

Decarbonization 101



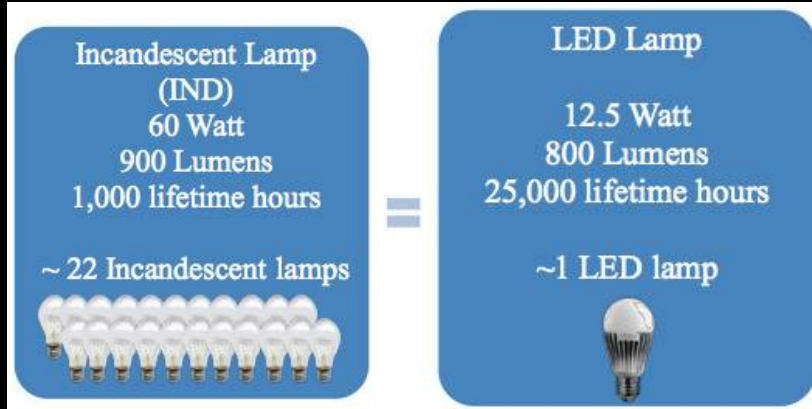
REDWOOD ENERGY
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REDWOOD ENERGY: LED BY SEAN ARMSTRONG AND MICHAEL WINKLER

- Sean and Michael separately began working on off-grid, solar powered houses in 1995-96
- Sean: B.S. in Natural Resources Conservation, Science teacher ('02-05') and Project Manager ('05-'11) for large developer/GC, Co-Founder and Managing Principal of Redwood Energy
- Michael: B.S. degrees in Physics and Engineering, careers in telecommunications and fuel cells, CEA, HERS Rater, LEED Rater



WHAT IS DECARBONIZING?



Efficiency like LEDs



Both small and large electric transport



Renewable Energy like off-shore wind and solar fields



Induction Cooking like at the French Laundry in Napa

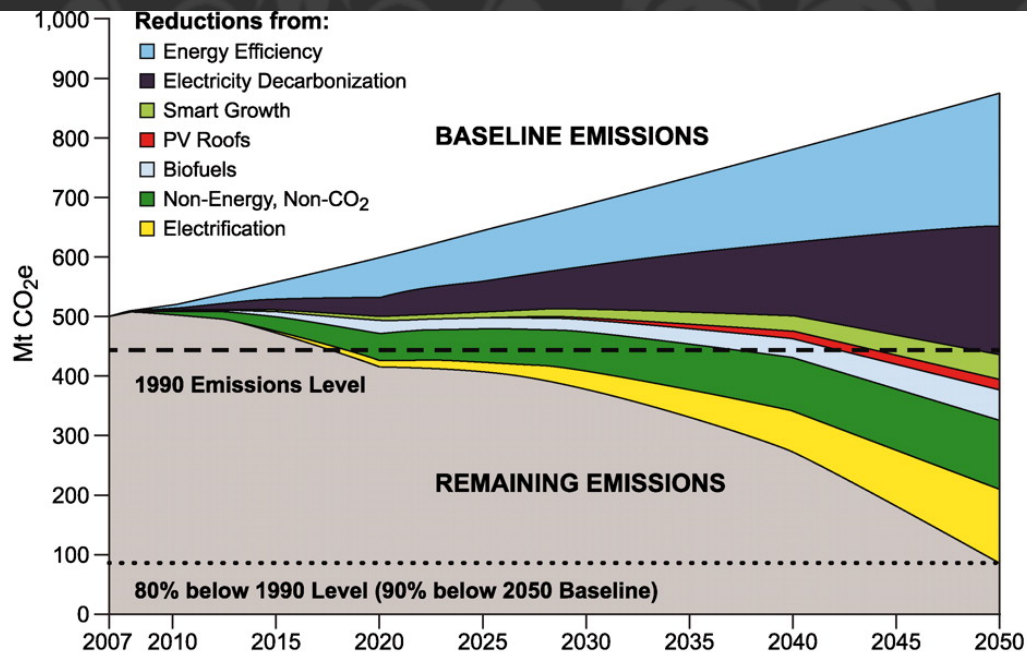
OUR LEGAL COMMITMENTS TO DECARBONIZING



AB 32, “The Global Warming Solutions Act of 2006” and successor implementation laws requires California to produce 80% less than 1990 levels of greenhouse gases by 2050. Equivalent to 95% less than 2012 levels.



COP 21, “The Paris Climate Accord of 2015,” of which California is a signatory, commits us to the international goal of preventing more than 2C increase in global temperatures.



**HOW ARE WE
PREDICTED TO
DECARBONIZE?**

Wedge Category:	Emissions Reduction Mt CO ₂ e (% of Total)		Types (and Numbers) of Measures Used	Key Attributes in 2050
	2030	2050		
Energy Efficiency	102 (33%)	223 (28%)	Building EE (18); Vehicle EE (9); Other EE (6)	Energy efficiency improved 1.3% per year on average for 40 years
Electricity Decarbonization	72 (23%)	217 (27%)	High renewables, high nuclear, high CCS, and mixture of the three	90% of generation requirement met with CO ₂ - free sources. Equivalent decarbonization in each scenario
Smart Growth	13 (4%)	41 (5%)	Reductions in vehicle miles traveled (VMT) (6)	VMT reduced in light duty vehicles (LDV) by 10%; freight trucks 20%; other transportation 20%
Rooftop PV	8 (3%)	21 (3%)	Residential and commercial PV roofs (2)	10% of electricity demand displaced by rooftop PV
Biofuels	18 (6%)	49 (6%)	Transportation biofuels; ethanol, biodiesel, biojet fuel (9); Residential, commercial, industrial biomethane (3)	2% of natural gas use in buildings displaced by biomethane, and 10-20% of petroleum-based fuels for vehicles displaced by biofuels
Non-Energy, Non-CO ₂	67 (22%)	116 (15%)	Cement, agriculture, and other (3)	Non-fuel; non-CO ₂ GHG emissions reduced 80% below baseline
Electrification	29 (9%)	124 (16%)	Transportation electrification (9); Other end-use electrification (5)	75% of LDV gasoline use displaced by PHEVs & electric vehicles; 30% of fuel use in other transport sectors electrified; 65% electrification of non-heating/ cooling fuel use in buildings; 50% electrification of industrial fuel uses
Baseline Case Emissions	688	875		
Mitigation Case Emissions	380	85		
Total Reduction	308	790		

DECARBONIZED ENERGY IN THE GRID IS BEING DRIVEN BY LOW COSTS OVER POLITICS

Which States Are Big on Wind Power?

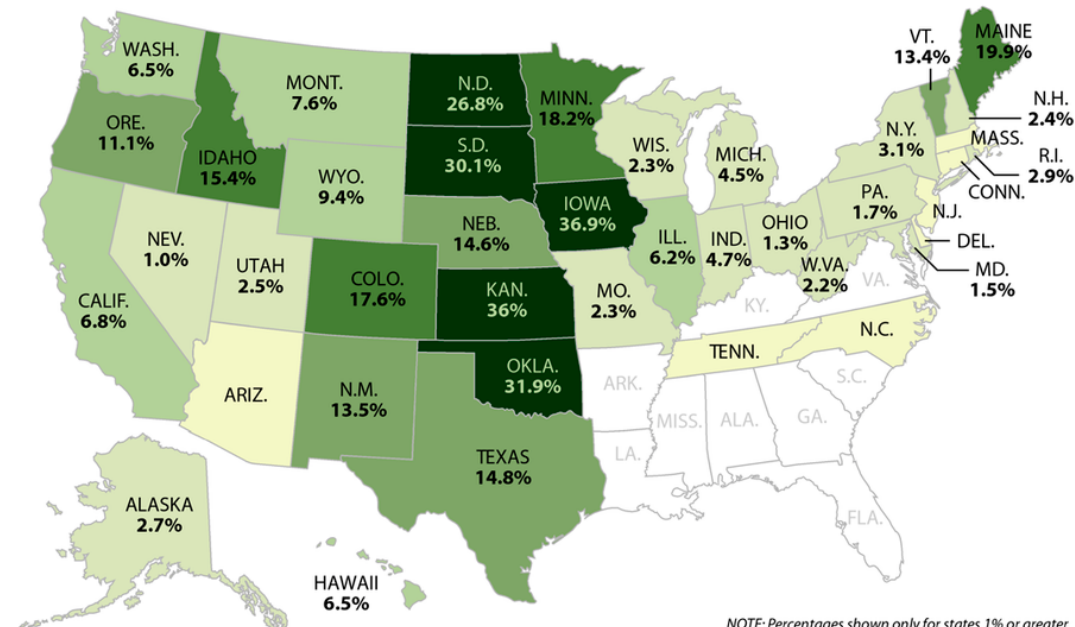
In four states, more than 30 percent of in-state electricity production now comes from wind energy, and several others are above 15 percent and growing, according to data from the American Wind Energy Association.

inside
climate
news

WIND ENERGY SHARE OF ELECTRICITY GENERATION

As a percentage of total, 2017

0% Up to 1% 1% to <5% 5% to <10% 10% to <15% 15% to <20% 20% and higher

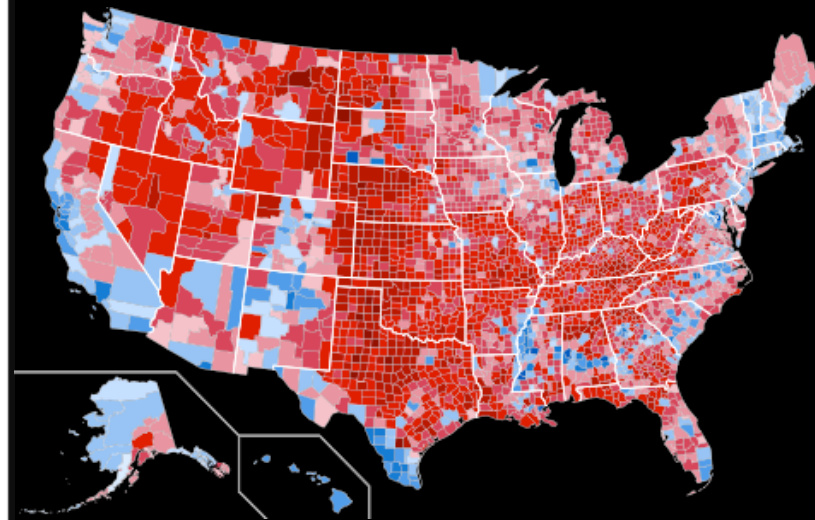


NOTE: Percentages shown only for states 1% or greater.

SOURCE: American Wind Energy Association (AWEA)

PAUL HORN / InsideClimate News

2016 Presidential Electoral Map



LAST YEAR'S NEWS—DECARBONIZED ENERGY IN CALIFORNIA'S ELECTRIC GRID IS EXCEEDING LEGAL MANDATES DUE TO LOW COST

UTILITY DIVE Home Events Library Jobs Opinion Topics ▾



BRIEF

CAISO: Renewables served 42% of California demand on May 16, setting record

THIS YEAR'S NEWS—CALIFORNIA RESIDENCES BUILT IN 2020 WILL ALSO CONTRIBUTE SOLAR TO THE ELECTRIC GRID

The New York Times



California Will Require Solar Power for New Homes



Solar panels on a Southern California home. State law requires at least 50 percent of California's electricity to come from noncarbon-producing sources by 2030. David Paul Morris/Bloomberg

2020 SOLAR CODE WILL ALSO SUPPORT ELECTRIFICATION OF RESIDENCES

Parallel Prescriptive Paths



There will be two parallel prescriptive paths for compliance, one for each of:

- 1. Mixed Fuel Homes**
- 2. All-Electric Homes**

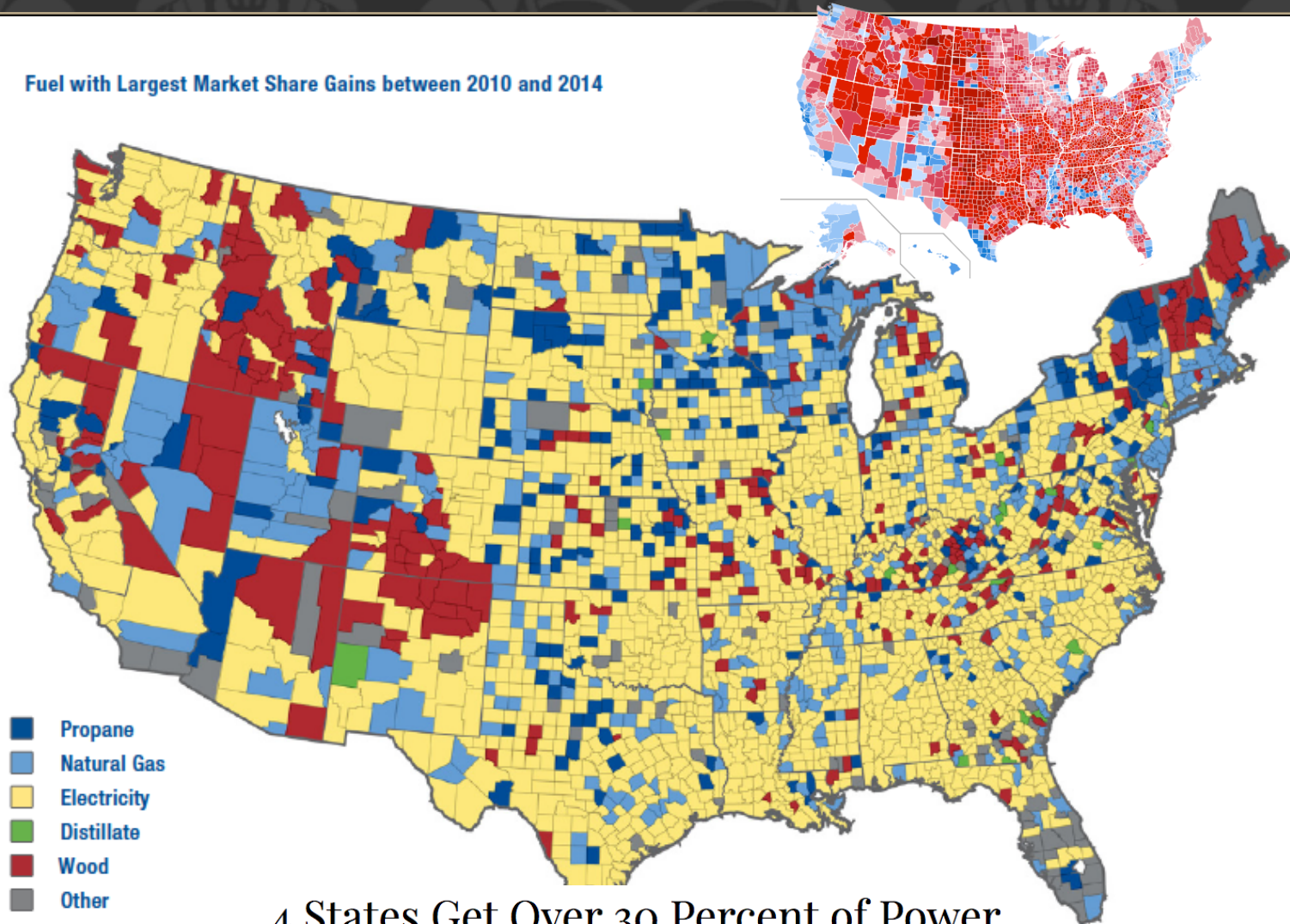
This allows the all-electric and mixed fuel homes to have their own prescriptive paths, NEEA Tier 3 HPWH models can easily be used to meet or exceed standard design using the performance path



ELECTRIFICATION IS NON-PARTISAN BECAUSE IT IS LESS EXPENSIVE TO BUILD

Fig.

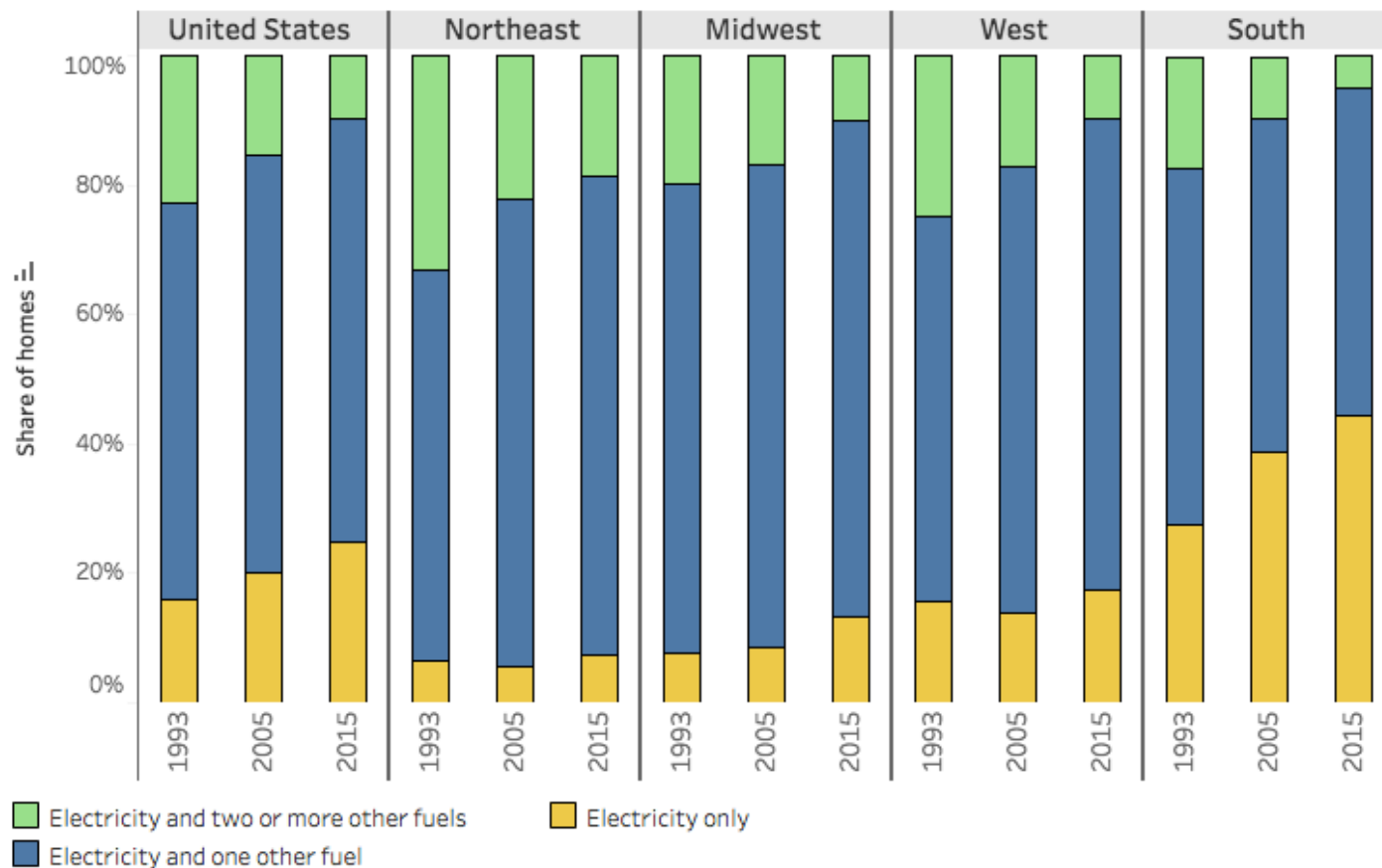
Fuel with Largest Market Share Gains between 2010 and 2014



4 States Get Over 30 Percent of Power
from Wind — and All Lean Republican

ELECTRIFIED BUILDINGS NOW ACCOUNT FOR 25% OF ALL NEW HOMES, LED BY THE SOUTH WHERE 4 IN 10 NEW HOMES ARE BUILT

What Fuels American Homes



WHY IS ALL-ELECTRIC GROWING? ELECTRIC HVAC EQUIPMENT IS LESS EXPENSIVE TO BUY



Rheem 3 Ton 14 SEER Heat Pump Split System R410A Refrigerant

from ACWholesalers.com

Rheem · Heat Pump · With Heater

Overview for Rheem RH1T3617STANJA RP1436AJ1NAThis Rheem 3 Ton 14 SEER Heat Pump Split System Bundle comes with a highly featured and reliable Rheem RP1436AJ1NA heat pump ...

[See more details at ACWholesalers.com](http://ACWholesalers.com) »

\$2,085.38

Free shipping. No tax

 ACWholesalers.com

★★★★★ (3,949)



Rheem 3 Ton 14 SEER 80% AFUE 75K BTU R410A Complete Split System AC and Gas

from Ingrams Water And Air Equipment

Rheem

Condenser Model: RA1436AJ1NA Coil Model: RCF3617STAMCA Furnace Model: R801SA075417MSA Rheem 3 Ton 14 SEER 80% AFUE 75K BTU R410A Complete Split System AC and Gas Rheem RA14 3 ...






[See more details at Ingrams Water And Air Equipment](http://Ingrams Water And Air Equipment) »

\$3,024.00

Free shipping. No tax







Ingrams Water And Air Equipment

★★★★★ (966)

				
ProLine® 50-Gallon ENT-50	ProLine® Master 50-Gallon HNT-50	ProLine® 50-Gallon PXNT-50	Voltex® Hybrid Electric Heat Pump 50-Gallon HPTU-50N	Voltex® Hybrid Electric Heat Pump 80-Gallon HPTU-80N
PROLINE®	MASTER	PROLINE® XE		
ELECTRIC WATER HEATERS				

Family Size	Small - Average	Small - Average	Average	Average	Average - Large
Benefits	<ul style="list-style-type: none"> • Lowest upfront cost • Easy to replace 	<ul style="list-style-type: none"> • Low upfront cost • Easy to replace 	<ul style="list-style-type: none"> • Energy efficiency and value • Easy to replace 	<ul style="list-style-type: none"> • Uniform Energy Factor • ENERGY STAR® Qualified 	<ul style="list-style-type: none"> • High performance • ENERGY STAR® Qualified
Annual Cost of Operation¹	\$419	\$419	\$627	\$114	\$218

**EFFICIENT
ELECTRIC
APPLIANCES
COST LESS TO
OPERATE
THAN
EFFICIENT GAS
APPLIANCES**

					
Polaris® High Efficiency GTP-199	Vertex™ Power-Vent 76,000 BTU GPHE-50	Vertex™ Power Direct Vent 100,000 BTU GDHE-50	Non-Condensing Tankless⁷ ATO-510	Concentric Vent Tankless ATI-510C	Condensing Tankless⁷ ATI-540
PROLINE® XE					
GAS WATER HEATERS					
Average - Large	Average - Large	Average - Large	Average - Large	Average - Large	Average - Large
<ul style="list-style-type: none"> • High performance • Stainless Steel Tank 	<ul style="list-style-type: none"> • Energy efficiency PLUS better hot water performance 	<ul style="list-style-type: none"> • Full range of features • Energy efficiency with high performance 	<ul style="list-style-type: none"> • Compact design for space savings • Continuous hot water with energy efficiency 	<ul style="list-style-type: none"> • Lowest upfront cost • Easy to replace • Contractor preferred concentric vent 	<ul style="list-style-type: none"> • Continuous hot water • ENERGY STAR® Qualified • Integrated recirculation pump options available
\$220	\$213	\$216	\$236	\$230	\$202

WHY IS ELECTRIFICATION GROWING? ALL-ELECTRIC SAVES ~\$500/FIXTURE, AND ~\$2000/HOUSE



Price Quote/Estimate	Source
\$578 - \$718 (single family)	Homewyse Web Site
\$300 - \$1000 (single family)	Costhelper.com
\$259 - \$733 (single family)	homeadvisor.com
\$200 - \$500 (single family)	Fixr.com
\$550 (single family)	EPRI for SMUD
\$200/fixture (MF)	Contractor quote, north coast
\$200-\$300/fxtr. (MF)	Contractor quote, Pasadena

ELECTRIFIED COOKING IS THE CHOICE OF CHEFS: JULIA CHILD, THOMAS KELLER/FRENCH LAUNDRY, CAFÉ FISELLE, GREAT BRITISH BAKING SHOW, GUY FIERI, ANTHONY BOURDAIN

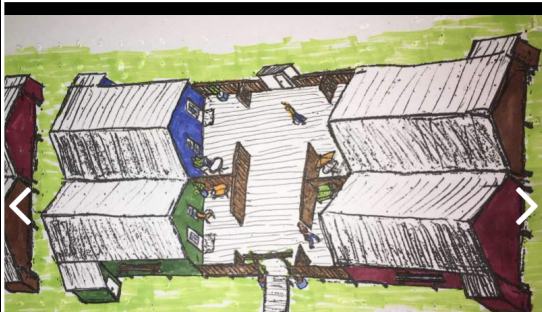


WHERE ARE WE GOING?

2015:
CELEDON,
San Diego.
BRIDGE
Housing



Sonoma County funds novel Santa Rosa tiny-house project for homeless



10 Story ZNE Tower in DC



5 Story ZNE in San Jose

Quetzal Gardens
San Jose, California

HOW CAN YOU CREATE POLICY TO SUPPORT CALIFORNIA'S DECARBONIZATION LAWS?

1. Provide single induction ranges at lending libraries like Sonoma Clean Power to support early adopters.
2. Provide and/or require more electric car charging stations
3. Provide incentives and/or adopt electrification ordinances that phase out natural gas in buildings



BUSINESS

SUBSIDIES FOR AMSTERDAM HOMEOWNERS WHO STOP USING NATURAL GAS

By Janene Pieters on August 11, 2017 - 10:10



No more gas connection for new Dutch houses

289
SHARES



QUESTIONS?



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