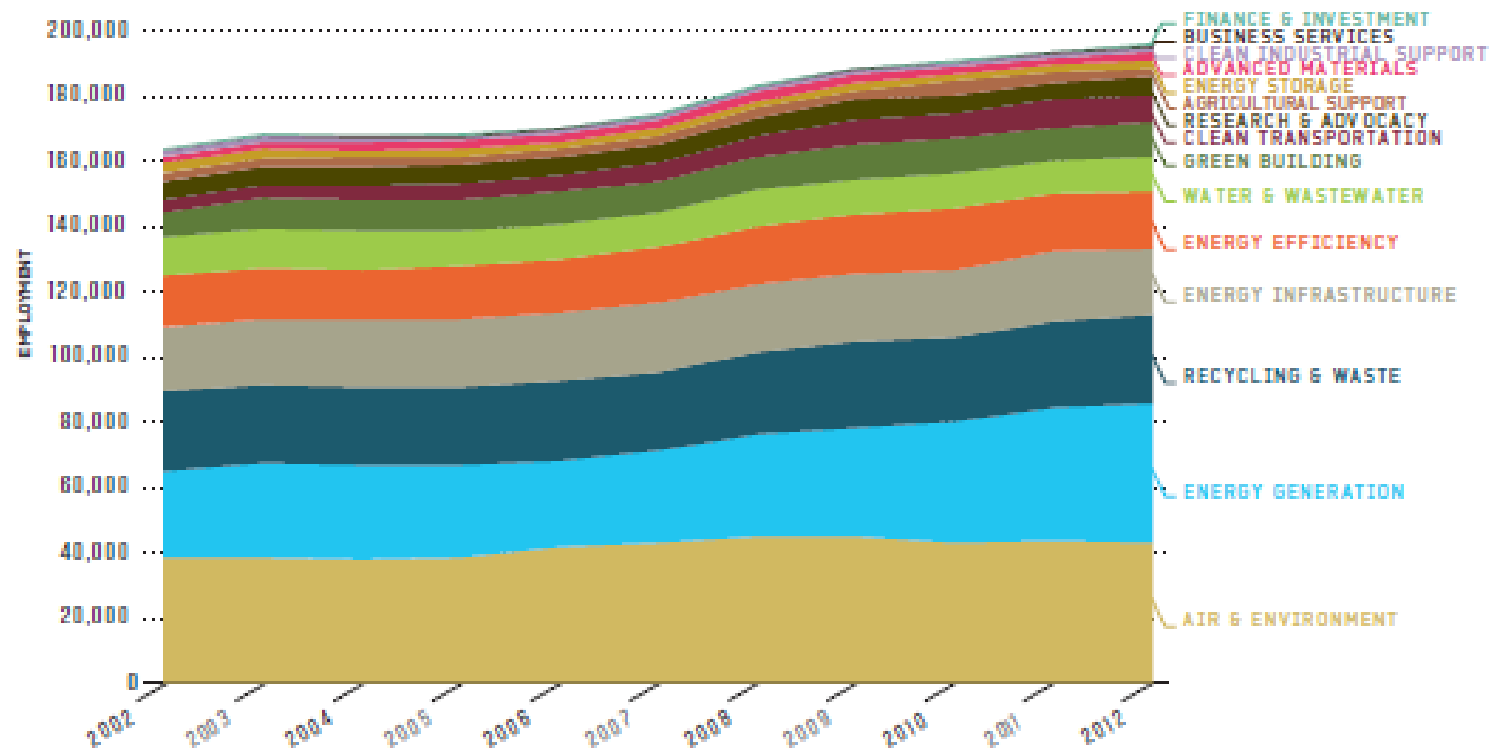
- ▶ Energy storage - transportation
- ▶ Workforce needs and potential
- ▶ Challenges

# Green Economy



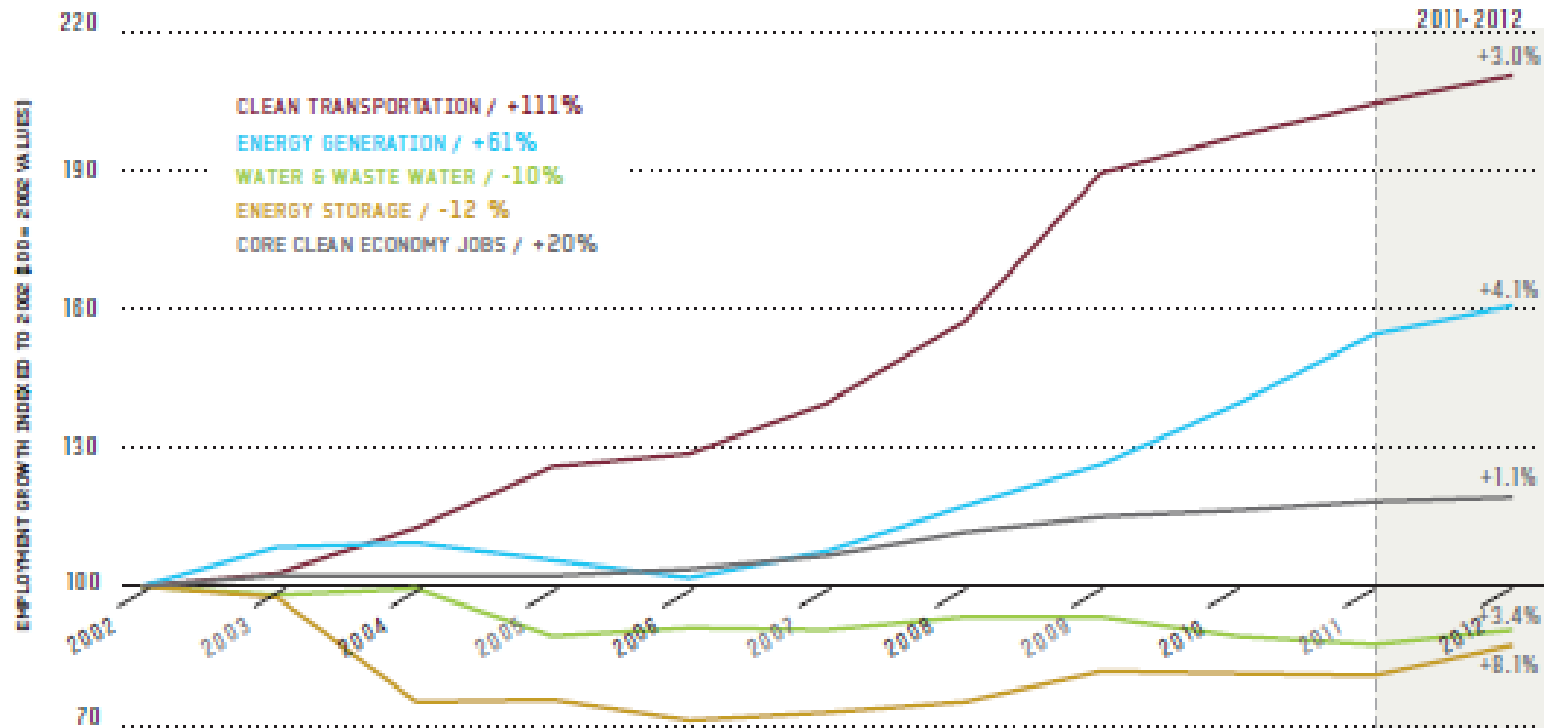
# California Employment by Clean Economy Segment

FIGURE 39. EMPLOYMENT BY CLEAN ECONOMY SEGMENT CALIFORNIA



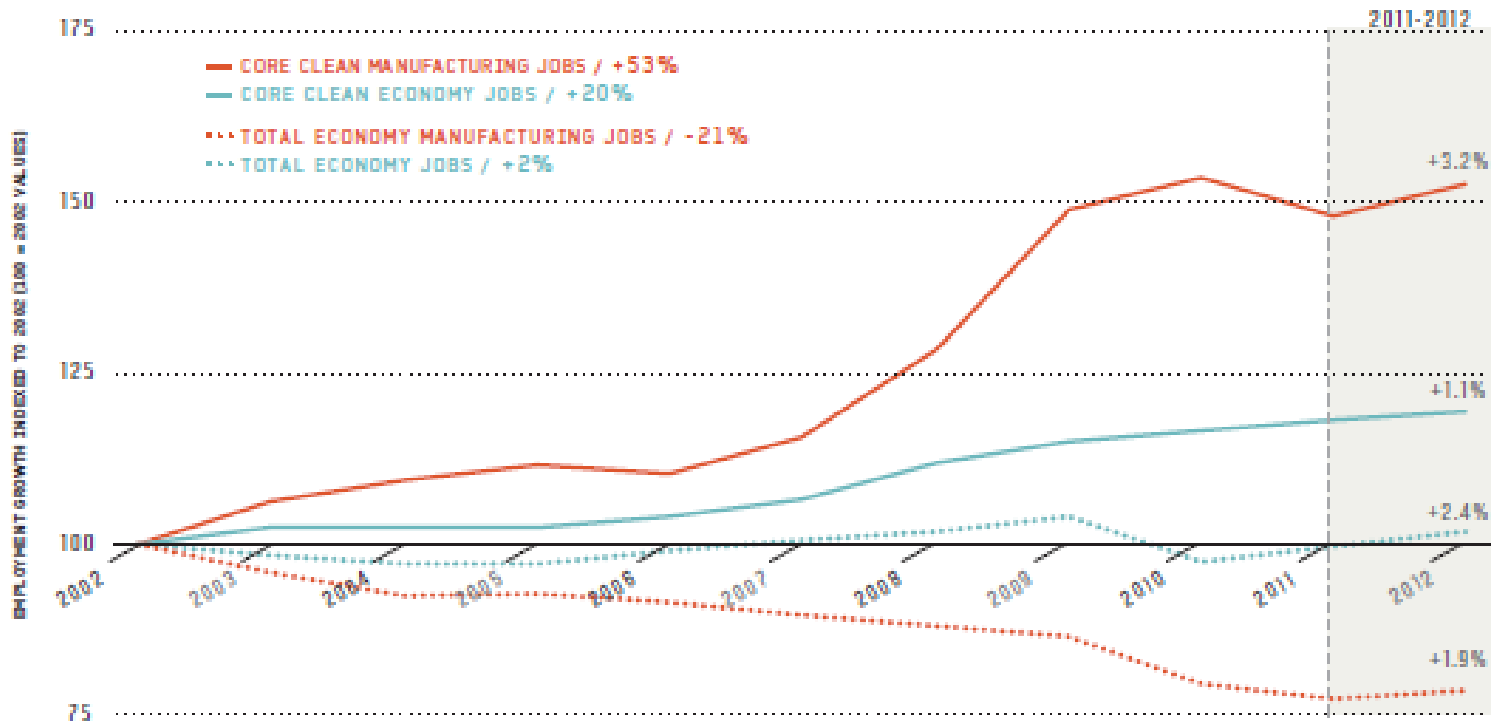
NEXT 10 CALIFORNIA GREEN INNOVATION INDEX Data Source: Green Establishments Database. Analysis: Collaborative Economics

# California Employment by Clean Economy Segment



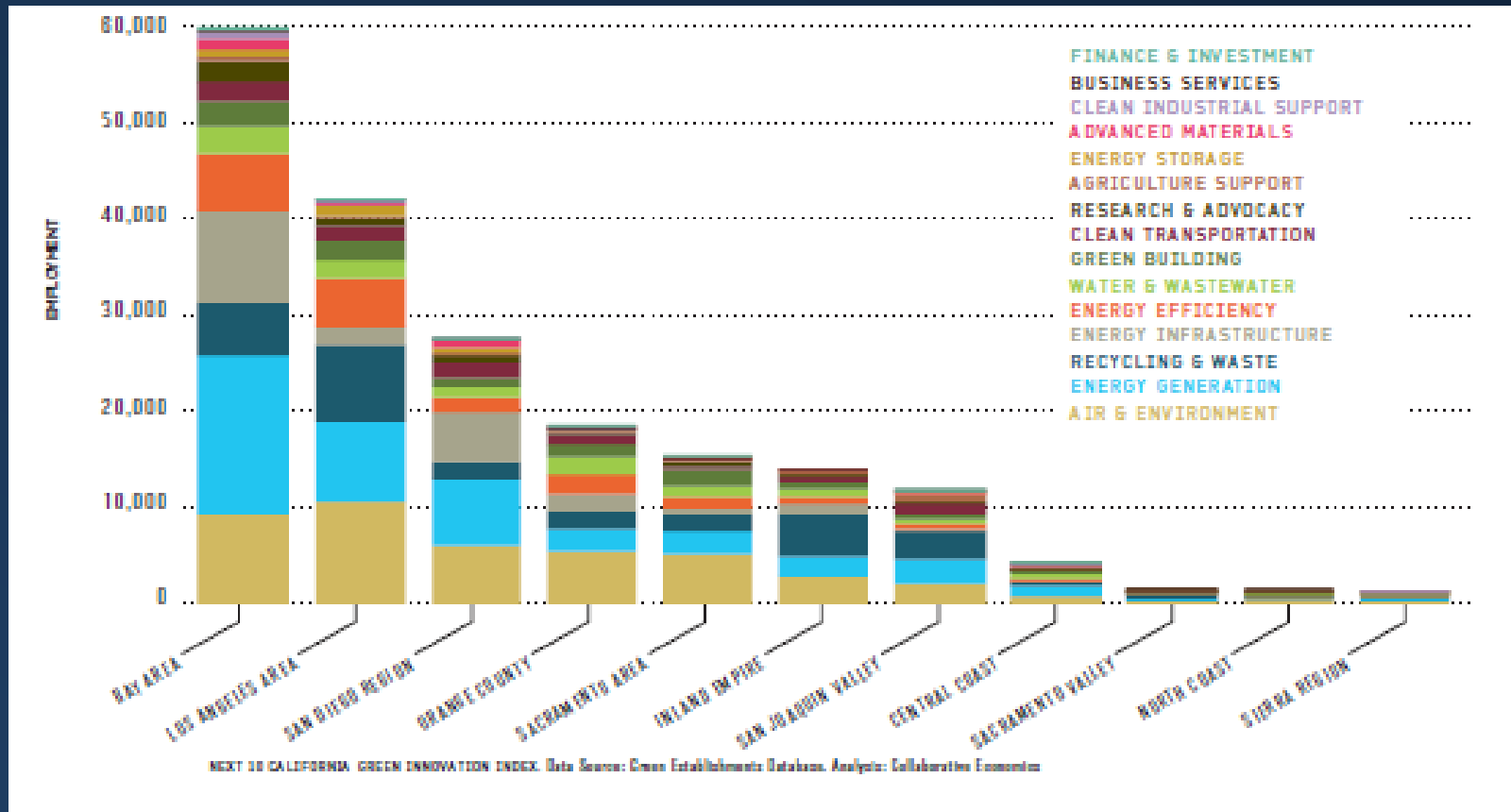
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# California Employment Growth



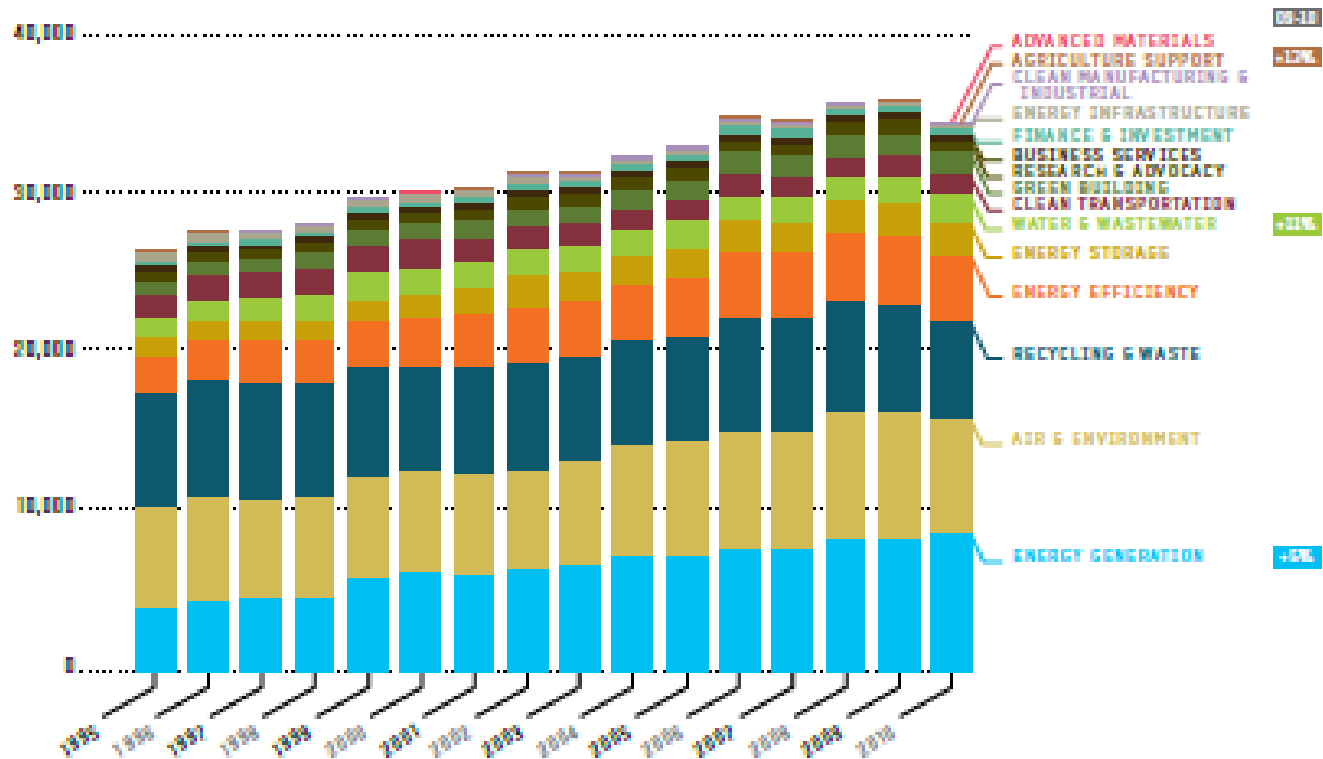
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# Regional Employment



# Green Economy in Los Angeles

EMPLOYMENT BY GREEN SEGMENT / LOS ANGELES AREA

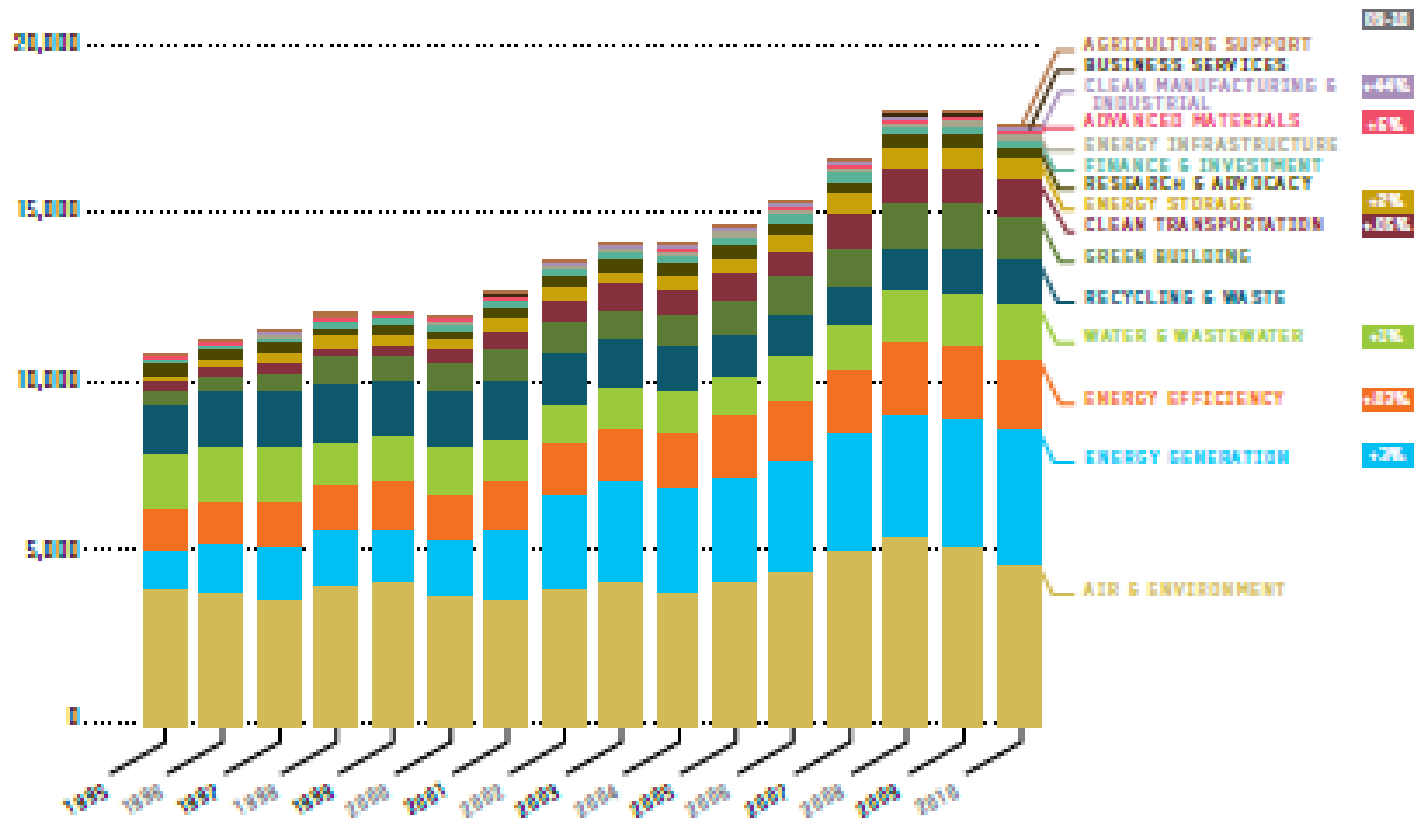


NOT TO SCALE. SOURCE: CITY OF LOS ANGELES, CALIFORNIA DEPARTMENT OF INDUSTRIAL DEVELOPMENT, CALIFORNIA DEPARTMENT OF REVENUE, CALIFORNIA DEPARTMENT OF REVENUE, CALIFORNIA DEPARTMENT OF REVENUE



# Green Economy in Orange County

EMPLOYMENT BY GREEN SEGMENT / ORANGE COUNTY



NOT AN EXHAUSTIVE LIST OF SEGMENTS. Data Source: Green Establishment Database Analysis, Collaborative Economics

# Green Economy Occupations



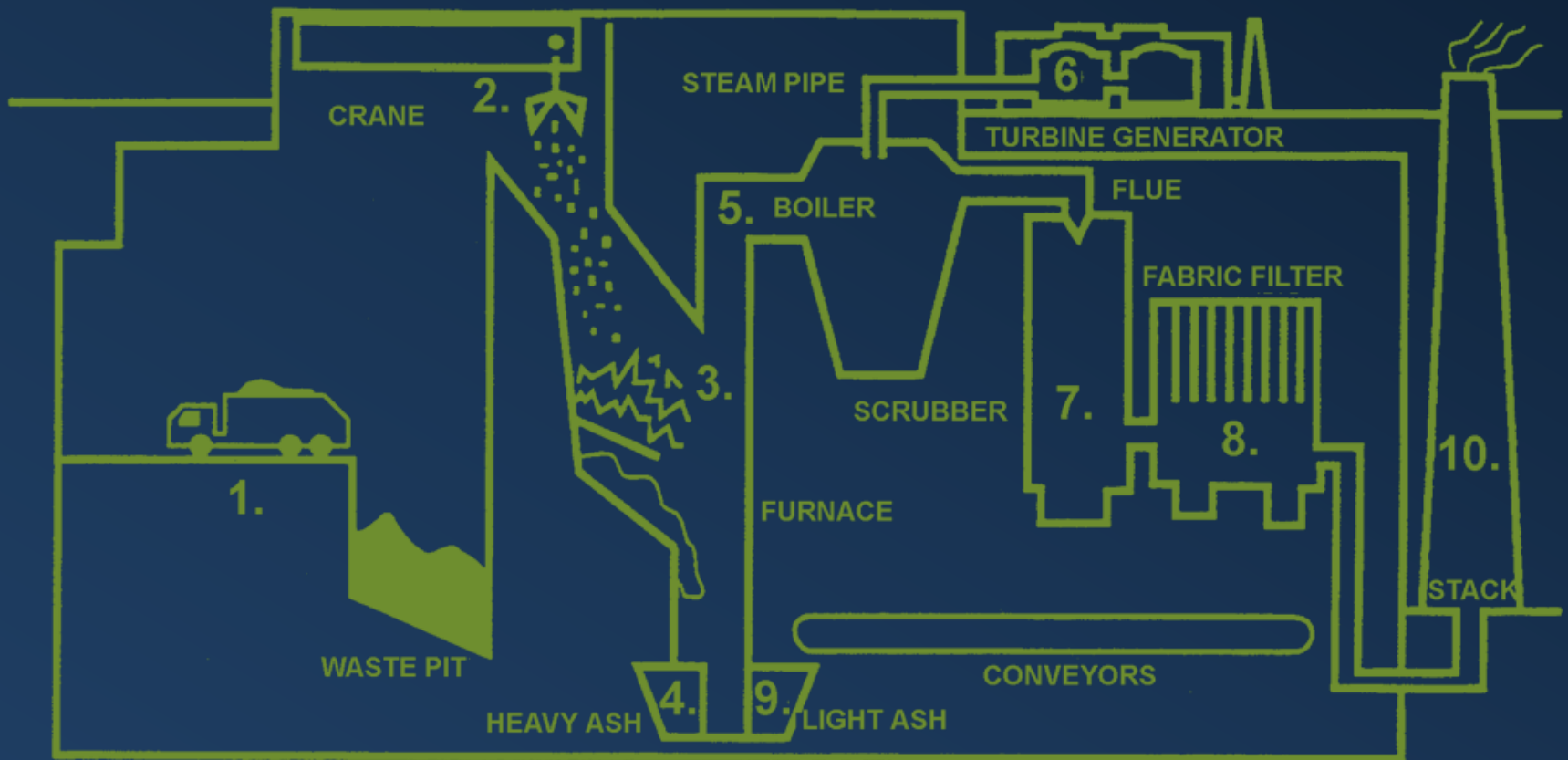
- ▶ **Increased Demand Occupations**
  - ▶ Electricians, Environmental Scientists, Industrial Machinery Mechanics, etc.
- ▶ **Enhanced Skills Occupations**
  - ▶ Construction Laborers, Machinists, Industrial Engineering Technicians, etc.
- ▶ **New and Emerging Occupations**
  - ▶ Chief Sustainability Officer, Energy Auditor, Biofuels Production Managers, etc.

# What is “Waste-to-Energy”?

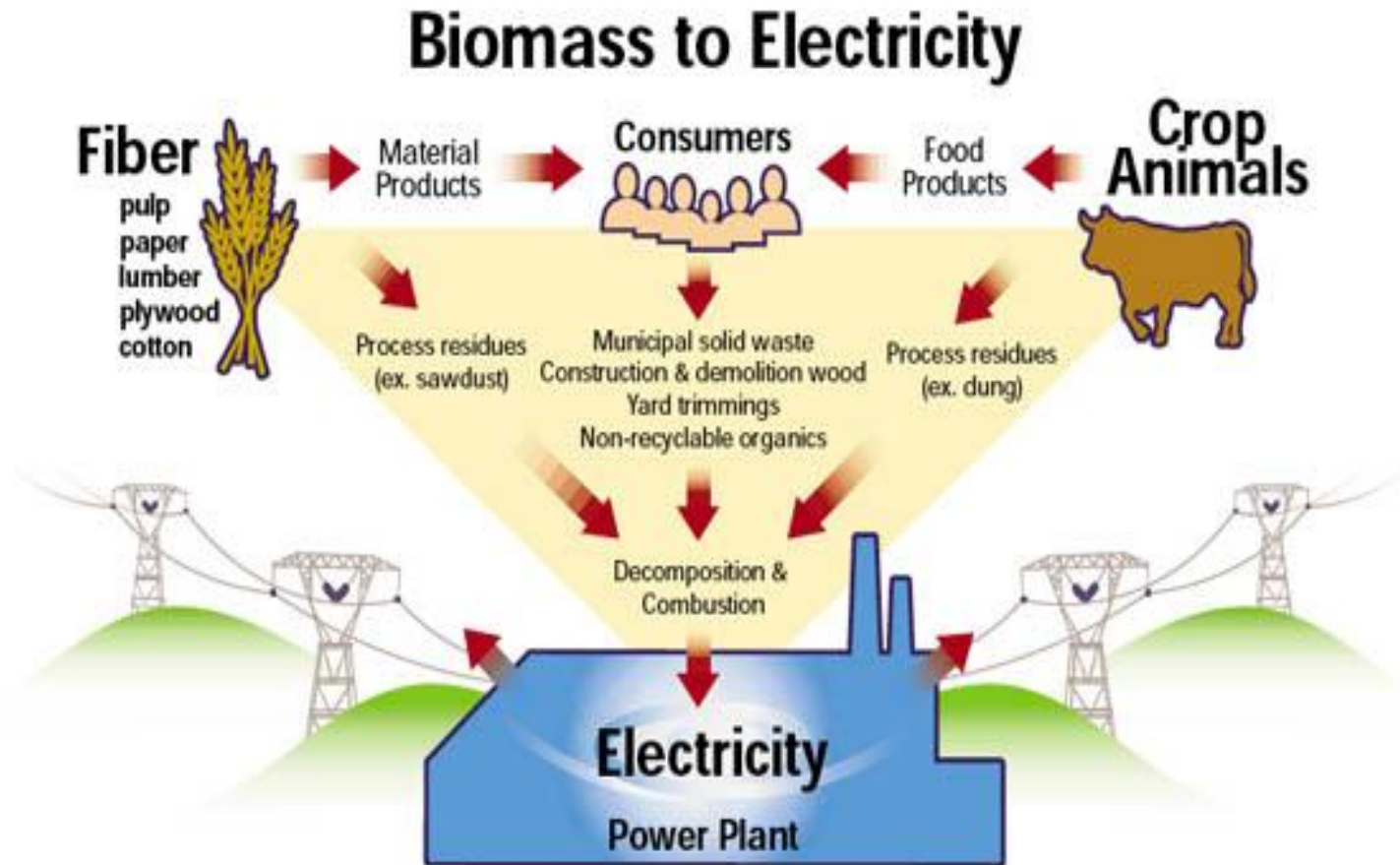


- ▶ Conversion of non-recyclable waste materials into heat, electricity or fuel
- ▶ Renewable energy source
- ▶ Reduction of carbon emissions compared to fossil fuel energy sources
- ▶ Reduced reliance on fossil fuels
- ▶ Reduced methane emissions from landfills

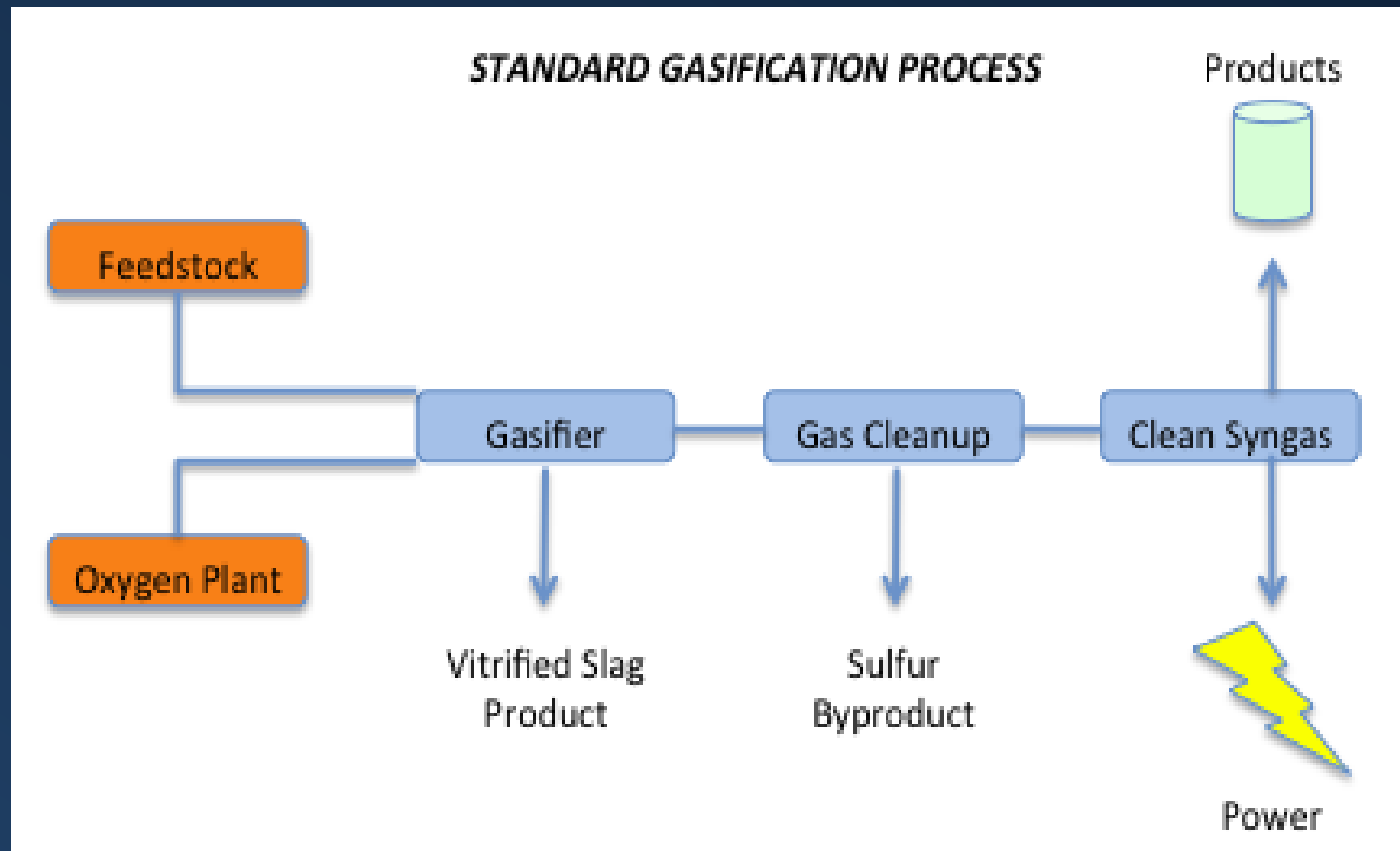
# Today's Waste-to-Energy



# WTE: Biomass

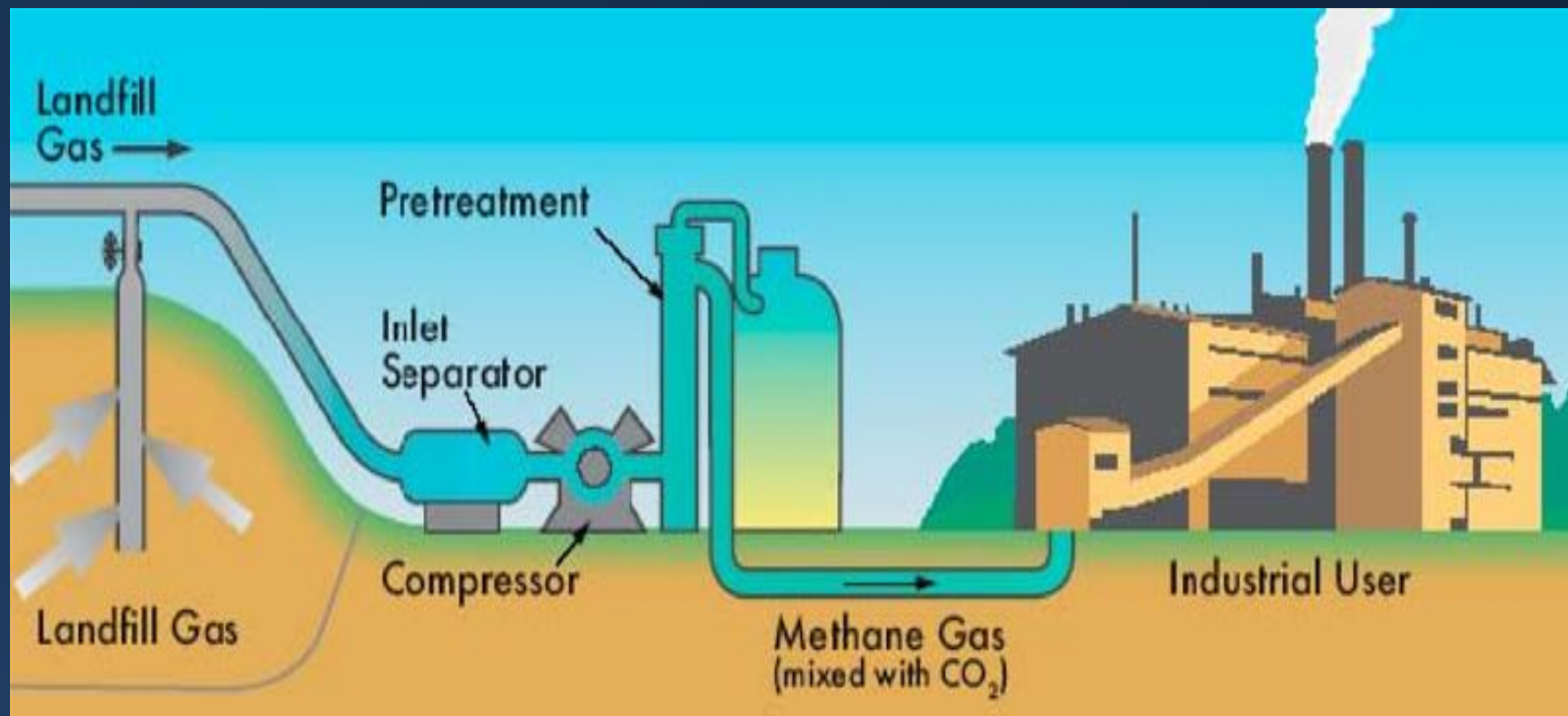


# WTE: Thermal Gasification & Pyrolysis

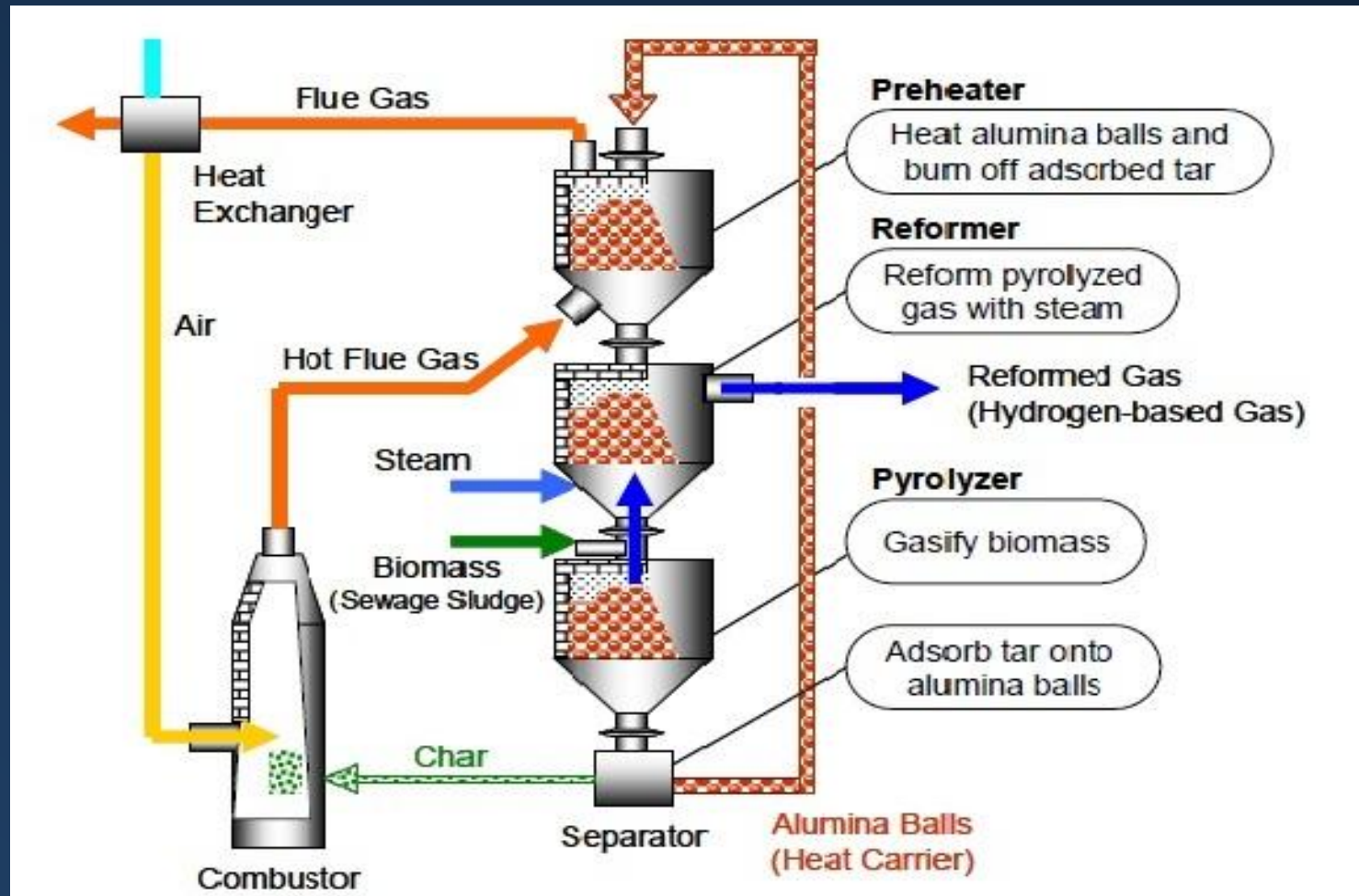




# WTE: Landfill Gas Capture

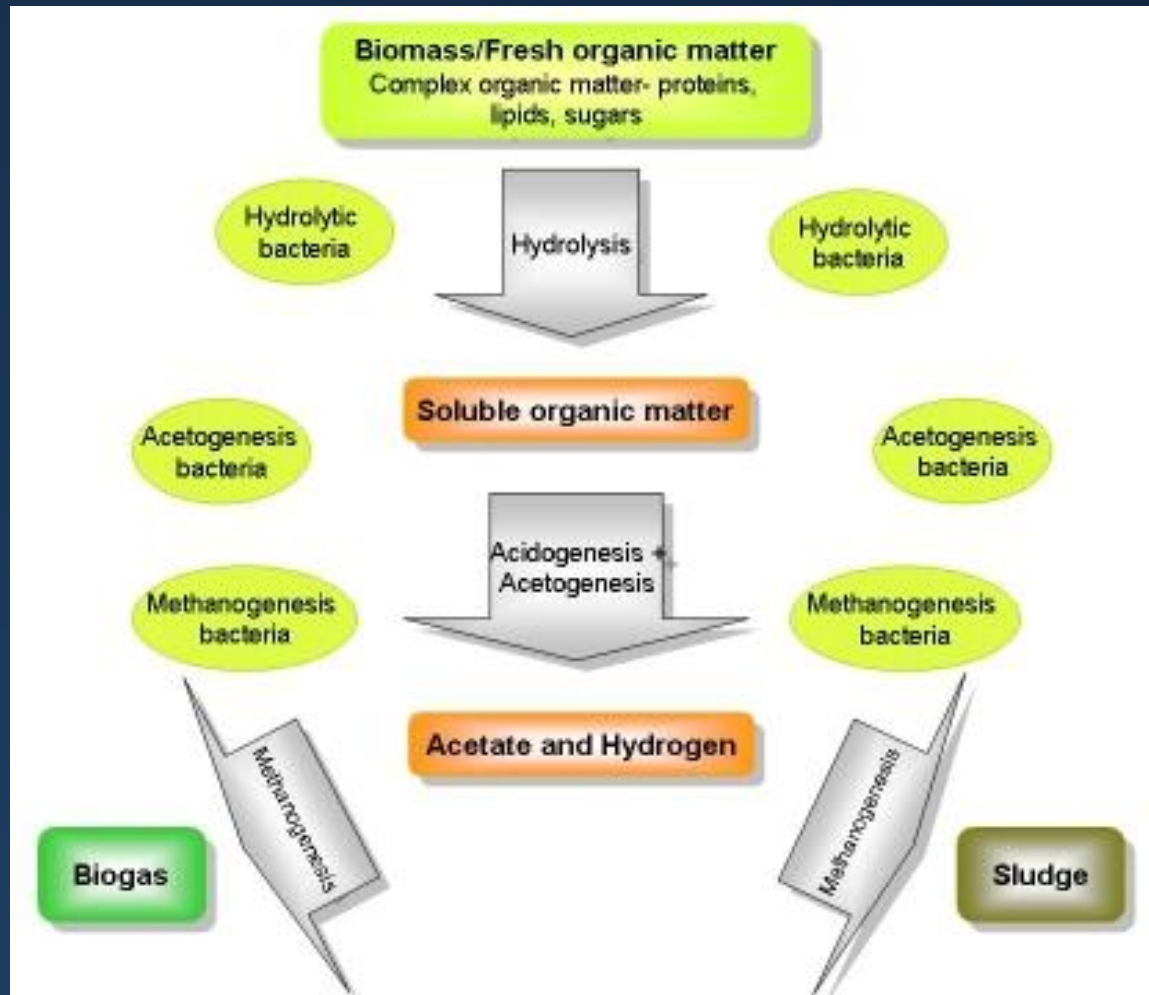


# WTE: Biomass to Hydrogen

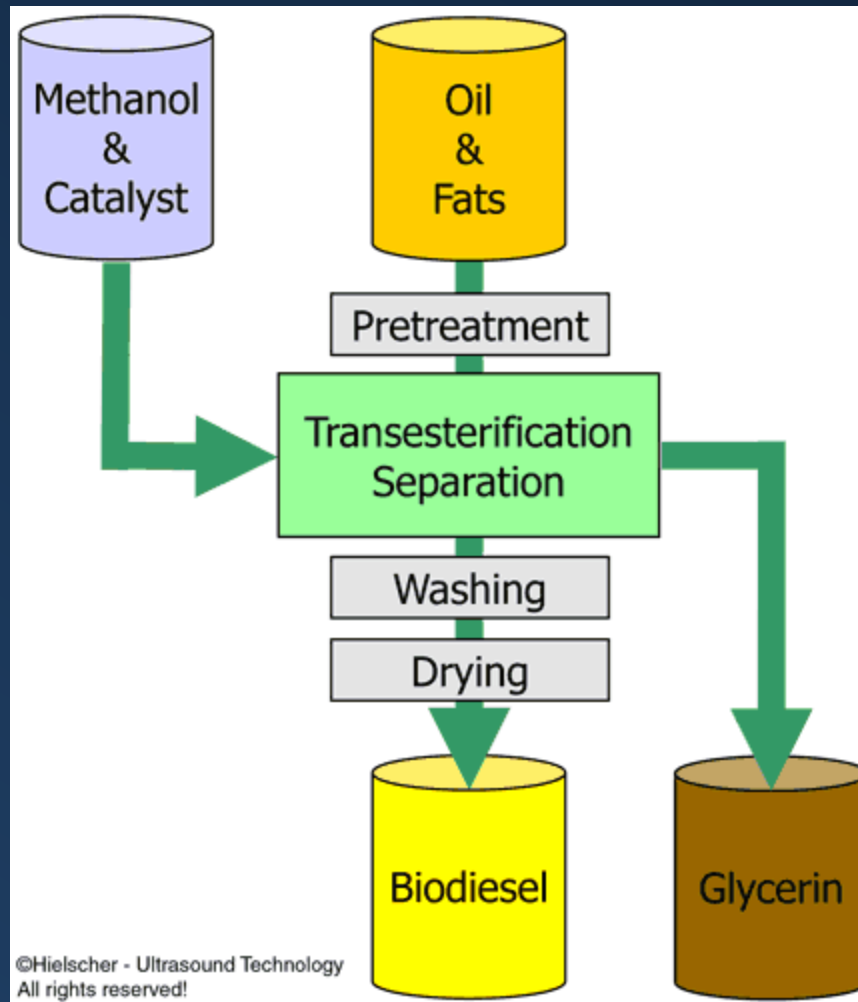




# WTE: Anaerobic Digestion



# WTE: Biodiesel Generation



# Operational WTE Plant



## ► Tracy Biomass Plant (Tracy, California)

- Privately owned biomass waste-to-energy plant
- Long-term agreement to sell power to PG&E
- Direct employment: 24
- Indirect employment: 160 (fuel supply collection, processing, transport)

# Pilot WTE Plants



- ▶ CleanWorld (Gold River, CA)
- ▶ Ener-Core Power (Irvine, CA)
- ▶ EPT (Visalia, CA)
- ▶ Emerging Technologies—Urban X  
Renewables, PowerWaste  
Gasification

# What Are WTE Jobs?



- ▶ **Jobs include: construction workers, truck drivers, salespersons, scientists, manufacturing workers, engineers, cost estimators, etc.**
- ▶ **Most of these jobs will be middle-skill jobs which require more than high school but less than college degree**



# Current WTE Job Openings in US



- Power Plant Operator (Bridgeport, CT)
- Laborers and Freight, Stock, and Material Movers, Hand (Anderson, CA)
- Power Plant Manager (George, VA)
- Facility Safety Coordinator (Honolulu, HI )
- Power Plant Shift Supervisor (Millbury, MA)
- Electrical & Instrumentation Technician (Saugus, MA)
- Power Plant Instrumentation & Control Tower (Saugus, MA)
- Day Crane Operator (Hudson Falls, NY)
- Power Plant Mechanic (Saugus, MA)
- Heavy Equipment Operator (Mendota, CA)
- Power Plant Maintenance Manager (Ft. Lauderdale, FL)

# WTE Indirect Services



- Environmental Consulting
- Environmental Testing
- Public Relations
- Industrial Monitoring
- Chemical Supplies
- Plant Cleaning Services
- Legal Services
- Recruitment Services

# How Many Jobs Will We Need?



- ▶ Average 59 jobs per 1,500 TPD at a WTE facility
- ▶ Los Angeles County will demand about 2,300 jobs in total for WTE industry and Orange County will demand 940 jobs.



# Current Employment in Waste

## Waste Treatment and Disposal

		Employment	
		LAC	OC
TOTAL EMPLOYMENT		2,809	787
53-7081	Refuse and Recyclable Material Collectors	712	199
47-4041	Hazardous Materials Removal Workers	274	77
53-7062	Laborers and Freight, Stock and Material Movers	245	69
53-3032	Heavy and Tractor Trailer Truck Drivers	193	54
11-1021	General and Operations Manager	111	31
47-2061	Construction Laborers	104	29
47-4071	Septic Tank Servicers and Sewer Pipe Cleaners	89	25
43-5111	Weighers, Measurers, Checkers and Samplers	67	19
43-4051	Customer Service Representatives	59	17
49-3031	Bus and Truck Mechanics	59	17

# Potential Workforce in LAC & OC

Potential Workforce Based on Existing Job Listings for  
WTE Facilities around the US

		Employment	
		LAC	OC
51-8013	Power Plant Operator	1,300	90
53-7062	Laborers and Freight, Stock and Material Movers	83,380	23,110
11-1021	General Manager	69,290	28,000
51-1011	Shift Supervisor	15,530	6,390
17-3023	Electrical and Electronics Engineering Technicians	3,510	2,600
47-2073	Operating Engineers /Other Construction Eqmt Operators	3,220	2,390
49-9041	Industrial Machinery Mechanics	5,320	1,500
49-9069	Precision Instrument and Equipment Repairers	410	**
51-8091	Chemical Plant and System Operators	460	**
29-9012	Occupational Health and Safety Technicians	160	60
51-9011	Chemical Equipment Operators	970	190

# Challenges: Regulatory Restrictions



- ▶ Pyrolysis and Gasification uses combustible gases in the absence or slight presence of air and oxygen
- ▶ Anaerobic Digestion - Implementation difficult due to costs and emissions controls. There are no incentive programs for anaerobic digestion of MSW
- ▶ Landfill Gas to Energy - Possible penalties from vinyl chloride contamination from California landfill gas – not applicable to out of state gas.

# Challenges: Advanced Technologies



- ▶ Current renewable “closed-loop” technologies are still being developed
- ▶ Advanced technologies require process-specific feedstock
- ▶ WTE start-ups may deplete funding prior to realizing profits

# Challenges: Employment



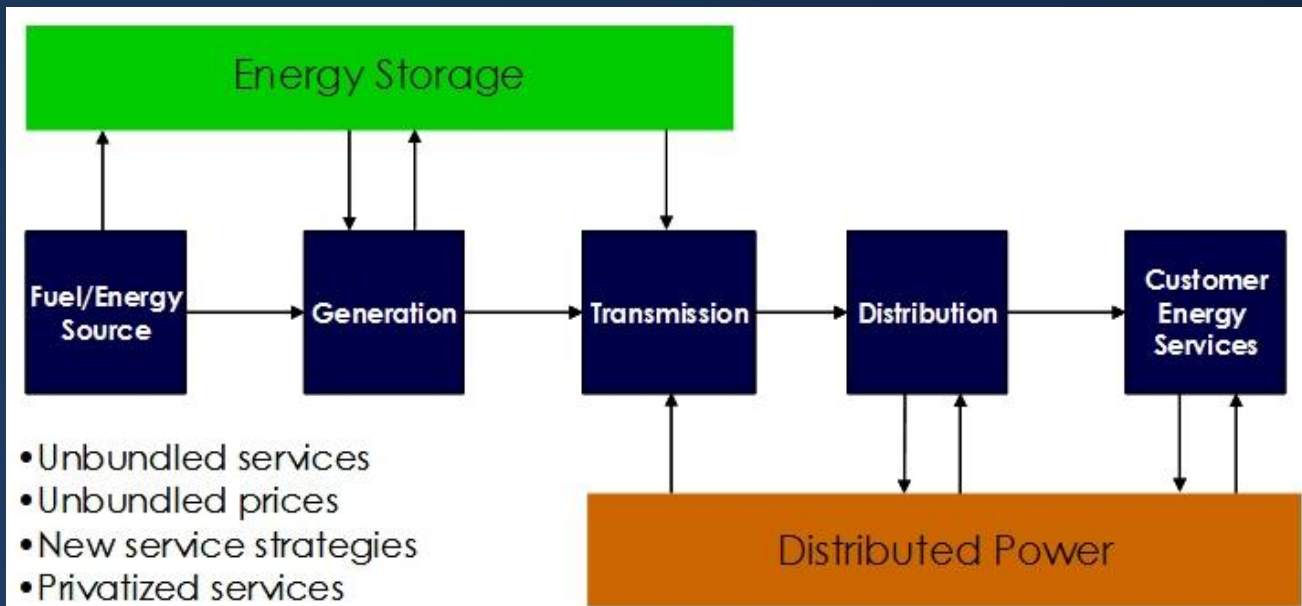
- ▶ Renewable and mass burn facilities directly employ 59, mostly low skill occupations requiring only OTJ training
- ▶ Developers of advanced technologies are well-educated and experienced professionals
- ▶ Lower skilled labor is not required until a project reaches functionality



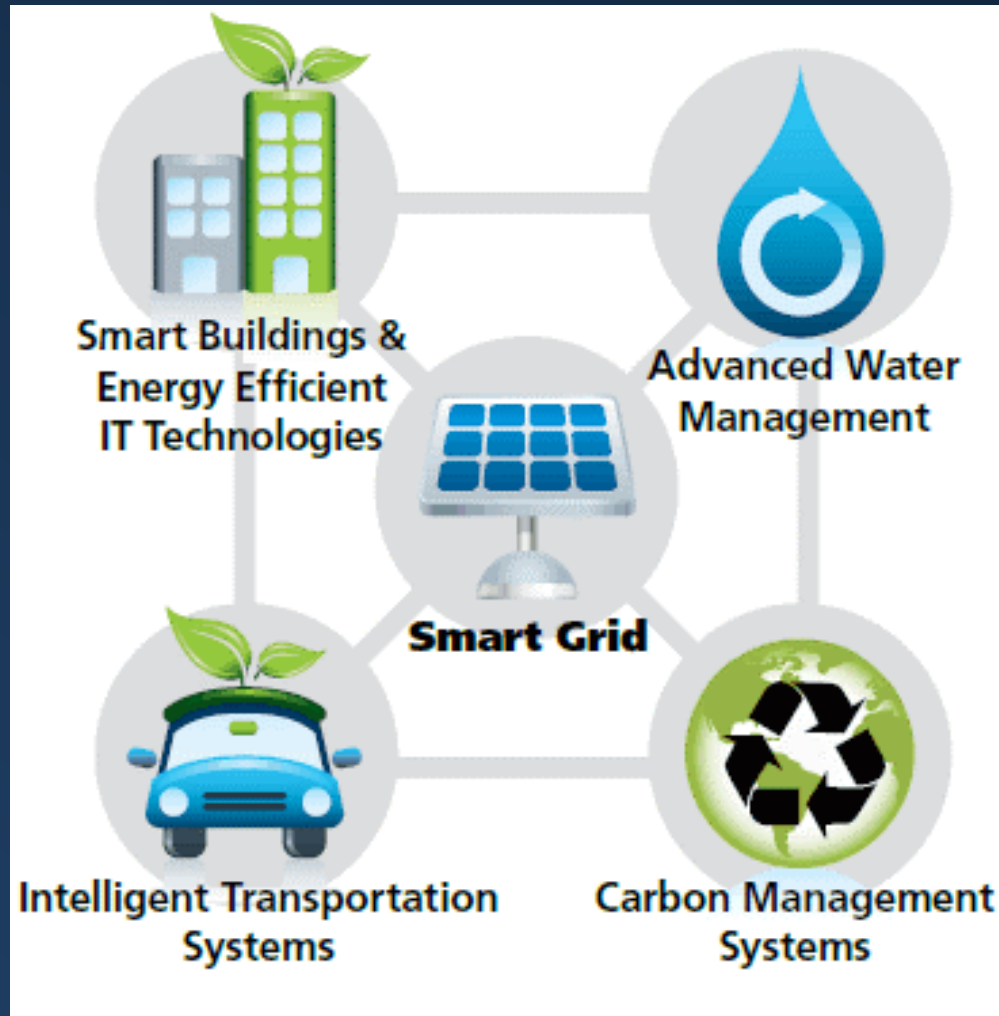
# What is Energy Storage?



Traditional way: Regulated utility bundled functions.  
One price does it all.

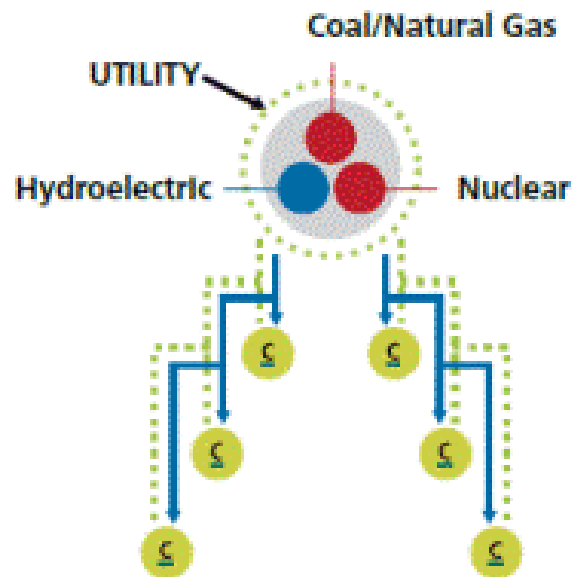


# What is Energy Storage?

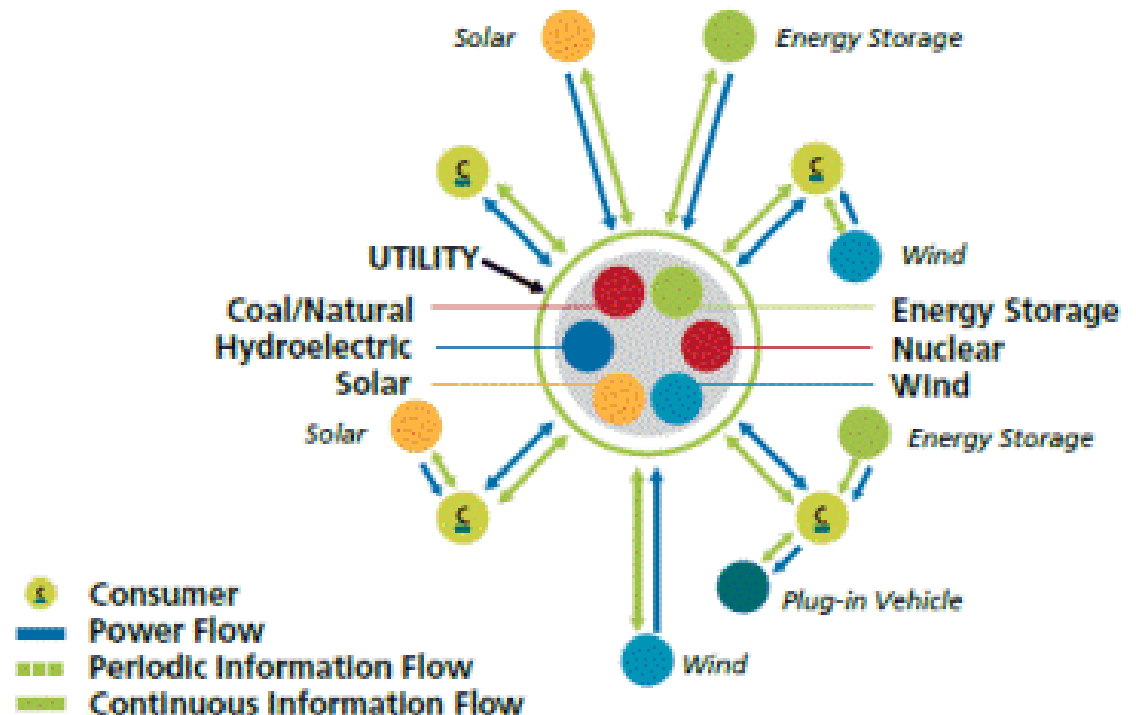


# Energy Storage Value Chain

Traditional Energy Value Chain

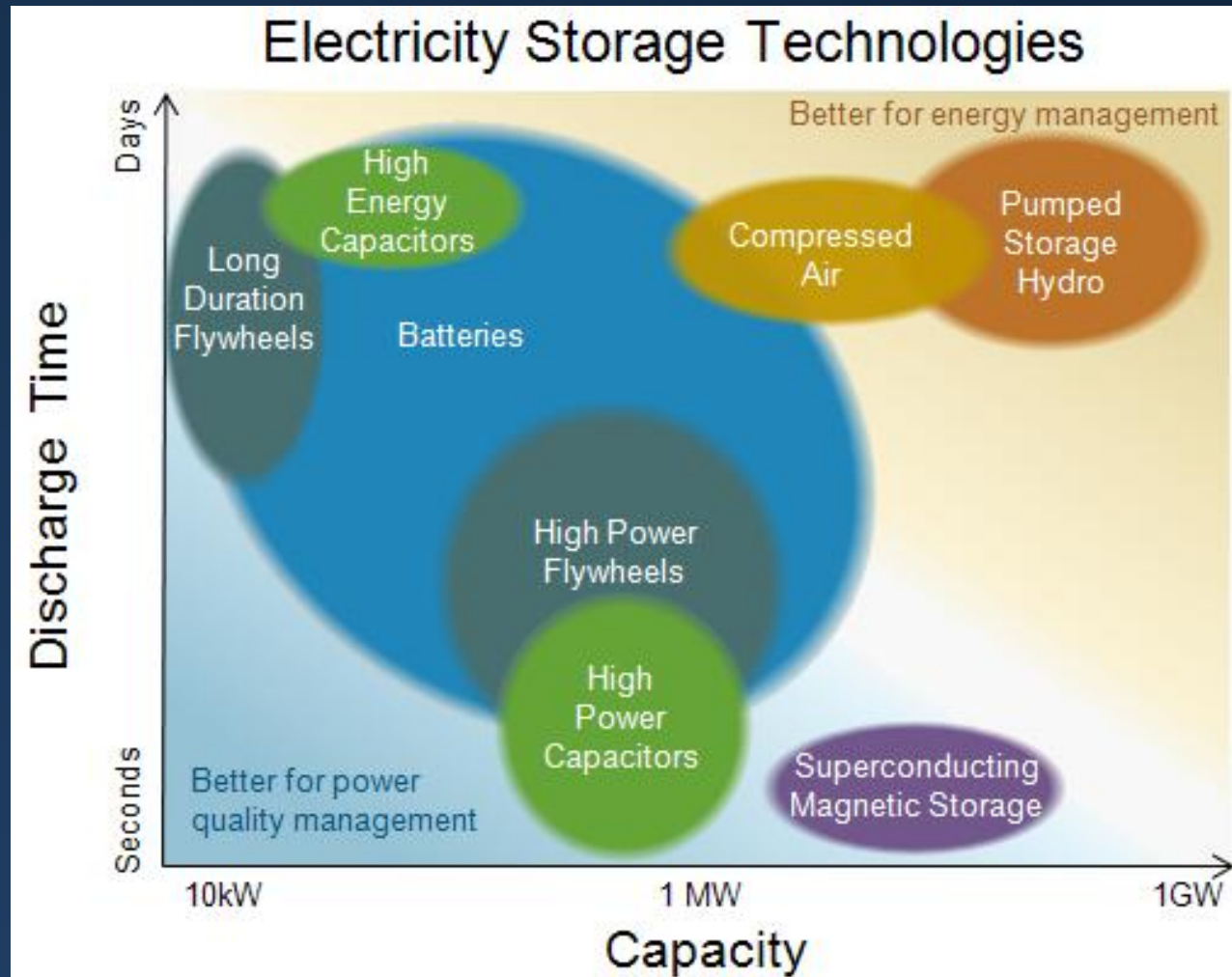


Transformed Energy Value Chain

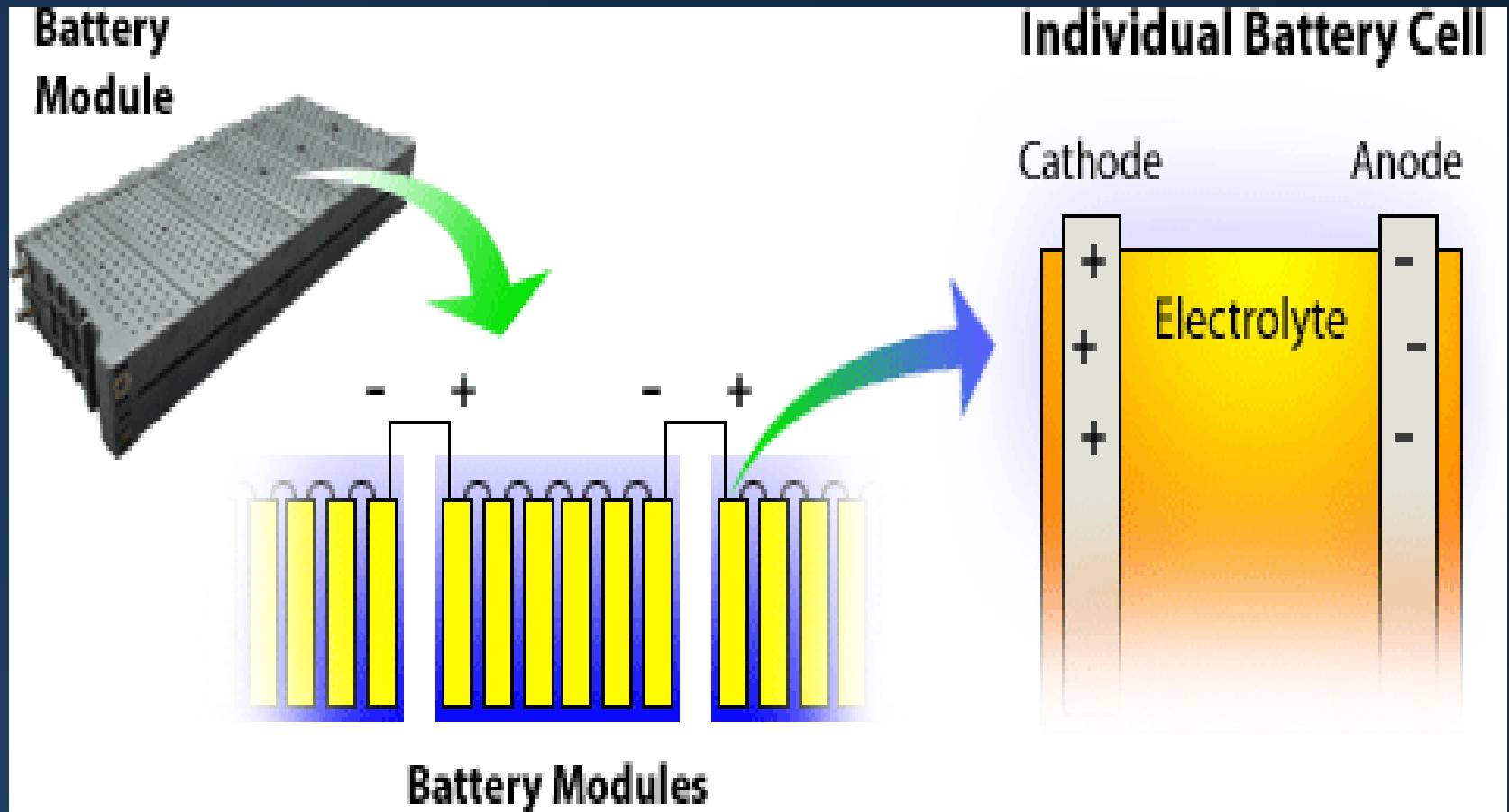




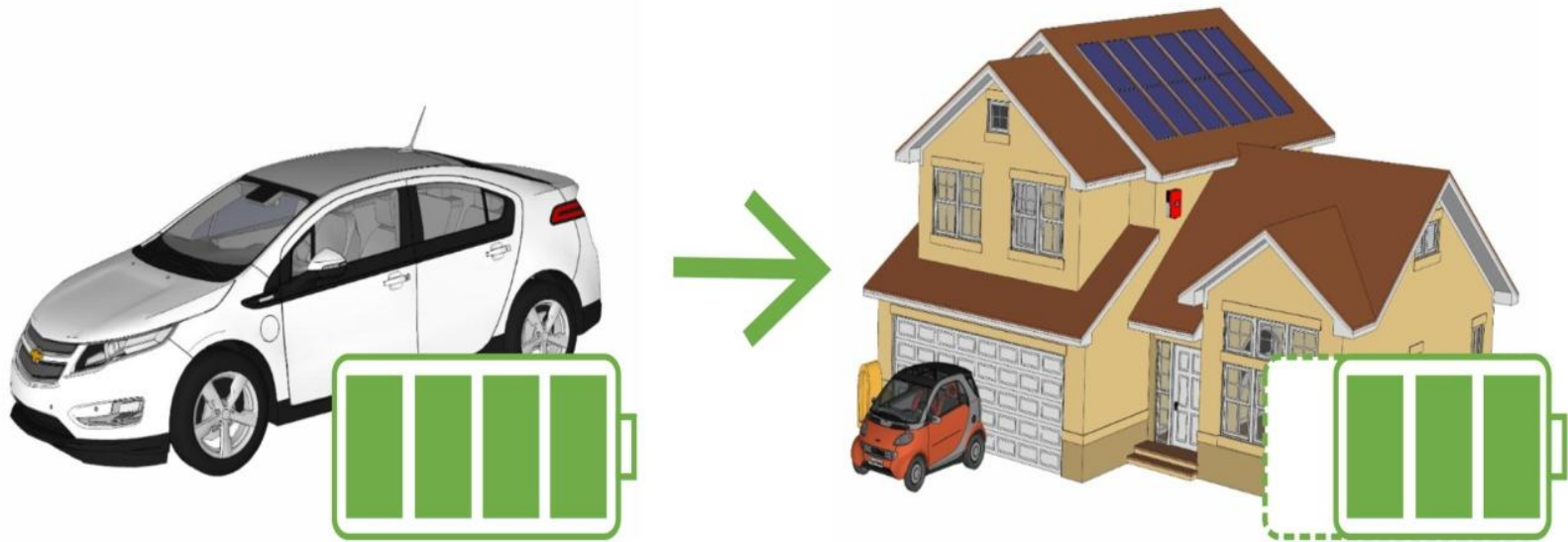
# Energy Storage Technologies



# Battery Technology

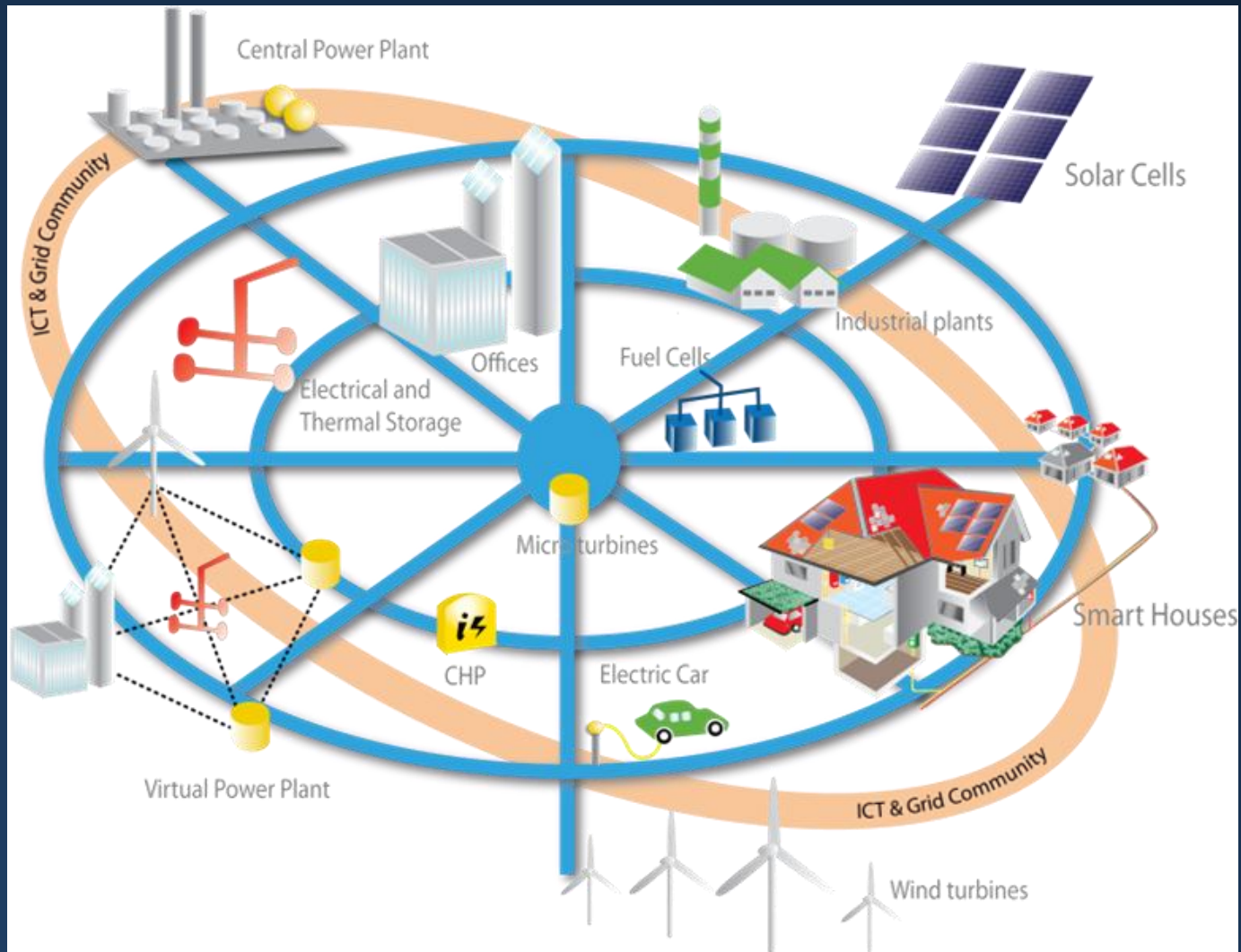


# Second Life Battery Technology



1st Life: Vehicle Traction Battery    2nd Life: Smart Home Energy Storage

# Vehicle Grid Integration



# Vehicle Grid Integration Savings

## Big Savings from Vehicle-Grid Integration (VGI)

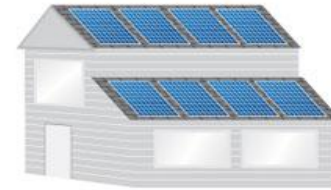


The U.S. electrical grid lacks energy storage.  
Battery-powered cars could fill this gap, storing and returning energy as needed.



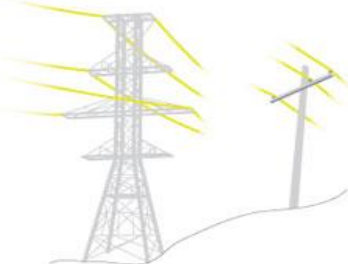
Grid operators can use EV batteries to smooth peaks and valleys in demand, avoiding use of peaker plants.

**\$150 million** per year in avoided emissions costs for California alone and up to **\$3 billion** in emissions savings nationwide



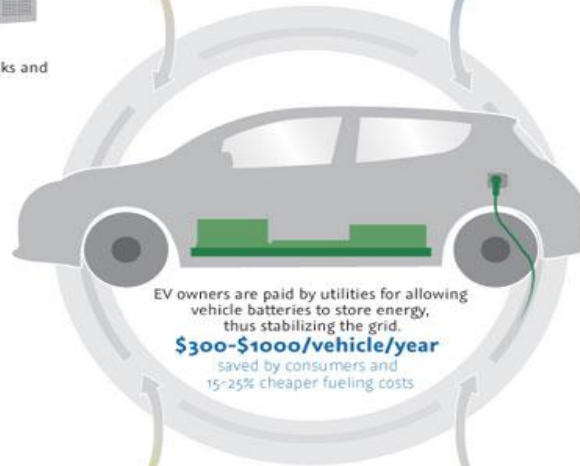
Rooftop solar can power cars, instead of going back to the grid. EV owners can use this "free" solar fuel.

Up to **\$1000/vehicle/year** saved by consumers



EV battery storage can buffer peak demand on grid, preventing damage and wear of transformers and wires.

**\$300 million to \$1.6 billion** in annual grid system value



EV owners are paid by utilities for allowing vehicle batteries to store energy, thus stabilizing the grid.

**\$300-\$1000/vehicle/year** saved by consumers and 15-25% cheaper fueling costs

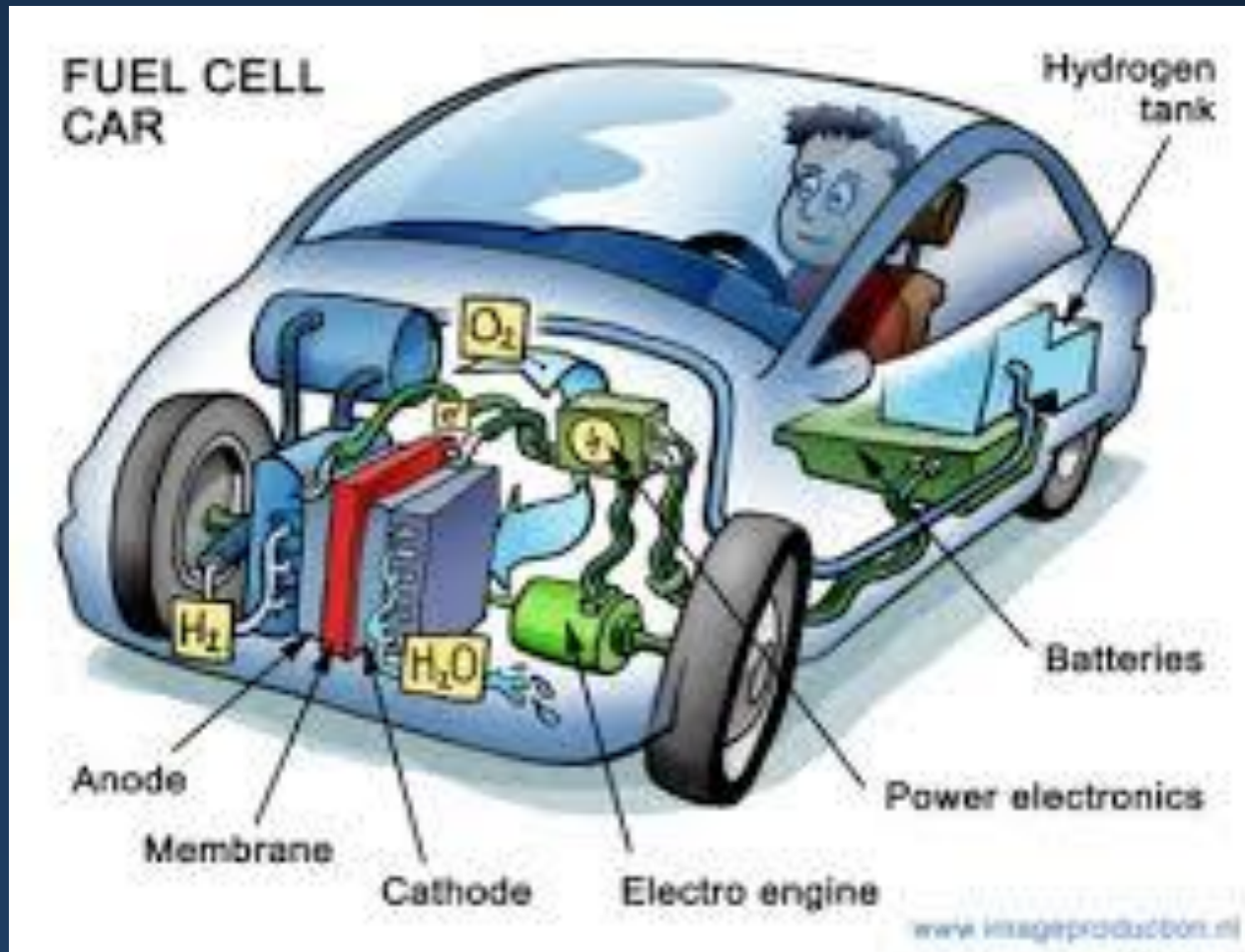


EV owners can schedule charging when greener renewable energy is most plentiful.

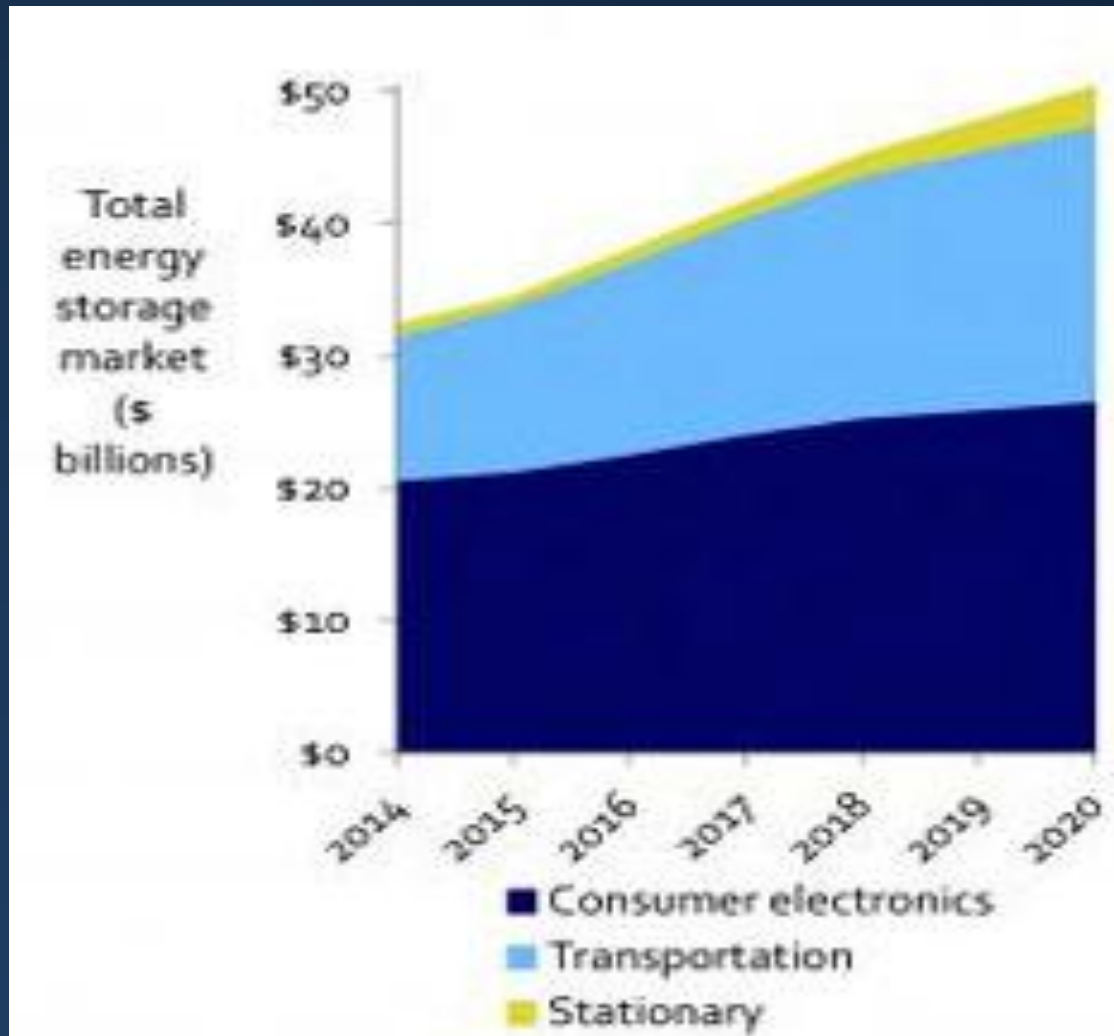
Up to **\$4 billion** in annual benefits for renewable energy



# Fuel Cell Technology

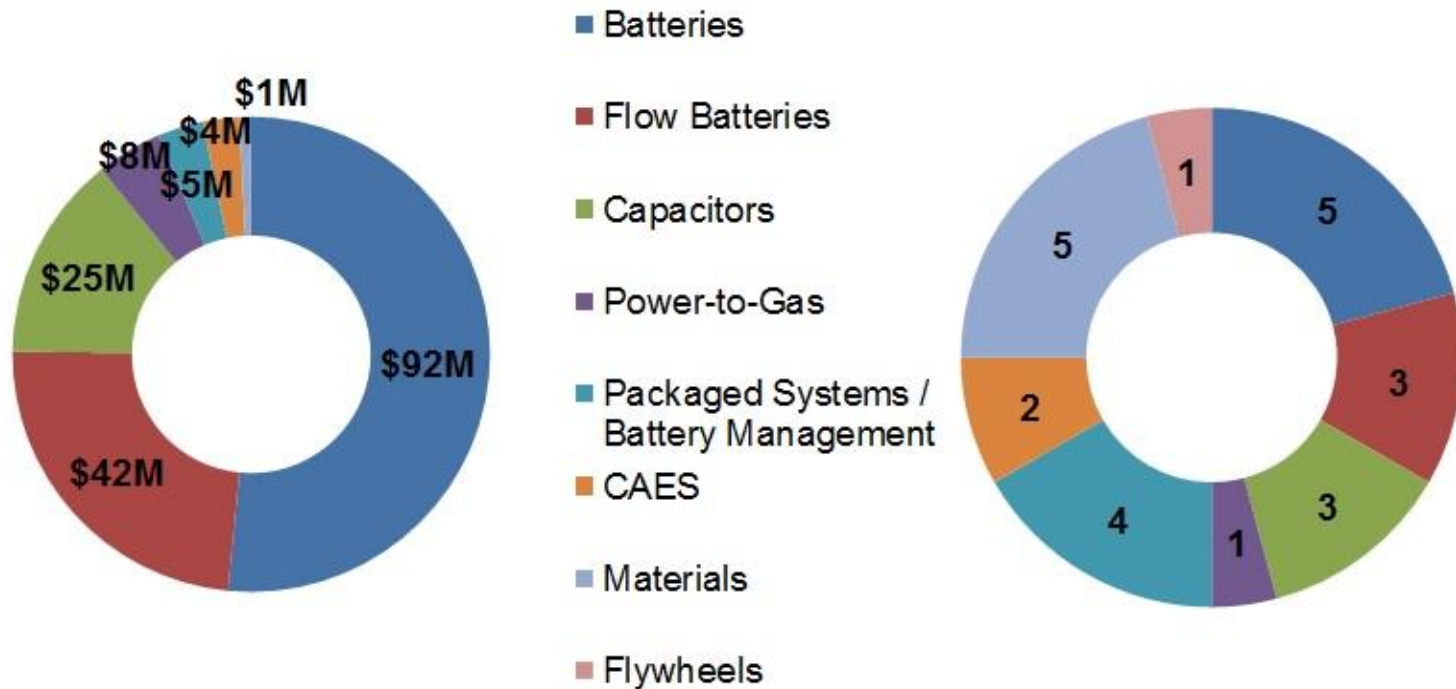


# Energy Storage Market



# Energy Storage Investment

Corporate & Institutional Venture Investment in Energy Storage - 1H14

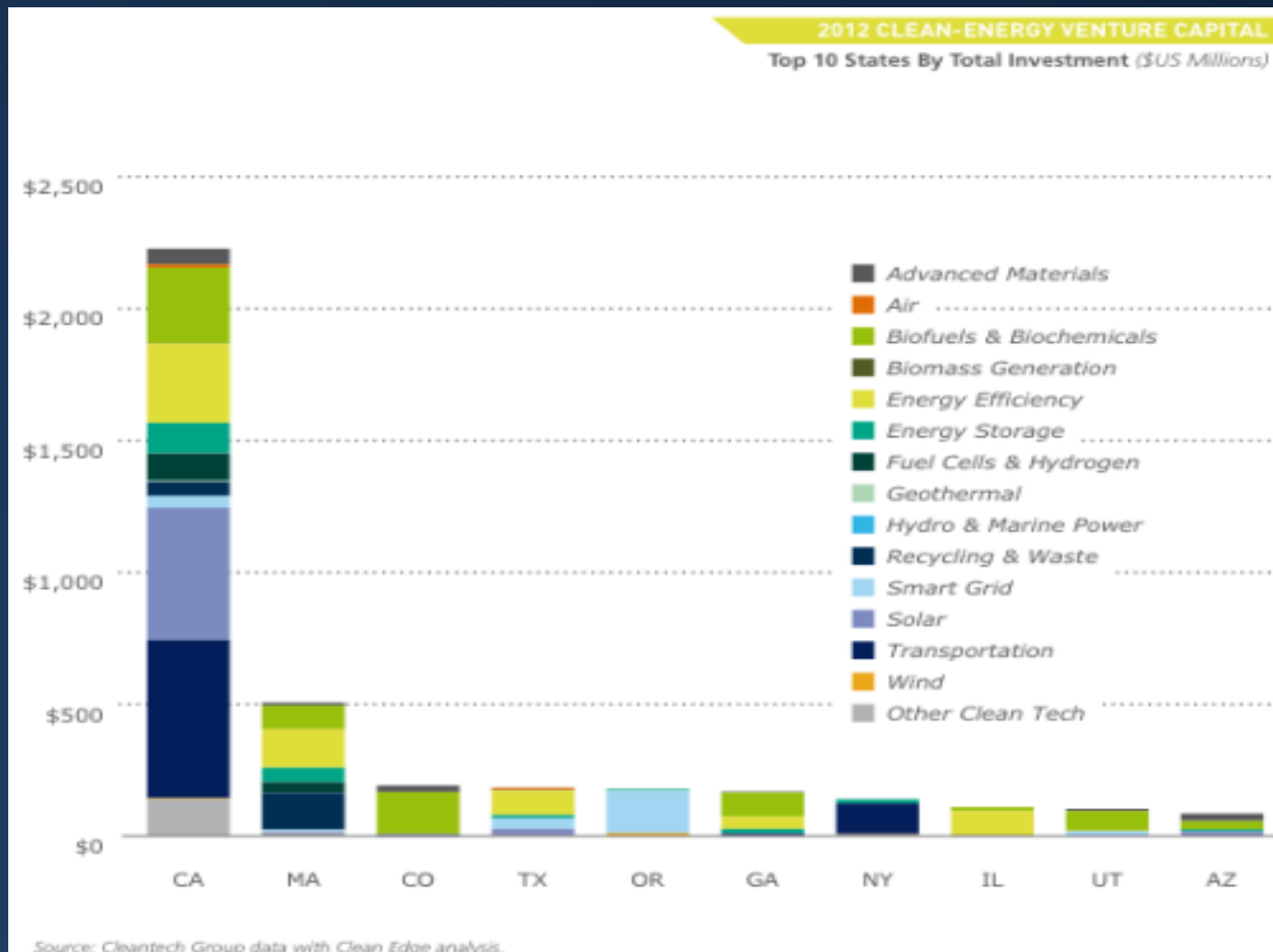


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# CA's Role in Clean Energy



# CA Green Innovation Index

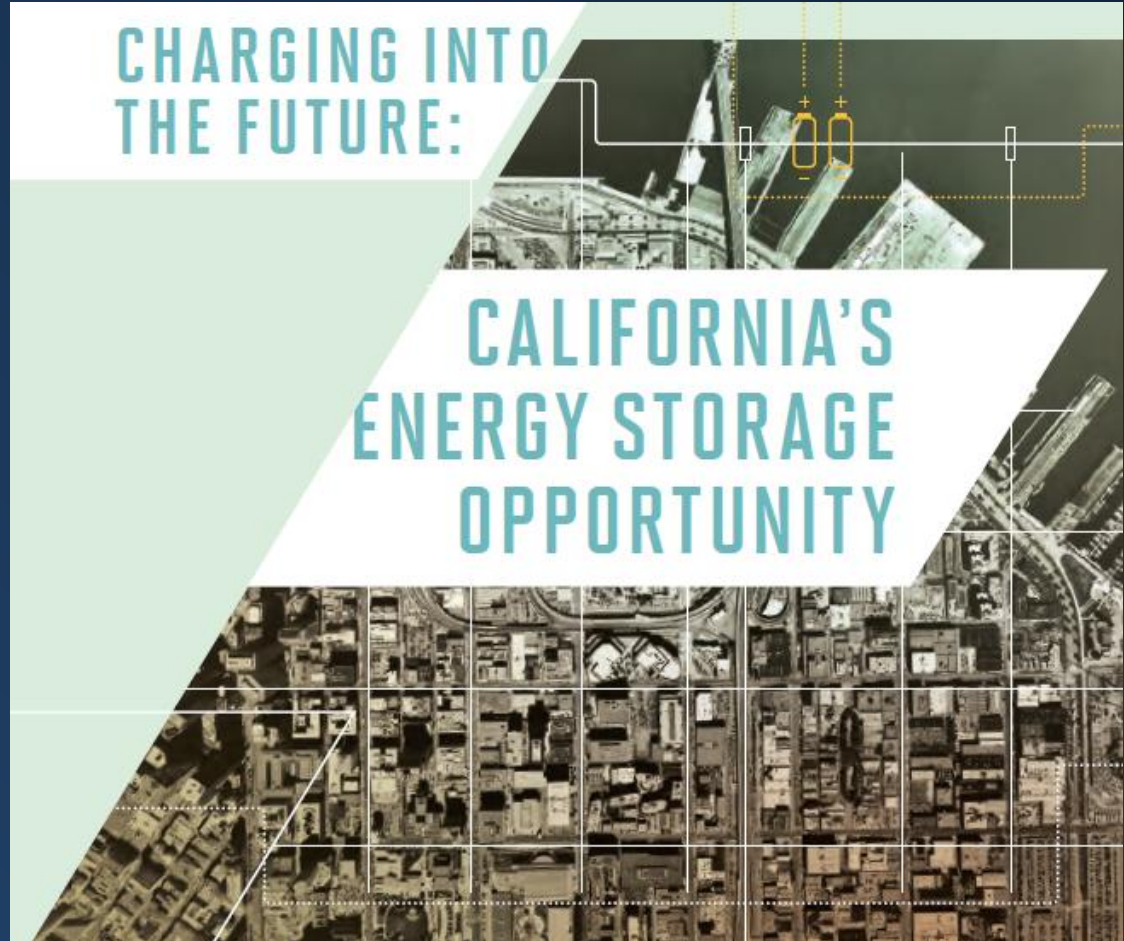


# California Energy Storage



CHARGING INTO  
THE FUTURE:

CALIFORNIA'S  
ENERGY STORAGE  
OPPORTUNITY





# Energy Storage Companies in California



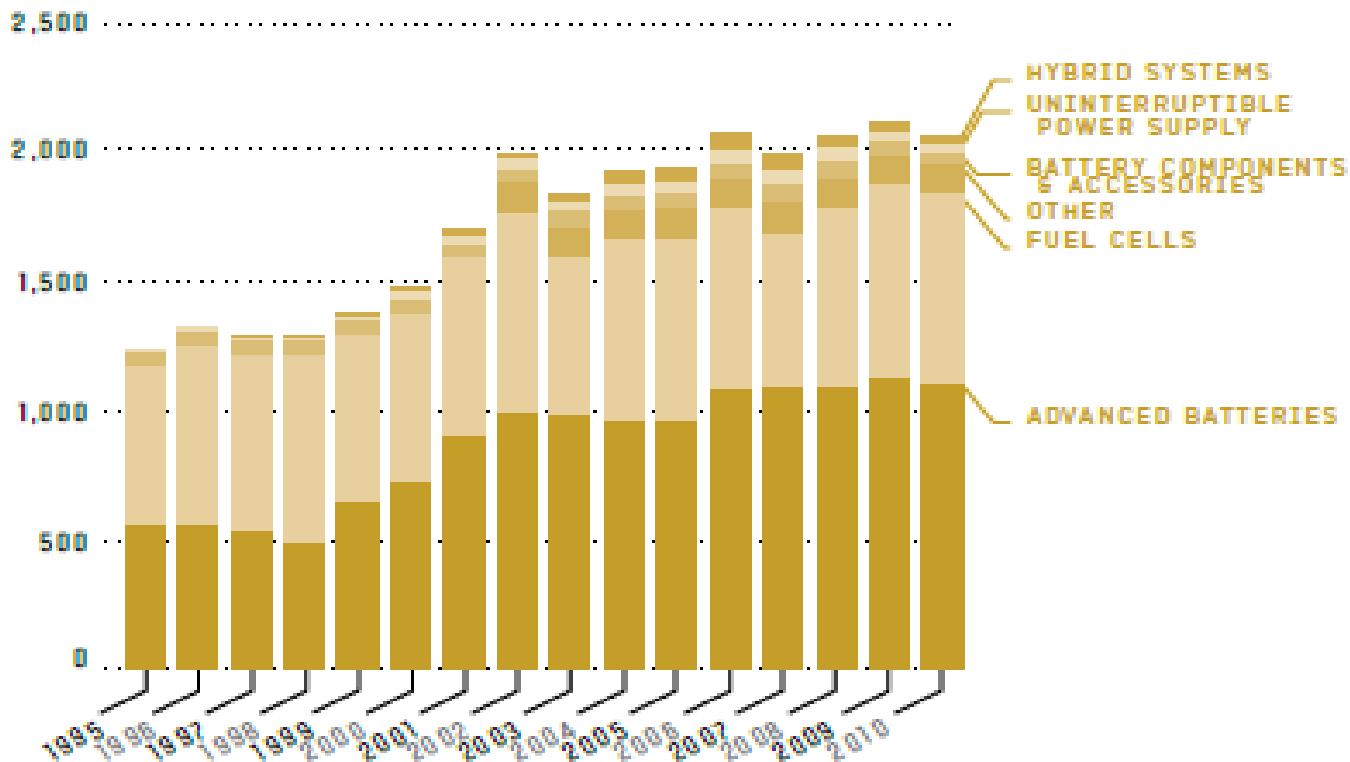
# CA Energy Storage Projects

RANKING	STATE	TOTAL IN MW	TOTAL NUMBER OF SMALL PROJECTS (4 KW-1.5MW)	TOTAL NUMBER OF LARGE PROJECTS (>1.5MW)
1	CALIFORNIA	481.78	26	9
2	TEXAS	333.60	3	5
3	ALABAMA	110.00	0	1
4	ALASKA	56.00	1	3
5	WEST VIRGINIA	35.02	2	2
6	HAWAII	28.43	7	2
7	NEW YORK	20.36	6	3
8	PENNSYLVANIA	10.60	7	2
	U.S. TOTAL	1107.69	86	33

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Includes compressed air, thermal storage, battery, and flywheel, excludes pumped hydro. Data Source: U.S. Department of Energy, Global Energy Storage Database. Analysis: Collaborative Economics

# Energy Storage Jobs – LA

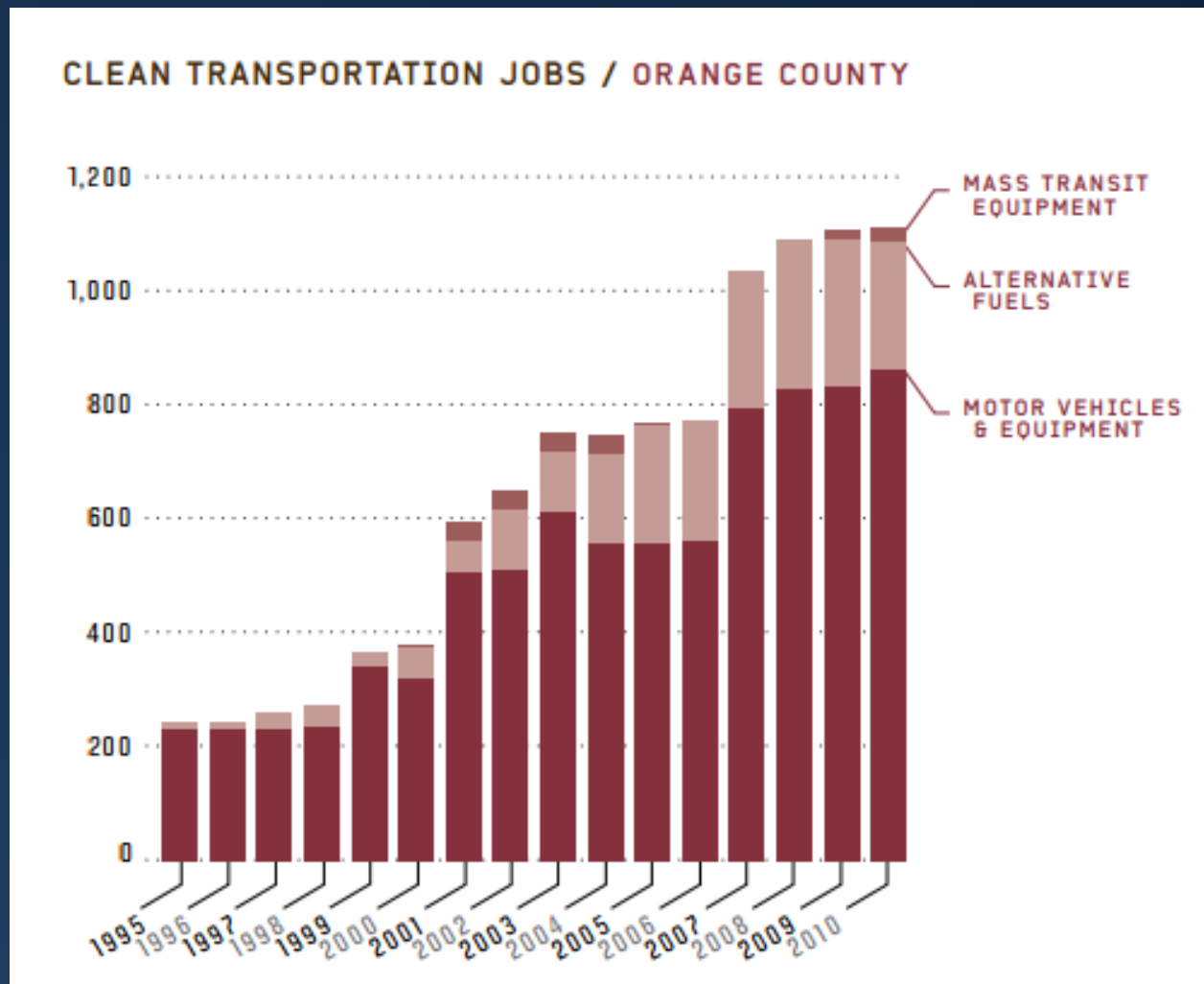
## ENERGY STORAGE JOBS / LOS ANGELES AREA



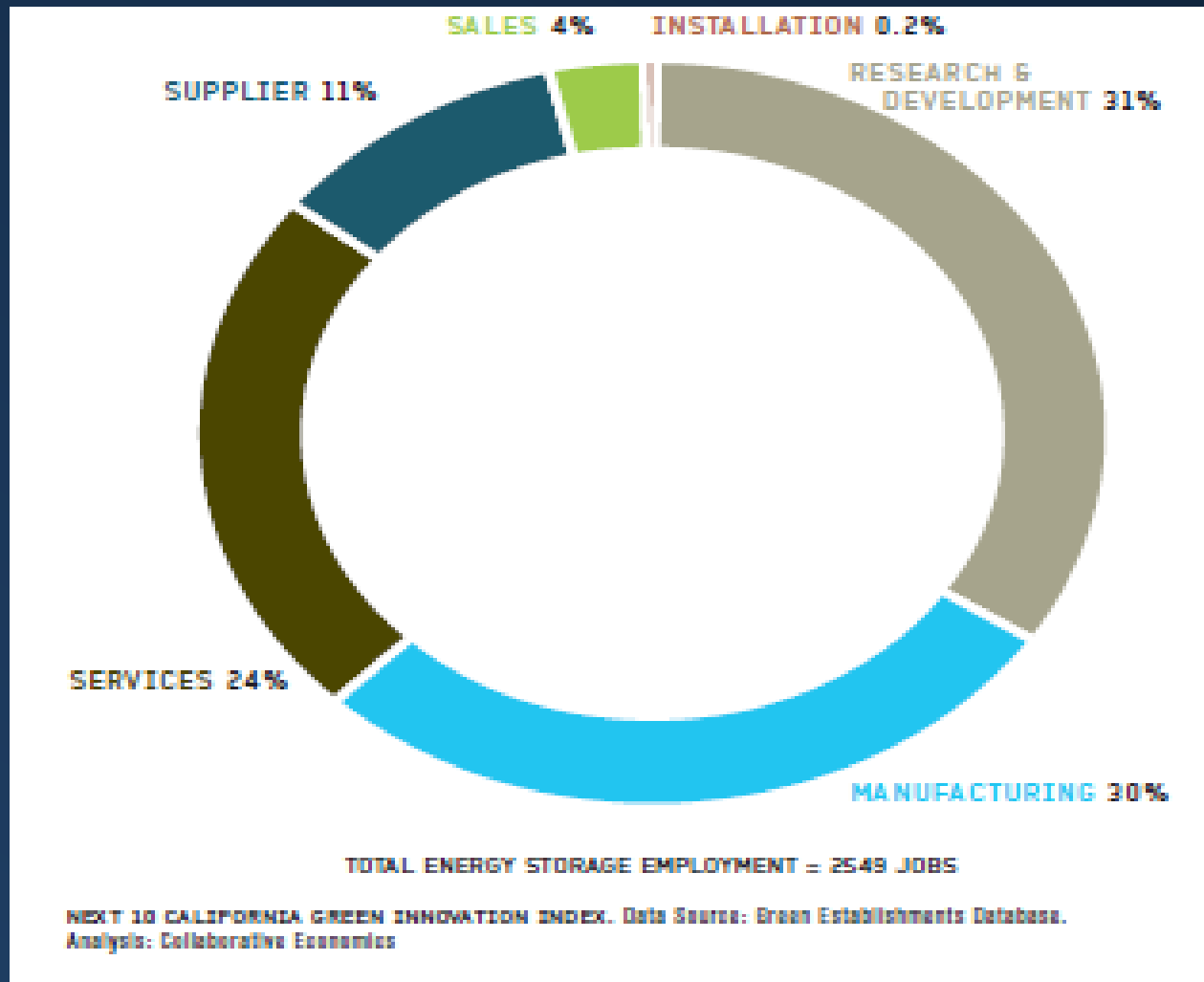
NEXT 10 MANY SHADES OF GREEN. Data Source: Green Establishment Database.  
Analysis: Collaborative Economics



# Clean Transportation Jobs – OC



# CA Energy Storage Employment



# Employment in CA, LA, OC

Occupation	California	LA County	Orange County
Managers, Operations	254,330	69,290	28,000
Engineers, Computer Applications	95,510	15,660	9,230
Engineers, Software Systems	78,990	13,030	7,200
Engineers, Chemical	2,310	780	100
Electrical Engineers	23,030	4,620	1,770
Engineers, Electronic Design Automation	34,270	7,240	4,010
Health & Safety Engineers, Except Mining Safety	2,660	590	210
Engineers, Industrial	22,910	6,110	2,550
Engineers, Mechanical	23,240	5,890	2,480
Electrical and Electronics Engineering Technicians	20,290	3,510	2,600
Technicians, Electro-Mechanical	2,780	360	440
Technicians, Mechanical Engineering	5,230	1,070	690
Engineering Technicians, Except Drafters, All Other	8,640	1,820	820
Technicians, Chemical	4,900	1,140	460
Electricians	46,020	10,550	**
First-Line Supervisors of Production / Operating Workers	50,730	15,530	6,390
Coil Winders, Tapers, and Finishers	1,260	480	100
Electrical and Electronic Equipment Assemblers	28,280	5,400	4,890
Electromechanical Equipment Assemblers	6,700	1,430	1,170
Team Assemblers	78,410	22,120	12,930
Assemblers, Semiconductor	5,640	850	700

# Tesla Motors: Giga-Factory



# Utility Companies' Role



SOUTHERN CALIFORNIA  
**EDISON**

An *EDISON INTERNATIONAL* Company

# Market Barriers



- ▶ The US Department of Energy noted that there are four key market barriers:
  - ▶ Cost competitiveness
  - ▶ Validated performance and safety
  - ▶ Equitable regulatory environment
  - ▶ Industry acceptance
- ▶ Additionally, size, weight, longevity, and efficiency must be improved



# CA Public Policies



- ▶ **Public policies are key**
  - ▶ AB 2514 (2010)—required CPUC to define grid scale energy storage procurement targets and policies
  - ▶ Self-Generation Incentive Program (SGIF) provides performance based incentive payments for up to 60% of project costs
- ▶ In 2013, the CPUC established a mandate to direct investor-owned utilities to procure 1.3 GW of energy storage capacity by 2020 and for energy storage providers to procure energy storage equal to 1% of their annual 2020 peak load *by* 2020

# CA Energy Storage Opportunity



- ▶ Forward-thinking
- ▶ Research and development
- ▶ Market driven
- ▶ Business practices

# Conclusion



- ▶ Demand will rise as advanced technologies reach mass production & economic efficiency
- ▶ The market is currently precarious, but will become robust in the future
- ▶ Diversified companies, such as Panasonic, Samsung, and LG show much promise
- ▶ Full employment will not be realized until efficiencies in technologies improve



*Thank You!*

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