



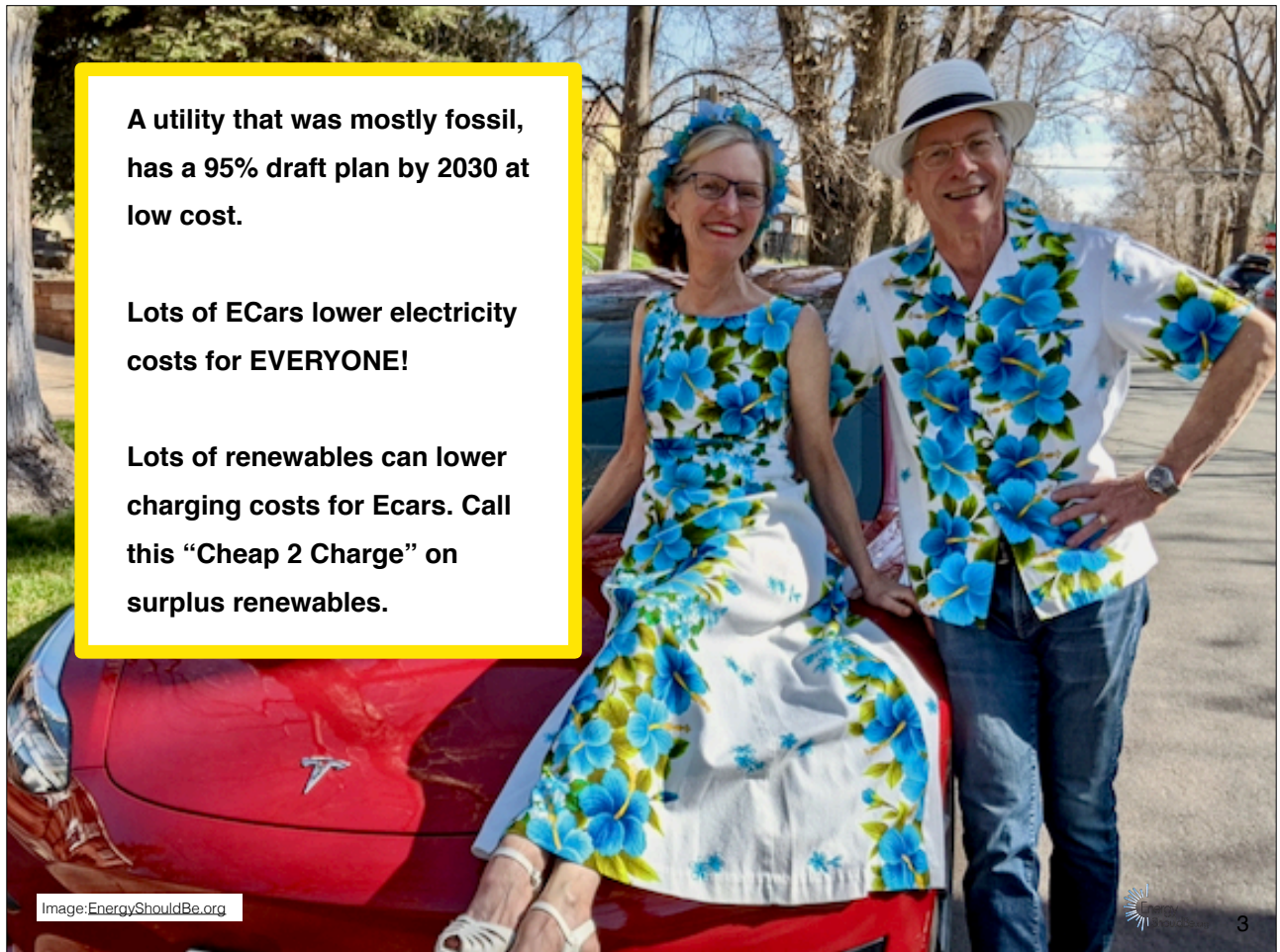
**Faster to 100% \*\* :**

**Why solar, wind, and electric cars are a perfect match**

\*\* or darn close

Ken Regelson  
April 29, 2020

Image:EnergyShouldBe.org



**A utility that was mostly fossil, has a 95% draft plan by 2030 at low cost.**

**Lots of ECars lower electricity costs for EVERYONE!**

**Lots of renewables can lower charging costs for Ecars. Call this “Cheap 2 Charge” on surplus renewables.**

Image:EnergyShouldBe.org





**Colorado Energy**

Image:EnergyShouldBe.org

**My Daughter Bakes Really Great Cakes!**  
Like most bakers, she follows a recipe.



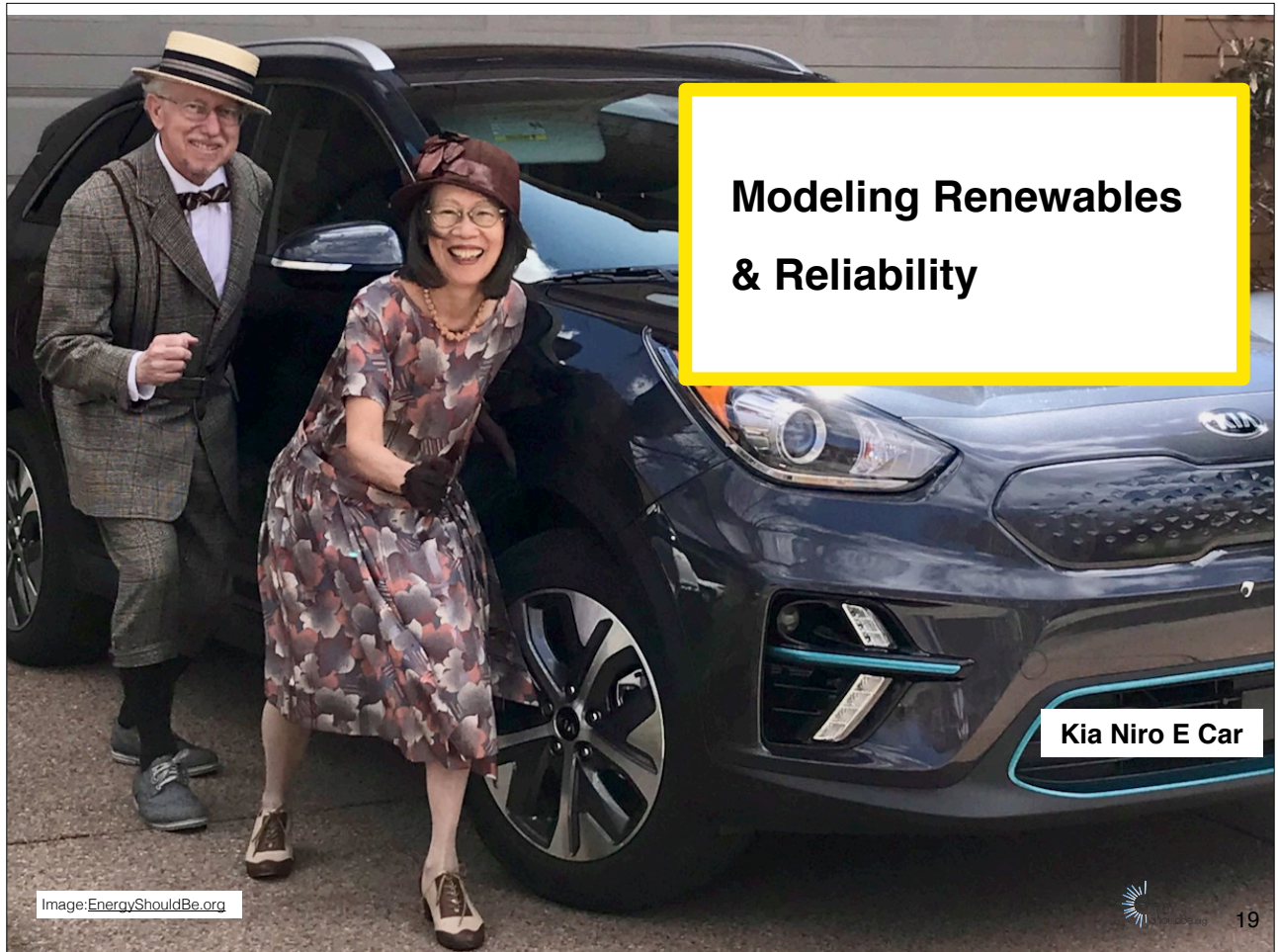
**Colorado Energy Recipe**  
1 part 100% Renewable Electricity  
1 part *Electrify All* - Everything Else

**Just Colorado - Annual**

	Colorado Climate Impact	Electricity or Fuel Cost Now Billions	Increase in electricity to <i>Electrify All</i>	Electricity Cost to <i>Electrify All</i> 10 ¢ / kWh
<b>Electricity</b> coal + fossil gas to make electricity	1/3	\$5.5 B	<i>No Change</i>	\$5.5 B 95% renewable
<b>Transportation</b> gasoline diesel	1/3	\$6.5 B	30%	\$1.8 B
<b>Comfort Heat</b> Buildings & Water fossil gas NOT used for electricity	1/3	\$1.5 B	20%	\$1.2 B
<b>Total</b>		<b>\$13.5 B</b>	<b>50%</b>	<b>\$8.5 B</b>

**\$5 Billion Savings per year!**

Notes: Most of data from 2016 EIA with analysis by EnergyShouldBe.org. The electricity use to electrify transportation is conservative. 10 cents per kWh is the blended cost of Colorado electricity. Divide EIA Table 10 all Colorado revenue by MWh Sales. The climate impact is a rough estimate based on actual CO2 output and a guess at the impact of methane leakage. The most speculative number is the electricity to electrify nat. gas use. This is based on using heat pumps with a COP of 3. Air source heat pumps are available now (2019) for Colorado at that COP.



**Modeling Renewables  
& Reliability**

Kia Niro E Car

Image:EnergyShouldBe.org

## Modeling Electric Grids and Renewables - PRPA Data

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
1	Use this model at your own risk.																										
2	Meters (use to adjust load up or down)	156,000	156,000	Meters																							
4					colorado 2,600,000 meters																						
5	Battery	2,000	2,000	MWh	Storage 17000 MW wind 10100																						
7	Hydro	90	90	MW	PV 4 to 40/200 MWh																						
9	Solar	500	500	MW	wind 1.9 c/kWh PV Stor																						
11	Wind	700	700	MW	3.8 c/kWh																						
16					PRPA 2018 About																						
17					6.5 c/kWh																						
18	Annual LOAD	3,201,193	3,201,193	MWh	For A Chart																						
19	Annual RE GENERATED	4,200,473	4,200,473	MWh	Title Calc 216																						
20	Renewables Used & Useful When Net Load > 0				A • 7.4 c/k • # of days 4																						
21	Annual RE USED	3,028,326	3,028,326	MWh	PRPA peak avg min																						
22	Annual RE USED	95%	95%	%																							
23	Annual RE OVER-GENERATED	1,172,147	1,172,147	MWh																							
24	Annual RE OVER-GENERATED	37%	37%	%																							
25	Annual HOURS CURTAILED	3846	3846	HOURS																							
26	Peak (max of load minus renewables)	449	449	MW																							
27	Annual Backup Gen. (Peaker) Usage	202818	202818	MWh																							
28	Minimum (load minus renewables)	-906	-906	MW																							
29	Energy Withdrawn From Storage	269,556	269,556	MWh																							
30	BASELOAD Generation	0	0	MW																							
31	Annual LOAD	3,201,193	3,201,193	MWh																							
32	Annual BASELOAD	0	0	MW																							
33	Net Annual LOAD - BASELOAD	3,201,193	3,201,193	MWh																							
34	Annual RE GENERATED	4,200,473	4,200,473	MWh																							
35	Renewables Used & Useful When Net Load > baseload (assum																										
36	Annual RE USED	3,028,326	3,028,326	MWh																							
37	Annual RE USED	95%	95%	%																							
38	Annual RE OVER-GENERATED	1,172,147	1,172,147	MWh																							
39	Annual RE OVER-GENERATED	37%	37%	%																							
40	Annual HOURS CURTAILED	3846	3846	HOURS																							
41	Simple Cost Model																										
42	Hydro (wght avg of WAPA CRSP & LAP	\$0.028	\$0.028	\$/kWh (PPA)																							
43	Solar (from Xcel 2017 PPAs)	\$0.023	\$0.023	\$/kWh (PPA)																							
44	Wind (From Xcel 2017 PPAs)	\$0.015	\$0.015	\$/kWh (PPA)																							
45	Battery (upfront cost)	\$0.125	\$0.125	\$/MWh (upfront cost)																							
46																											
47	Interest Rate	3.5%	3.5%	%																							
48	Term	20	20	years																							
49	Sell Excess Overgeneration at	\$0.010	\$0.010	\$/kWh																							
50	Annual Operating Expense	\$125	\$125	M\$																							
51	Cost of baseload & peaking power	\$0.015	\$0.015	\$/kWh																							
52	Loans	\$224	\$224	M\$																							
53	Transmission (all kWh. Assumes no local generation)	\$0.003	\$0.003	\$/kWh																							
54	\$/kWh blended (no separate rates residential, comm	\$0.074	\$0.074	\$/kWh																							
55																											
56																											

**Models don't predict THE FUTURE.**

They allow us to cheaply try out

**POSSIBLE FUTURES based on assumptions.**

**Microsoft Excel.**

Email Ken for a free copy

## The Data Came From...

### Cost:

Xcel Colorado  
 Platte River Power Authority - PRPA  
 EIA (DOE)

### Annual Use (Load) and Generation From PRPA:



**Platte River**  
 Power Authority

Estes Park • Fort Collins • Longmont • Loveland



Lessons learned from PRPA are general enough to apply to all Colorado, US, and with some exceptions, the world.



## Compare For and Non-Profit Self-Generators. Colorado.

	Long Term Goal	100% Renewables Goal	95% Renewables Plan	% Colorado Served Retail	Blended Rate (cents/kWh)	
<b>PRPA</b> non-profit	<b>100% non-carbon</b>	<b>2030</b>	<b>2020</b> no more cost than BAU!!!	<b>6%</b>	<b>8.0</b>	<b>Lowest Rates in CO. Excellent Reliability.</b>
<b>Xcel</b> for profit	<b>100% reduction in carbon dioxide</b>	<b>2050</b>	<b>N/A</b>	<b>54%</b>	<b>9.5</b>	<b>If Xcel charged PRPA's rates we would save about \$400 Million per year on electricity. Bigger is not better.</b>



PRPAs Goal and Plan is HISTORIC.



We need to spread the word.

I'll speak to any group of any size...



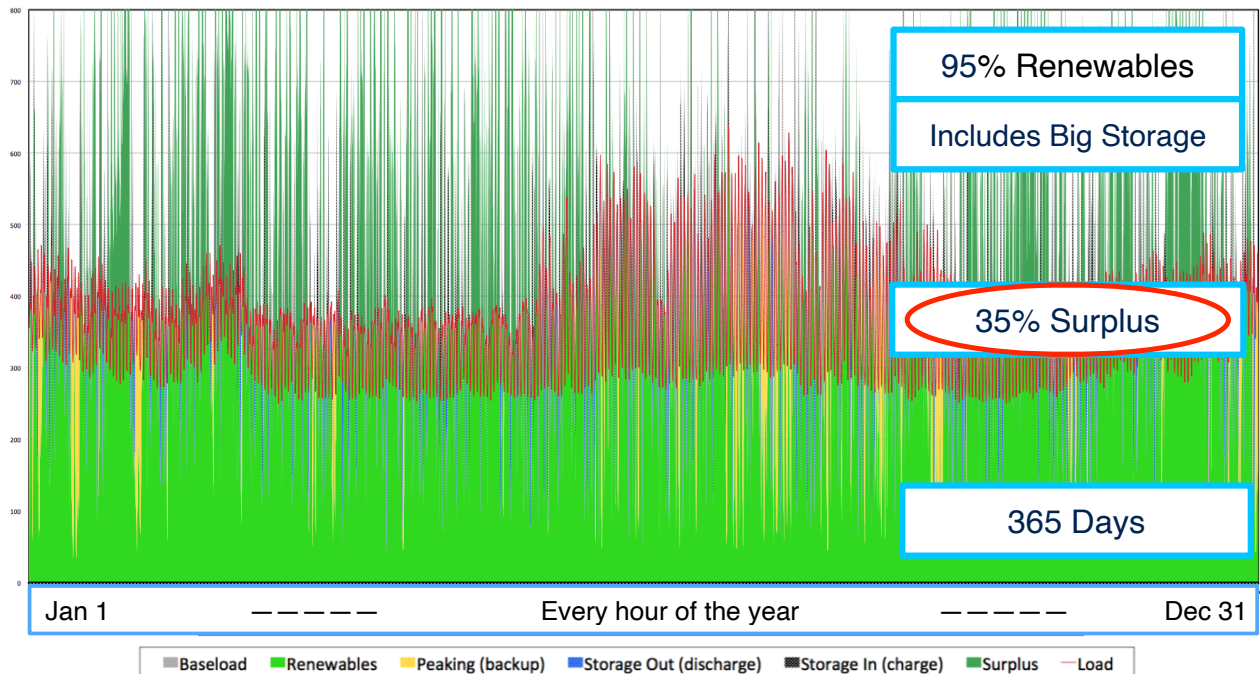
## Compare For and Non-Profit Self-Generators. Colorado.

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<b>Tri-State</b> non-profit	<b>100% Clean Energy</b>	<b>2040</b>	<b>N/A</b>	<b>15%</b>	<b>11.0</b>	
<b>Colorado Springs Muni</b> non-profit	(none)			<b>9%</b>	<b>9.2</b>	
<b>IREA</b> non-profit	(none)			<b>6%</b>	<b>12.4</b>	
<b>Black Hills</b> for profit	(none)			<b>4%</b>	<b>12.8</b>	

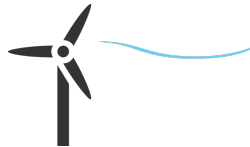
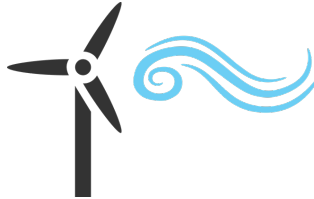
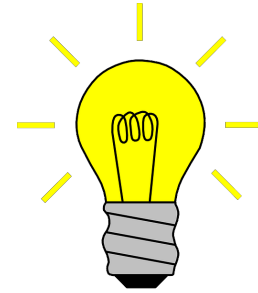
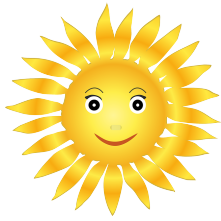
Source: EIA Table 10 2015 retail sales by utility. Blended rate for Tri-State and PRPA are a weighted average for Colorado retail utilities by MWh sales. % Colorado served is by number of customers (meters). Number of customers turns out to track well with MWh sales. "?" means data not available.



## Solar Wind Hydro & Storage



Above 30% of electricity from wind and solar there will be surplus. Why?



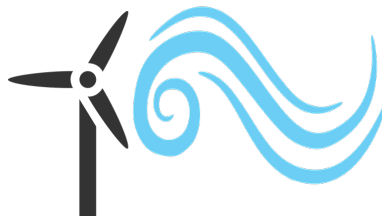
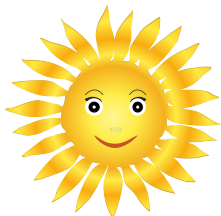
**Blackout =  
no electricity  
use!**

Images pixabay.com




29

Above 30% of electricity from wind and solar there will be surplus. Why?



**When there is lots of solar and/or  
lots of wind, and little use of  
electricity there will be surplus!**



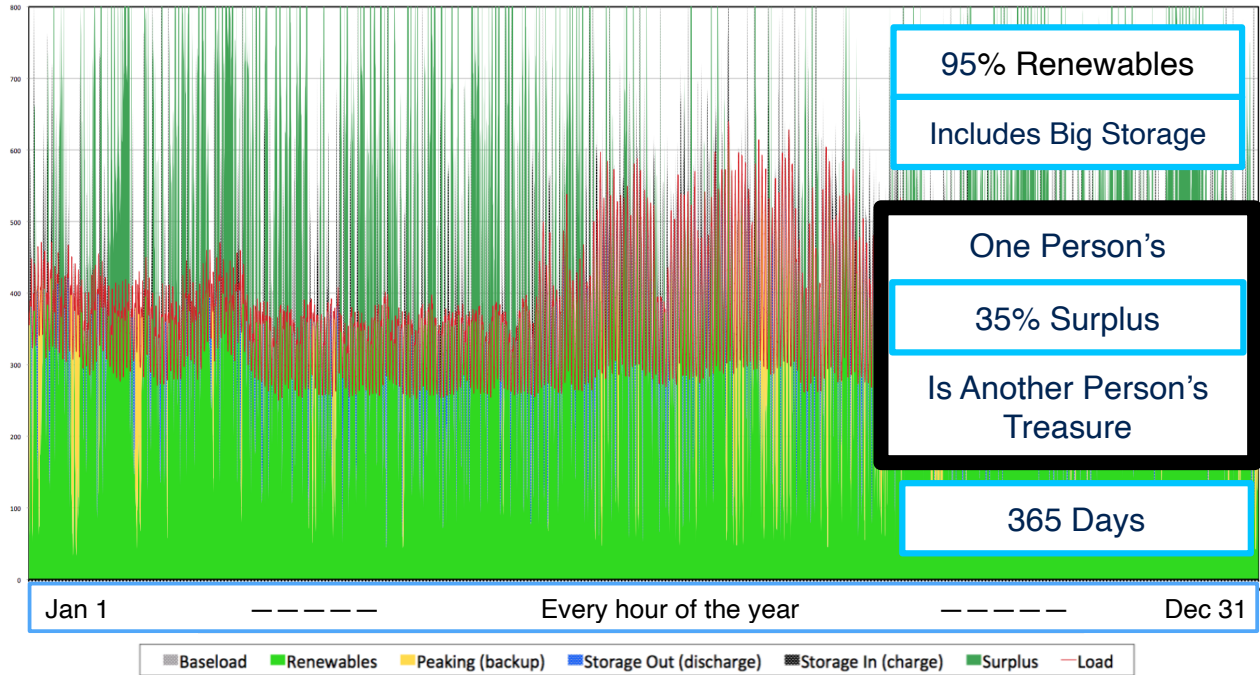
 **Selling the surplus,  
even for cheap, keeps rates low.**

Images pixabay.com

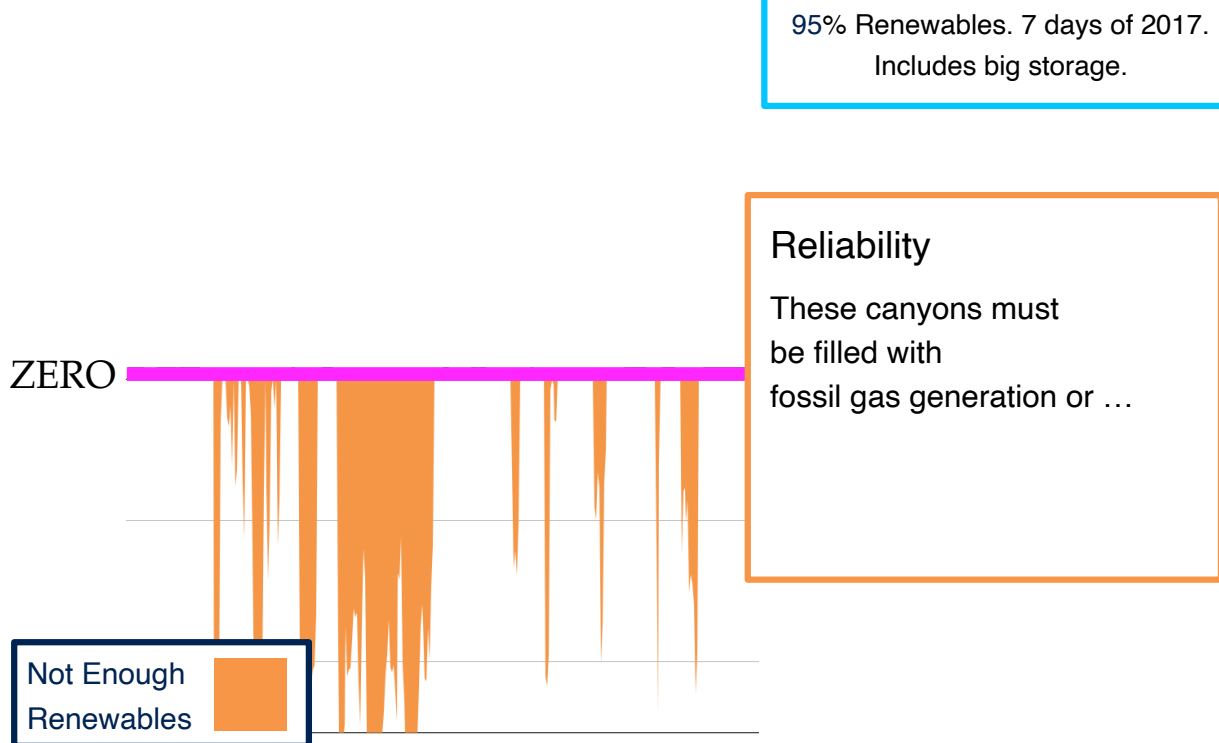


30

## Solar Wind Hydro & Storage



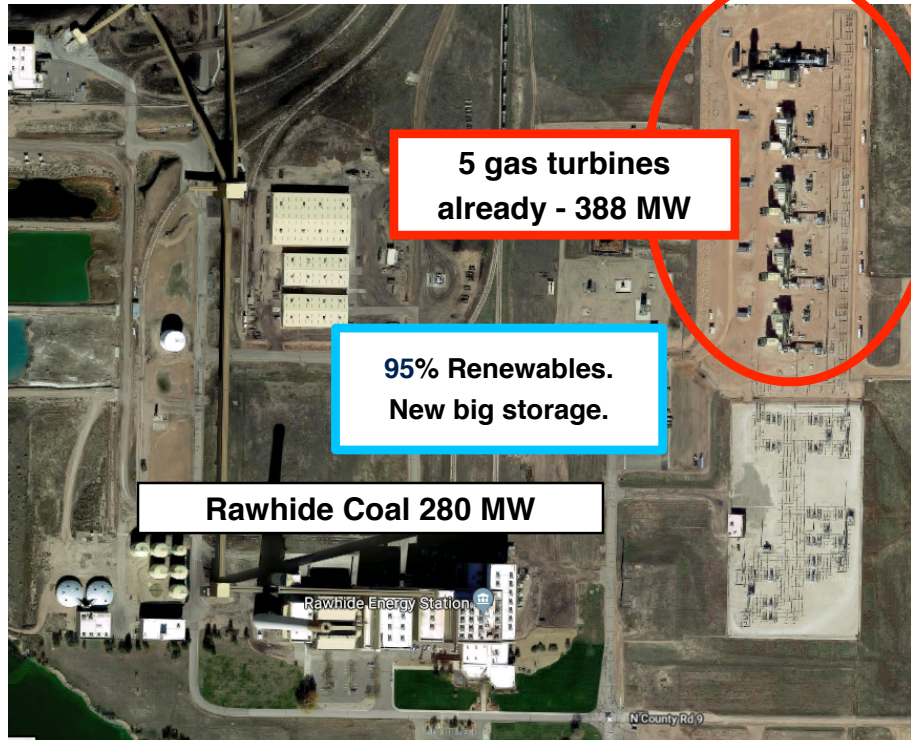
## Reliability During "Dark-Calms" at OK Cost



## Reliability: Filling in With Gas

2030 One Possibility - No Coal. 95% Renewable Hourly.

### PRPA's Rawhide Station



~~Craig Coal 154 MW~~

Image: Google Satellite View

33

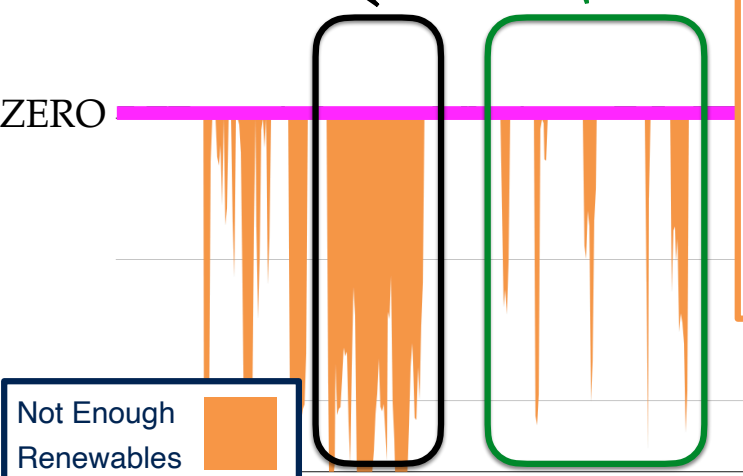
## Reliability During "Dark-Calms" at OK Cost

Grand Canyon of Dark-Calms for 2017 expensive to fill. Added storage used once or twice per year.

A Narrow canyon is low-cost to fill. Added storage used many times per year.

95% Renewables. 7 days of 2017. Includes big storage.

ZERO



Not Enough Renewables

### Reliability

These canyons must be filled with fossil gas generation or even more storage or ????. "Grand Canyons" are expensive to fill with storage.

Images: Energy Should Be 2017 data for PRPA. Chosen for "grand canyon" of dark calms. Size and number of "Grand Canyon Dark-Calms" varies year to year.





PUBLIC VERSION Updated Attachment A

RFP Responses by Technology

						Median Bid	
			# of	Project		Price or	Pricing
			Projects	MW		Equivalent	Units
			55	19	4,436	\$ 5.08	\$/kW-mo
			04	3	476	6.21	\$/kW-mo
			73	3	873	█	\$/kW-mo
			14	24	1,945	10.53	\$/kW-mo
			17	1	317	█	\$/kW-mo
	Wind	96	41,915	42	16,949	\$ 19.30	\$/MWh
	Wind and Solar	5	2,601	4	2,151	19.96	\$/MWh
	Wind with Battery Storage	11	5,700	5	2,700	20.63	\$/MWh
	Solar (PV)	148	28,382	78	14,085	30.96	\$/MWh
	Wind and Solar and Battery Storage	7	4,048	7	4,048	30.41	\$/MWh
	Solar (PV) with Battery Storage	79	14,980	57	10,098	38.30	\$/MWh

 **Eye-Poppingly low!!!**

 **Left 95% of bids on the table.**

Xcel Energy (bottom P 51) <https://www.documentcloud.org/documents/4546891-Xcel-Energy-Electric-Resource-Plan-120-Day-Report.html>

**Eye-Poppingly**  
 “The (plan) includes ~~unprecedented~~ low pricing across a range of generation technologies including wind at levelized pricing between \$11-18/MWh, solar between \$23-\$27/MWh, solar with storage between \$30-\$32/MWh...”  
 - Xcel

**In 2022, Xcel Colorado 55% Renewables**

 **Left 95% of bids on the table.**

Xcel Energy (bottom P 51) <https://www.documentcloud.org/documents/4546891-Xcel-Energy-Electric-Resource-Plan-120-Day-Report.html>

### Eye-Poppingly

“The (plan) includes ~~unprecedented~~ low pricing

**Even if you could build a new coal or gas generator for FREE, all-in new wind and solar electricity costs less.**

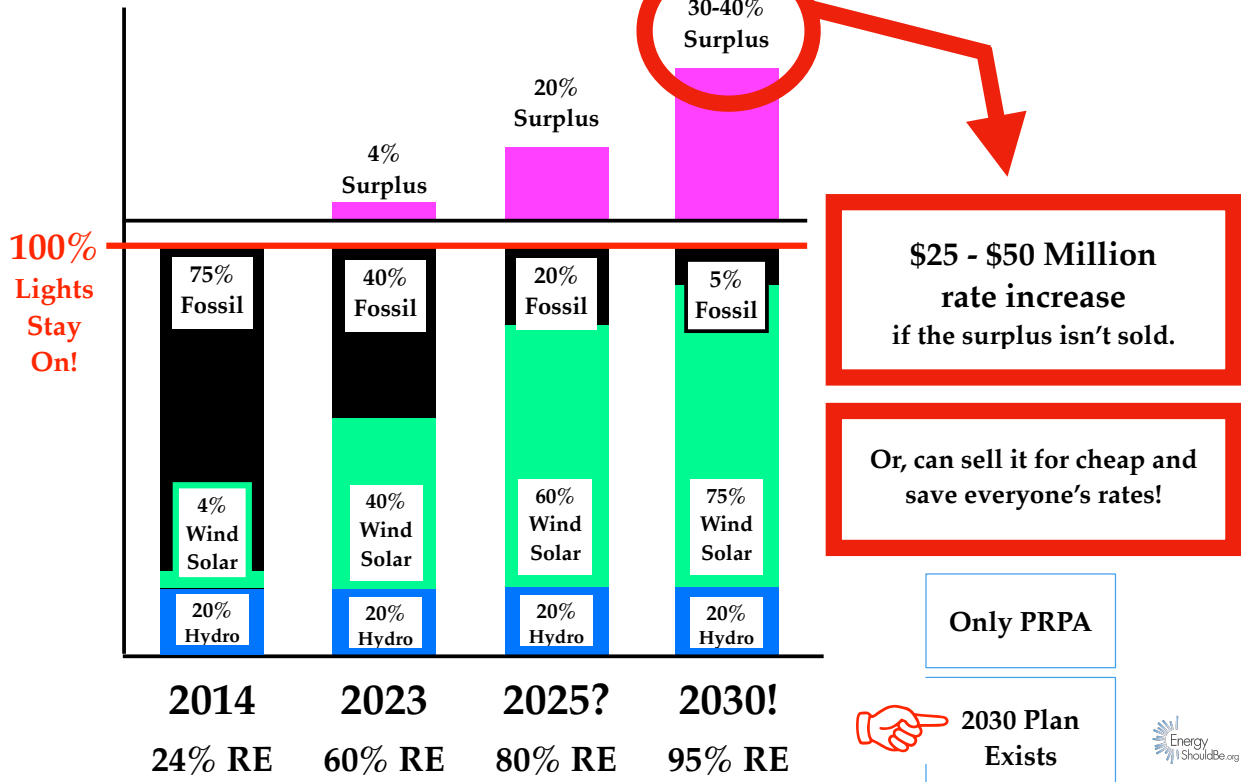
**Even existing fossil plants cost more for operations, maintenance, and fuel, than all-in new wind & solar costs.**

Xcel Energy (bottom P 51) <https://www.documentcloud.org/documents/4546891-Xcel-Energy-Electric-Resource-Plan-120-Day-Report.html>



**Selling Surplus  
For Cheap  
Lowers  
Everyone's Cost**

**For PRPA Surplus is a COST problem > 30% Variable Wind & Solar**



**Sell Surplus Renewables for Cheap to Who?**

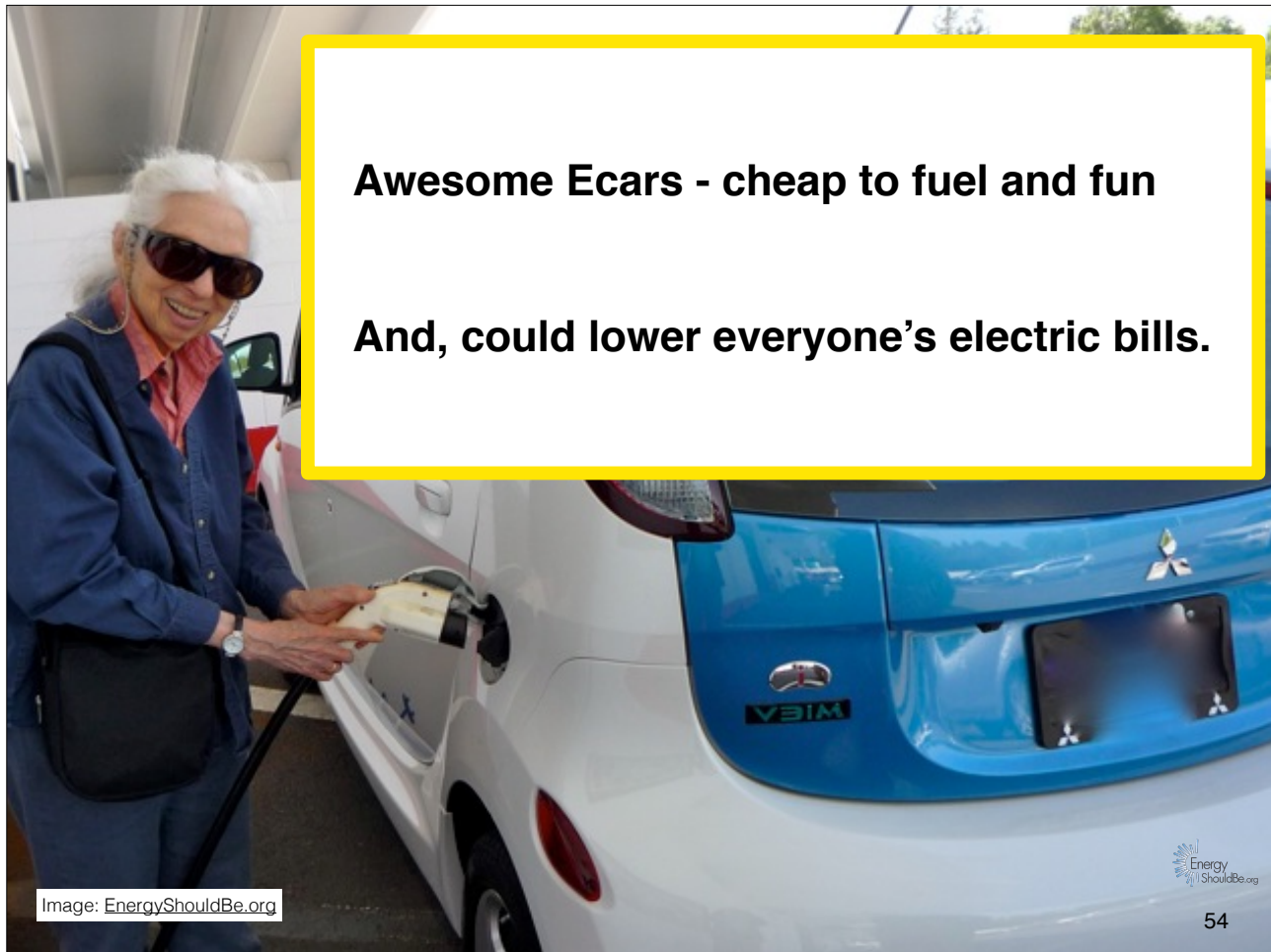
\$25 - \$50 Million rate increase if the surplus isn't sold.

Called "curtailment".  
Turning off wind & solar.

Or, can sell it for cheap and save everyone's rates!

"Sell for cheap" to who??

- Other utilities.  
**Energy Imbalance Market**
- Existing customers.
  - Business
  - Residential



**Awesome Ecars - cheap to fuel and fun**

**And, could lower everyone's electric bills.**

Image: EnergyShouldBe.org



### Ford 2019 E Car Study

**“...people vibe with electric vehicles. Looking for shock value?”**

- **Two in three people said they would pick an electric vehicle to make a good first impression on someone.**
- **Eight out of ten are down for an electric-powered date night**
- **three in four saying they'd prefer to date an electric vehicle owner. “**



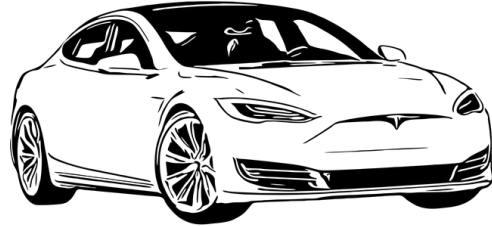
Poll: <https://media.ford.com/content/fordmedia/fna/us/en/news/2020/02/13/spark-a-new-romance-with-all-electric-mustang-mach-e.html>  
Images: pixabay.com



## 2015 Two Practical Electric Cars



**Leaf: realistic 80 mile range**



**Tesla Model S**

Images: [EnergyShouldBe.org](http://EnergyShouldBe.org) and [pixabay.com](http://pixabay.com) Tesla Image by Susrut Mishra from [pixabay.com](http://pixabay.com)



## 2019 Five E Cars at Lower Cost - 220 Miles Range or More



**Chevy Bolt**



**Tesla Model 3**



**Kia Niro E Car**

**Nissan Leaf**



**Hyundai Kona E Car**

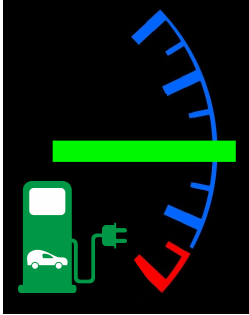
Images: [EnergyShouldBe.org](http://EnergyShouldBe.org) and [pixabay.com](http://pixabay.com) Kona Image by [mikenr1](http://mikenr1) from [Pixabay](http://Pixabay)



**Ecar Charging Modeling Assumptions**  
**“Cheap 2 Charge from Surplus” Program**

240 miles of Range

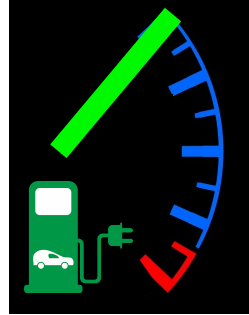
*Always Wake to*  
**120 Miles (50%)**



**Cheap 2 Charge**

*“Fill Er Up!”*

**240 Miles (100%)**



Can override for a  
 full charge.

average 30 miles per day

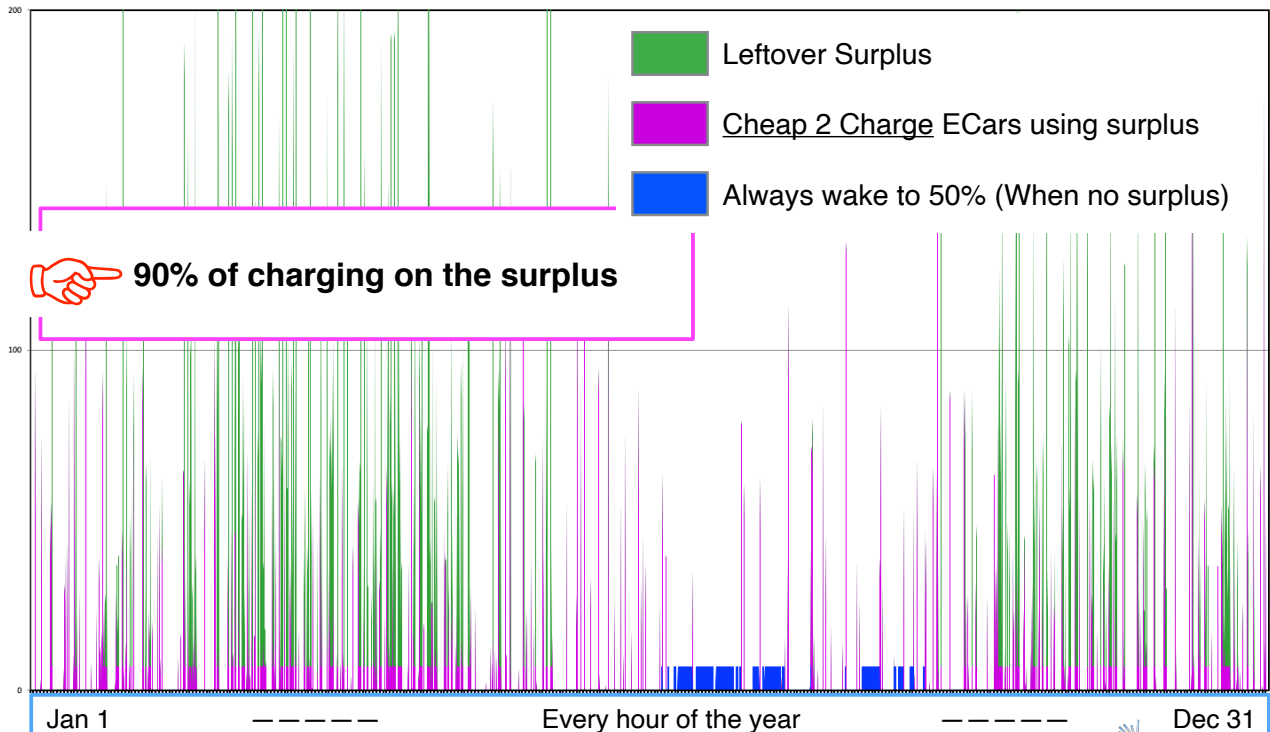
Images: pixabay.com



**Rewarding Flexible Use of Surplus Electricity**

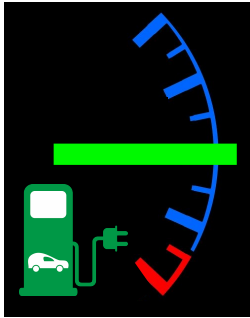
**Wind & solar PRPA 2023.**

**60% Renewable. 20,000 Plug-ins.**

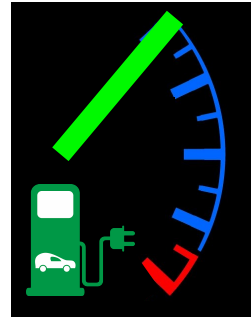


**Ecar Charging Modeling Assumptions**  
**“Cheap 2 Charge from Surplus” Program**

*Always Wake to*  
**120 Miles (50%)**



**Cheap 2 Charge**  
**“Fill Er Up!”**  
**240 Miles (100%)**



120 miles of additional range when full  
 4 days from Full to Half at 30 miles per day

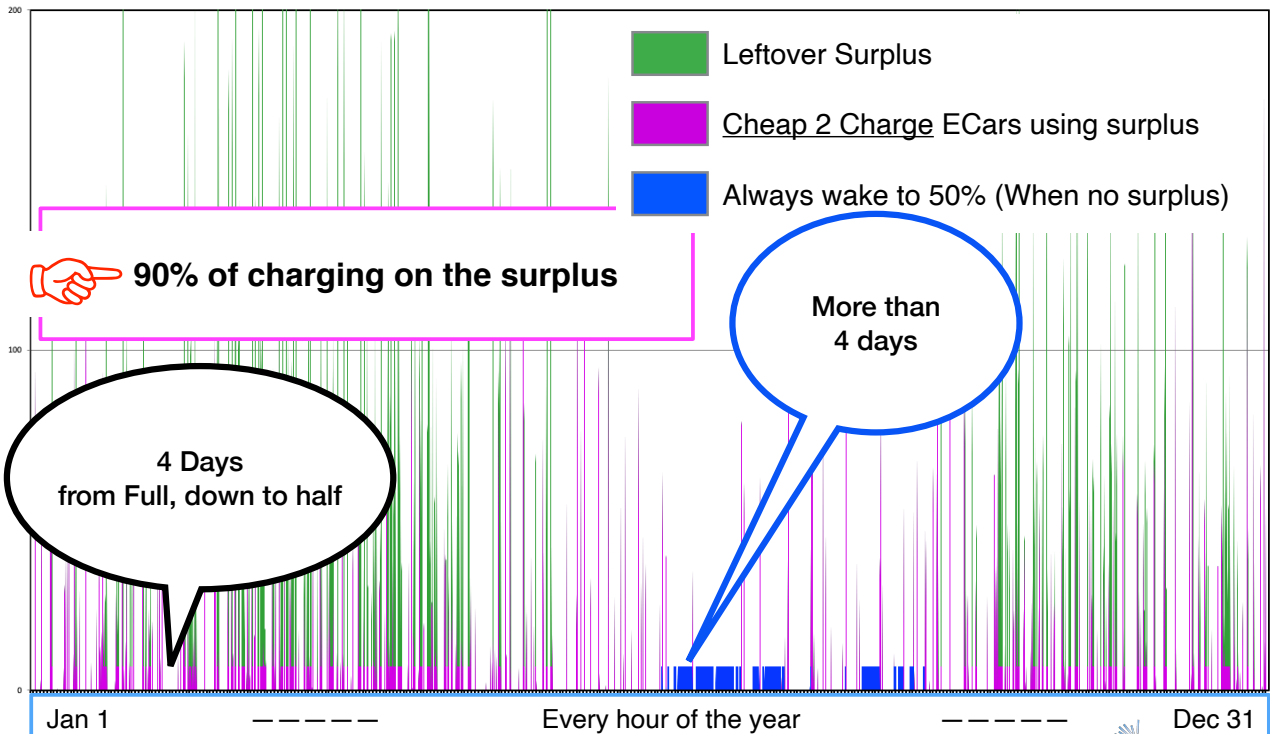
Images: pixabay.com



**Rewarding Flexible Use of Surplus Electricity**

**Wind & solar PRPA 2023.**

**60% Renewable. 20,000 Plug-ins.**

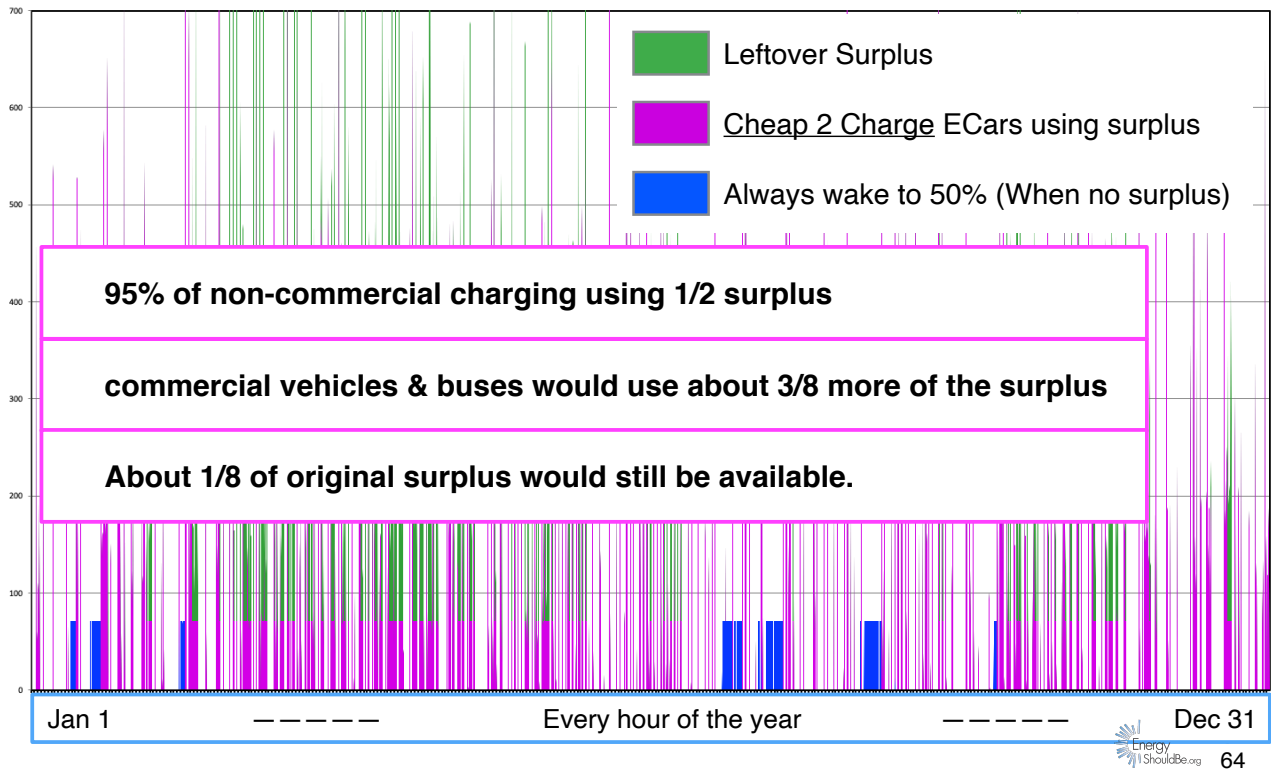




## Rewarding Flexible Use of Surplus Electricity

Wind & solar PRPA 2030.

95% Renewable. 200,000 Plug-ins.



**Do Ecar chargers exist today that allow charging when the sun is shining or wind blowing?**


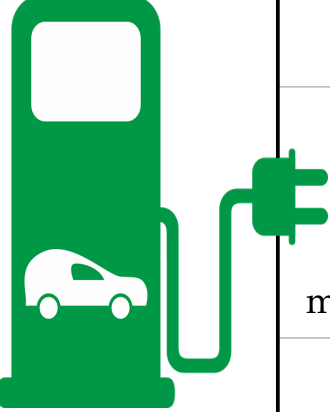
**When surplus electricity?**

**Cheap 2 Charge?**

- Yes
- Almost
- No



## Ecar Fuel Savings per Year

	Cost per mile	15,000 miles per year	Savings per year
	10 ¢	\$1,500	-
	US residential rate 3.5 ¢	\$500	\$1,000
	On Surplus <i>Cheap 2 Charge</i> 1 ¢ most of year, then 3.5 ¢	\$200	\$1,300
	FREE	FREE	\$1,500

Images: [pixabay.com](http://pixabay.com)

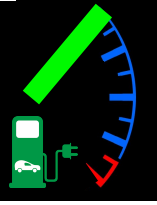


10¢ per mile gasoline is at \$3.00 / gallon and 30 MPG.

Electricity at national average 12 ¢ per kWh and an Ecar at 3.5 miles per kWh. 1 ¢ per mile is about 3 ¢ per kWh electricity.



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## Best Choice to Use the Surplus. Storage & Impact. Just PRPA.

	How Used <i>Storage lasts...</i>	Energy Use per day per car...	Impact per year
	Electric car <i>4 days.</i>	30 miles about 9 kWh/day	270,000 vehicles. Roughly <b>30%</b> of total electricity use all transportation - commercial and residential.
	Hot water heater. <i>1 - 2 days.</i>	3 people 6/kWh/day for electric resistance. Heat pumps use less - about half to a third.	110,000 homes. Roughly <b>8%</b> of total electricity use.
	Pre heat/cool home or business. <i>A few hours.</i>	TBD	TBD

Images: [pixabay.com](http://pixabay.com)



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## Not Just Us Saying Cheap 2 Charge is Good For ALL



# New Report Shows Electric Vehicles = Lower Bills for All

By Fresh Energy | November 25, 2019

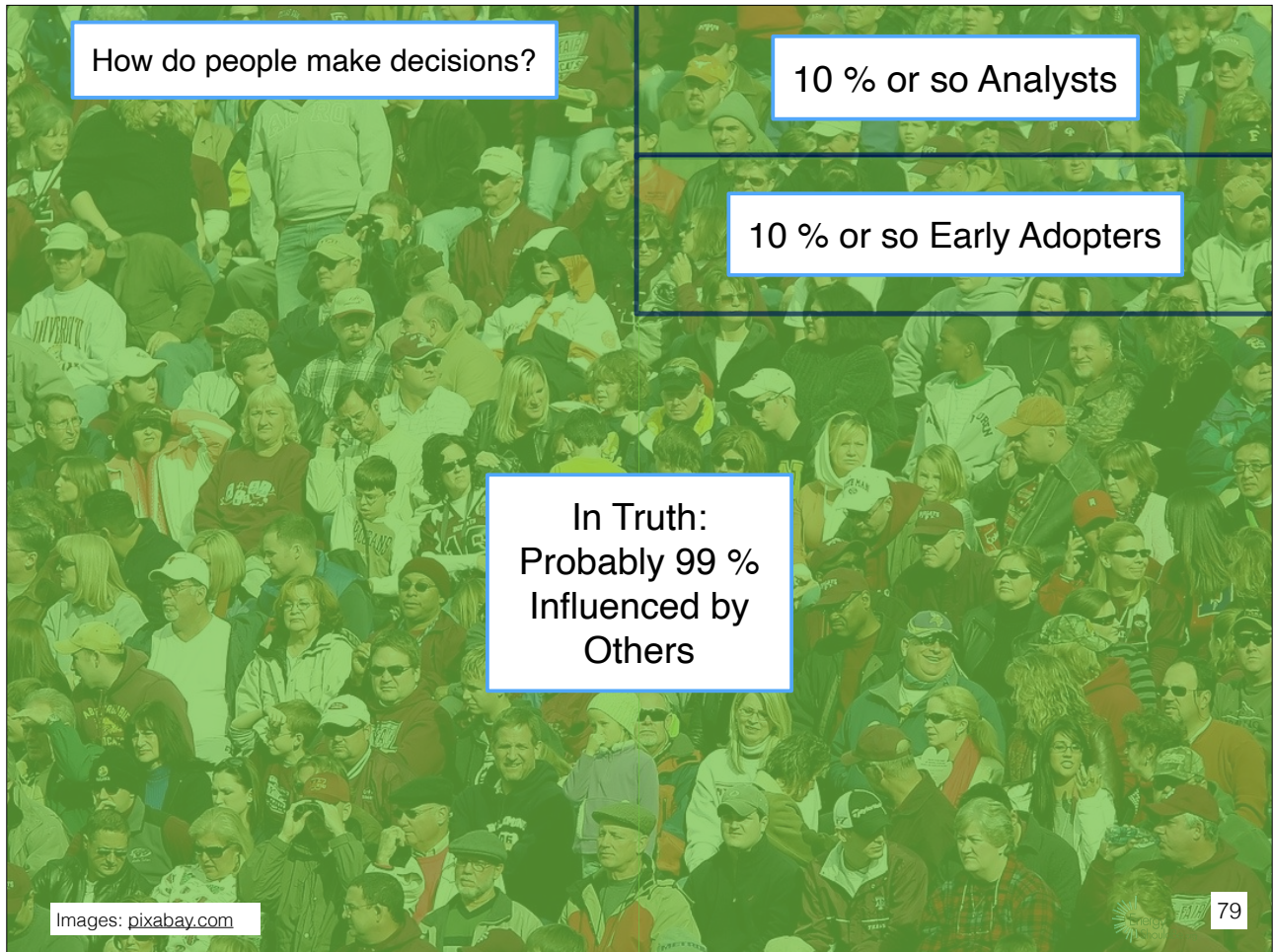
⋮  
The report shows that ... rate policies ... maximizing **off-peak** vehicle charging... residential utility customers in Minnesota could save as much as **\$71 per year** on their electricity bills.

 Our modeling shows “off-peak” is good.  
“On surplus” is better.

Our emphasis added. <https://fresh-energy.org/new-report-shows-electric-vehicles-lower-bills-for-all/>



Image: EnergyShouldBe.org



**Hyundai Kona's available for sale in Colorado.**

**Which one gasoline? Which is an Ecar?**



**Removable adhesive bumper stickers or magnets.**

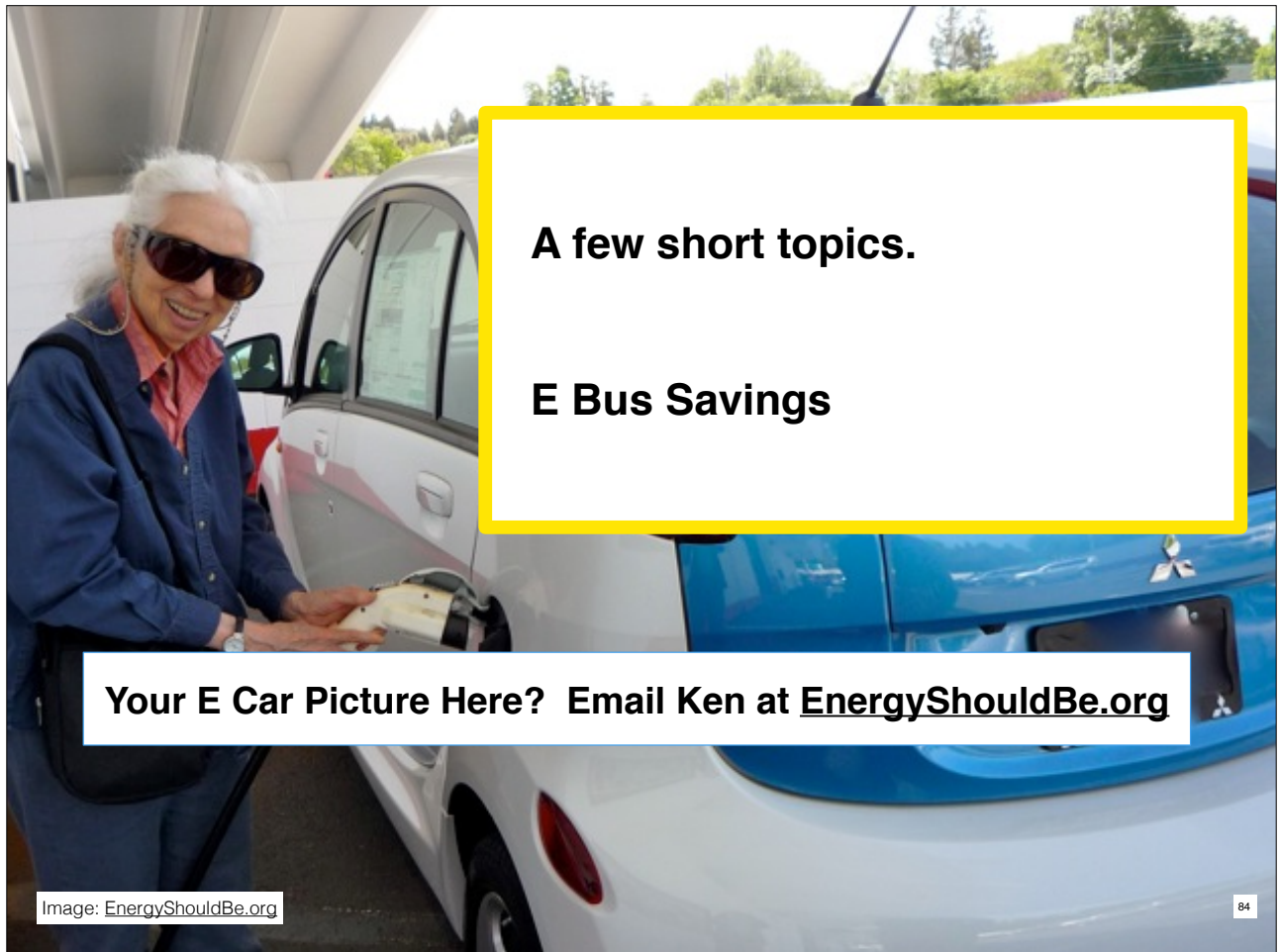
**ECAR♥.ORG**

 **PLUG INTO**  + 

**ECAR♥.ORG**

**MY NEXT CAR PLUGS IN**

82



**A few short topics.**

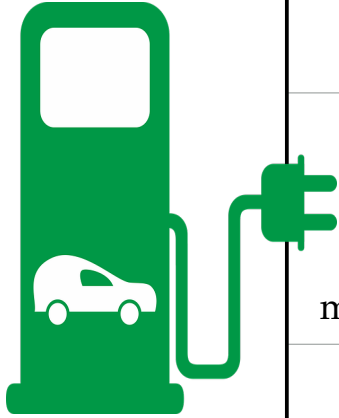
**E Bus Savings**

**Your E Car Picture Here? Email Ken at [EnergyShouldBe.org](mailto:Ken@EnergyShouldBe.org)**

## Transit Bus Fuel Savings per Year



Cost per mile	34,000 miles per year	Savings per year
46 ¢	\$16,000	-
13 ¢	\$4,500	<b>\$11,500</b>
On Surplus <i>Cheap 2 Charge</i> 4 ¢ most of year, then 13 ¢	\$2,000	\$14,000
FREE	FREE	\$16,000



Images: pixabay.com

46¢, 13¢ from <http://swenergy.org/new-xcel-energy-rate-could-speed-rtd's-purchase-of-electric-buses-> using Xcel's proposed rate for 13¢. 34,000 miles per year from <https://afdc.energy.gov/data/10309>

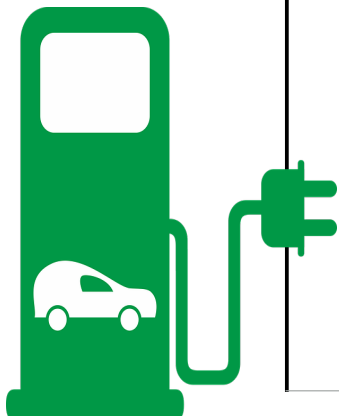


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## Transit Bus Maintenance Savings per Year



Cost per mile	34,000 miles per year	Savings per year
\$1.53	\$52,000	-
\$0.55	\$19,000	<b>\$33,000</b>



Images: pixabay.com

\$1.53 and \$0.55 from <https://www.publicpower.org/periodical/article/electric-buses-mass-transit-seen-cost-effective> 34,000 miles per year from <https://afdc.energy.gov/data/10309>



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**Using Less Fossil Gas  
Increases Fixed Costs**

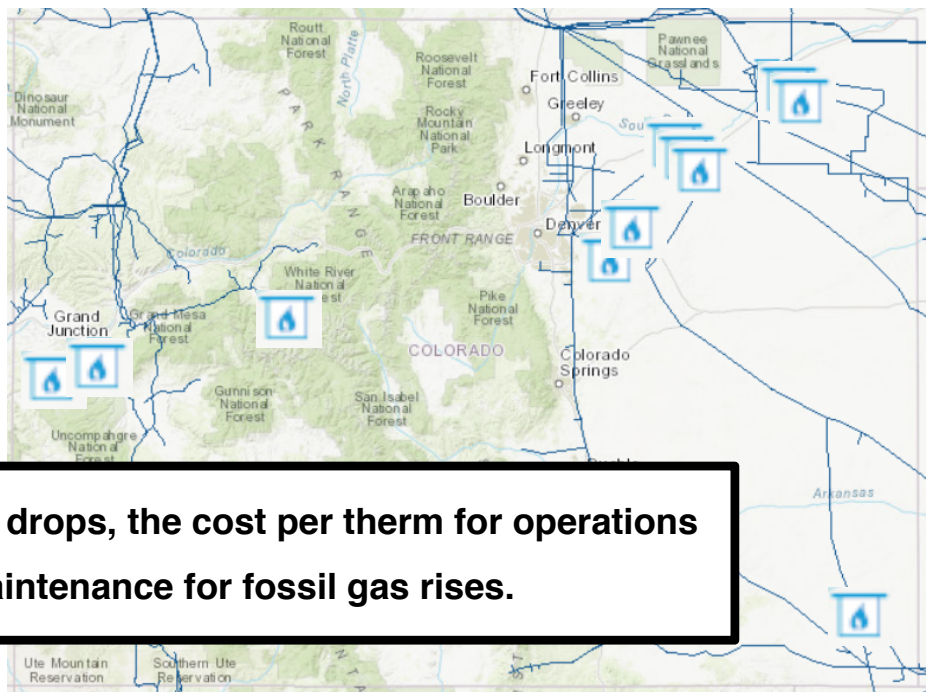
**Tesla  
Model 3**

Image: EnergyShouldBe.org

Energy  
ShouldBe.org

As we use less and less...  
What happen\$ to fossil ga\$ pipeline\$ and \$torage Costs?

**Storage**



**As use drops, the cost per therm for operations  
and maintenance for fossil gas rises.**

Source: EIA map <https://www.eia.gov/state/maps.php?v=Natural%20Gas>

Energy  
ShouldBe.org

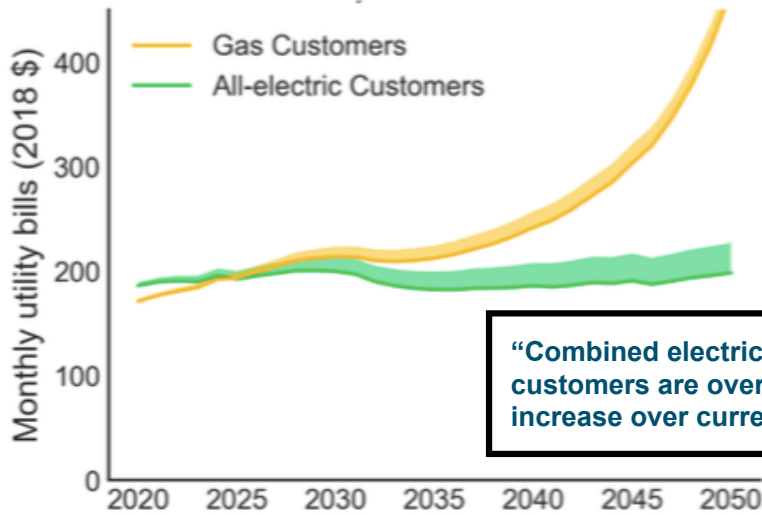
# California Gas Future Study



Energy+Environmental Economics

## Draft Results: Future of Natural Gas Distribution in California

**High Building Electrification Scenario:  
Bill Impacts with targeted gas pipeline retirements**



“Combined electric and gas bills for remaining gas customers are over \$490/month in 2050, a 2.5X increase over current bills “



## For ALL Colorado: Is There Enough Renewables?

PUBLIC VERSION Updated Attachment A

RFP Responses by Technology

Generation Technology	# of		Project	Project	Median Bid	
	Bids	Bid MW			Price or	Pricing
			MW	Equivalent	Units	
Combustion Turbine/IC Engines	29	6,365	19	4,436	\$ 5.08	\$/kW-mo
Combustion Turbine with Battery Storage	7	804	3	476	6.21	\$/kW-mo
Gas-Fired Combined Cycles	3	873	3	873	█	\$/kW-mo
Stand-alone Battery Storage	28	2,144	24	1,945	10.53	\$/kW-mo
Compressed Air Energy Storage	1	317	1	317	█	\$/kW-mo
Wind	96	41,915	42	16,949	\$ 19.30	\$/MWh
Wind and Solar	5	2,601	4	2,151	19.96	\$/MWh
Wind with Battery Storage	11	5,700	5	2,700	20.63	\$/MWh
Solar (PV)	148	28,382	78	14,085	30.96	\$/MWh
Wind and Solar and Battery Storage	7	4,048	7	4,048	30.41	\$/MWh
Solar (PV) with Battery Storage	79	14,980	57	10,098	38.30	\$/MWh



**Using Only “Wind” & “PV + storage” -->  
All Colorado: 95% Renewable. 60% Surplus.**







Image: EnergyShouldBe.org

## Energy Imbalance Markets Will Not Work All the Time

### Surplus is a COST problem > 50% Renewables

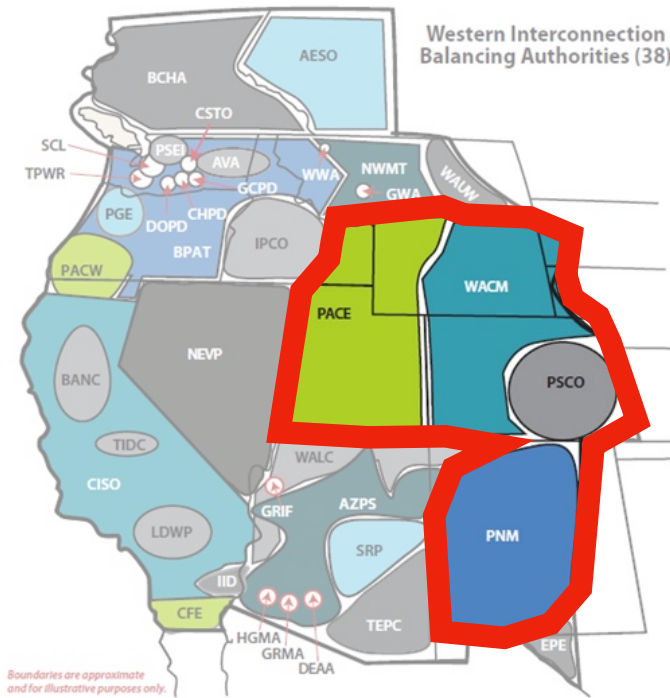
**\$25 - \$50 Million  
rate increase  
if the surplus isn't sold.**

**Or, can sell it for cheap and  
save everyone's rates!**

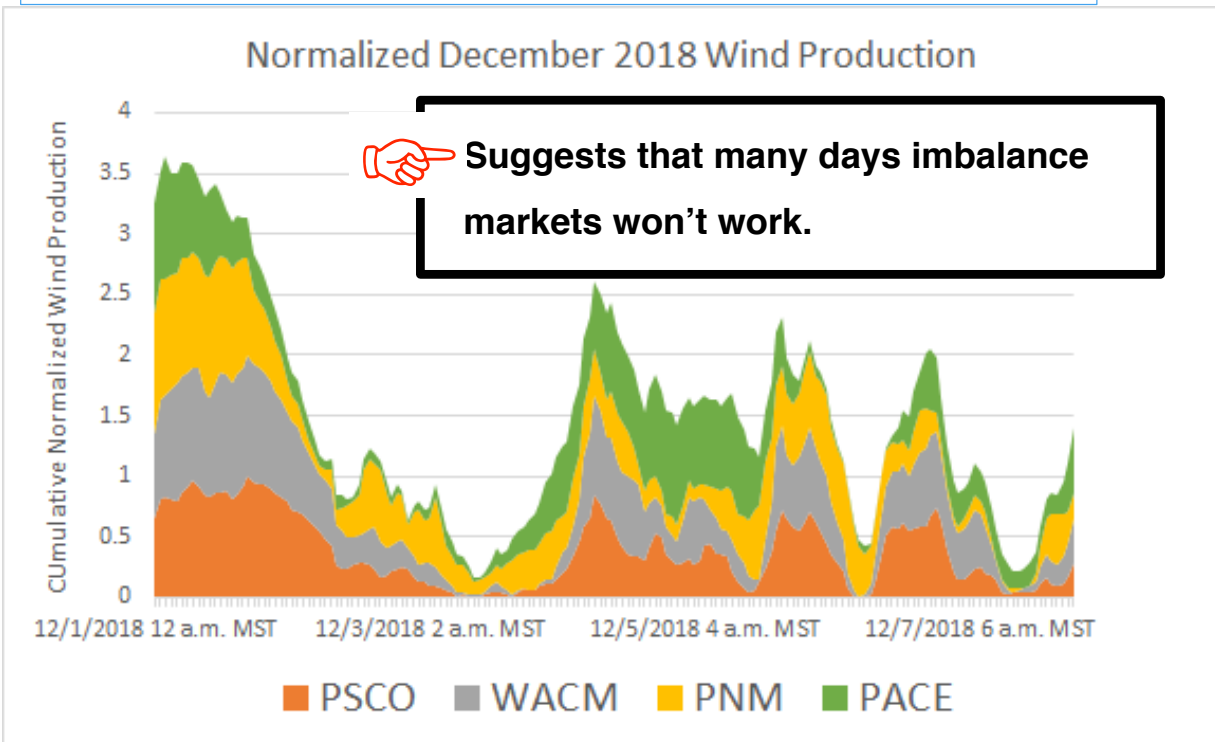
“Sell for cheap” to who??

- Other utilities.
- **Energy Imbalance Market**
- Existing customers.

## 4 Neighboring Balancing Authorities



## 7 Days. Just Wind. 4 Neighboring Balancing Authorities



## Surplus is a COST problem > 30% Variable Wind & Solar

Or, can sell it for cheap and save everyone's rates!

“Sell for cheap” to who??

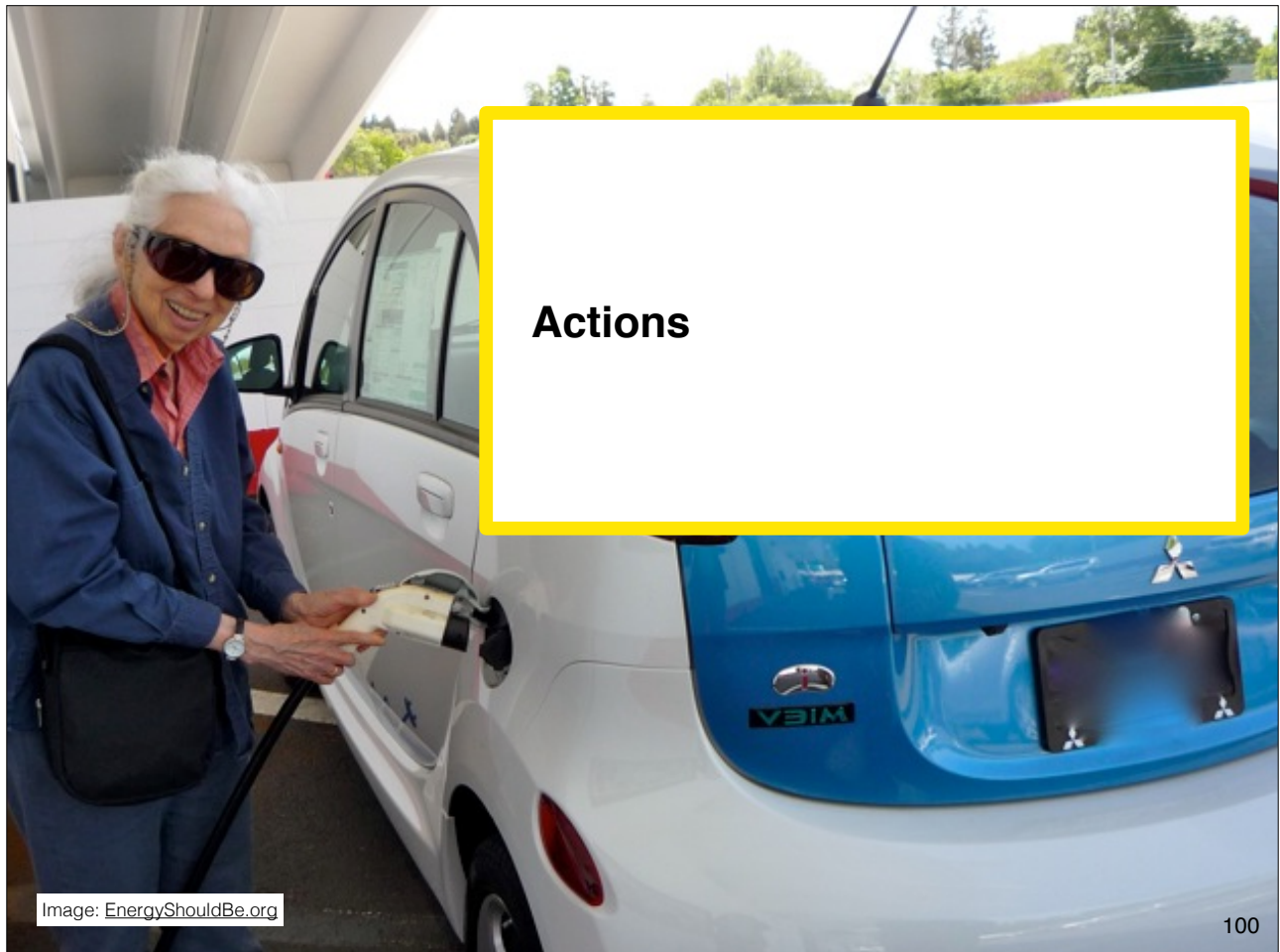
- Other utilities.  
Energy Imbalance Market
- Existing customers.

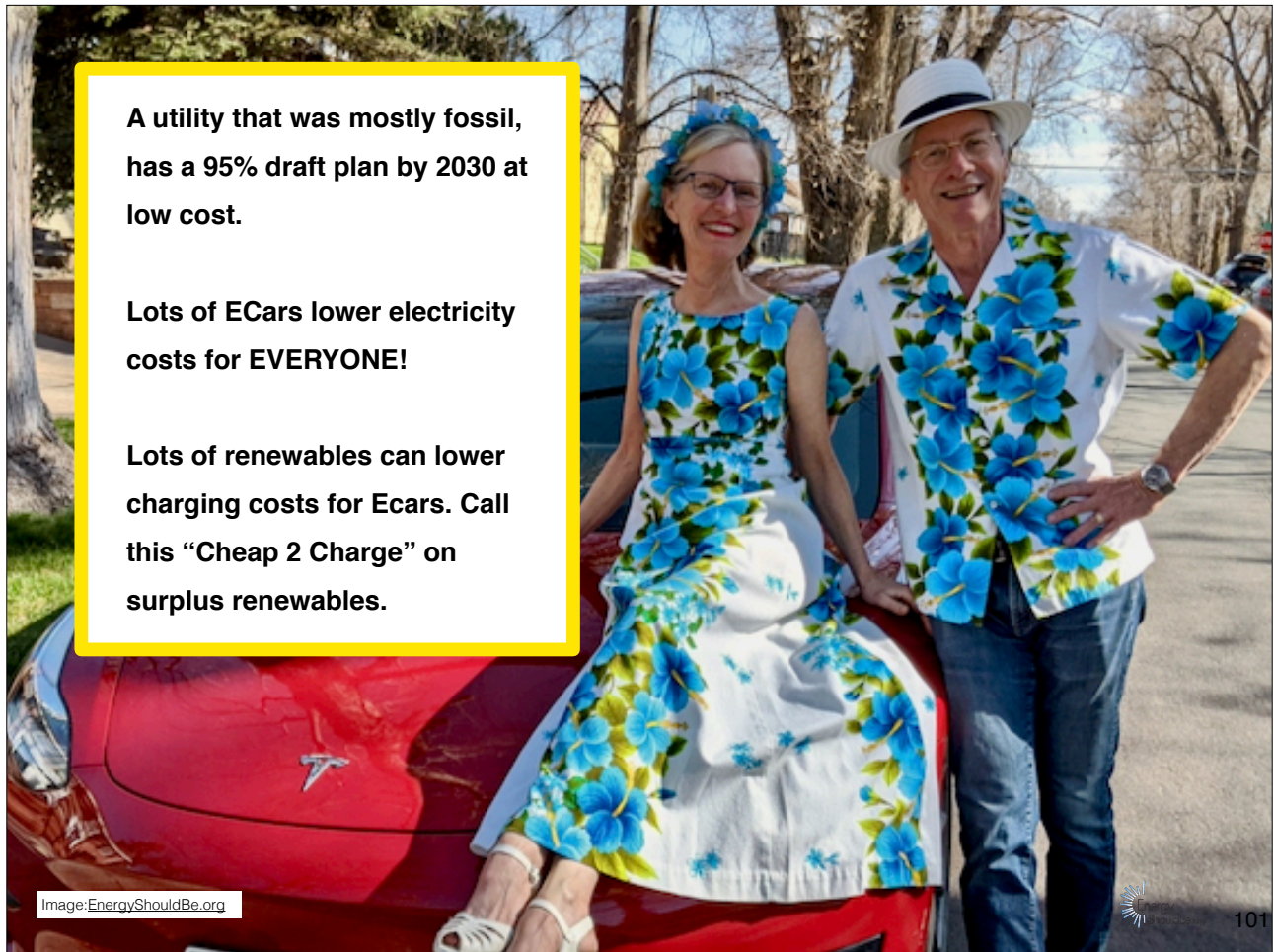


Which one? Probably “Do Both!”

And.

Be extremely skeptical of high cost projects to implement either.  
(e.g. New Transmission)





**A utility that was mostly fossil, has a 95% draft plan by 2030 at low cost.**

**Lots of ECars lower electricity costs for EVERYONE!**

**Lots of renewables can lower charging costs for Ecars. Call this “Cheap 2 Charge” on surplus renewables.**

Image:EnergyShouldBe.org



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## Actions

- Ask everyone “If PRPA has a PLAN to get 95% by 2030 at lower rates than Xcel, why can’t all electric companies?” Tell them: “This is historic!”
- Offer them a talk by Ken on 100% or darn close renewables.
- Test drive an E Car. Tell everyone: “my next car will plug-in!”
- Send fun plug-in pics to Ken.
- Email Ken at [EnergyShouldBe.org](mailto:EnergyShouldBe.org) for a bumper sticker.
- Tell everyone “I want Cheap 2 Charge - sell surplus renewables cheaply to customers first, then other utilities”
- Tell everyone: “Anything that doesn’t support maximum use of cheap renewables, perpetuates expensive fossils.”
  - TOR, not TOU. (Time Of Renewables, not Time Of Use).

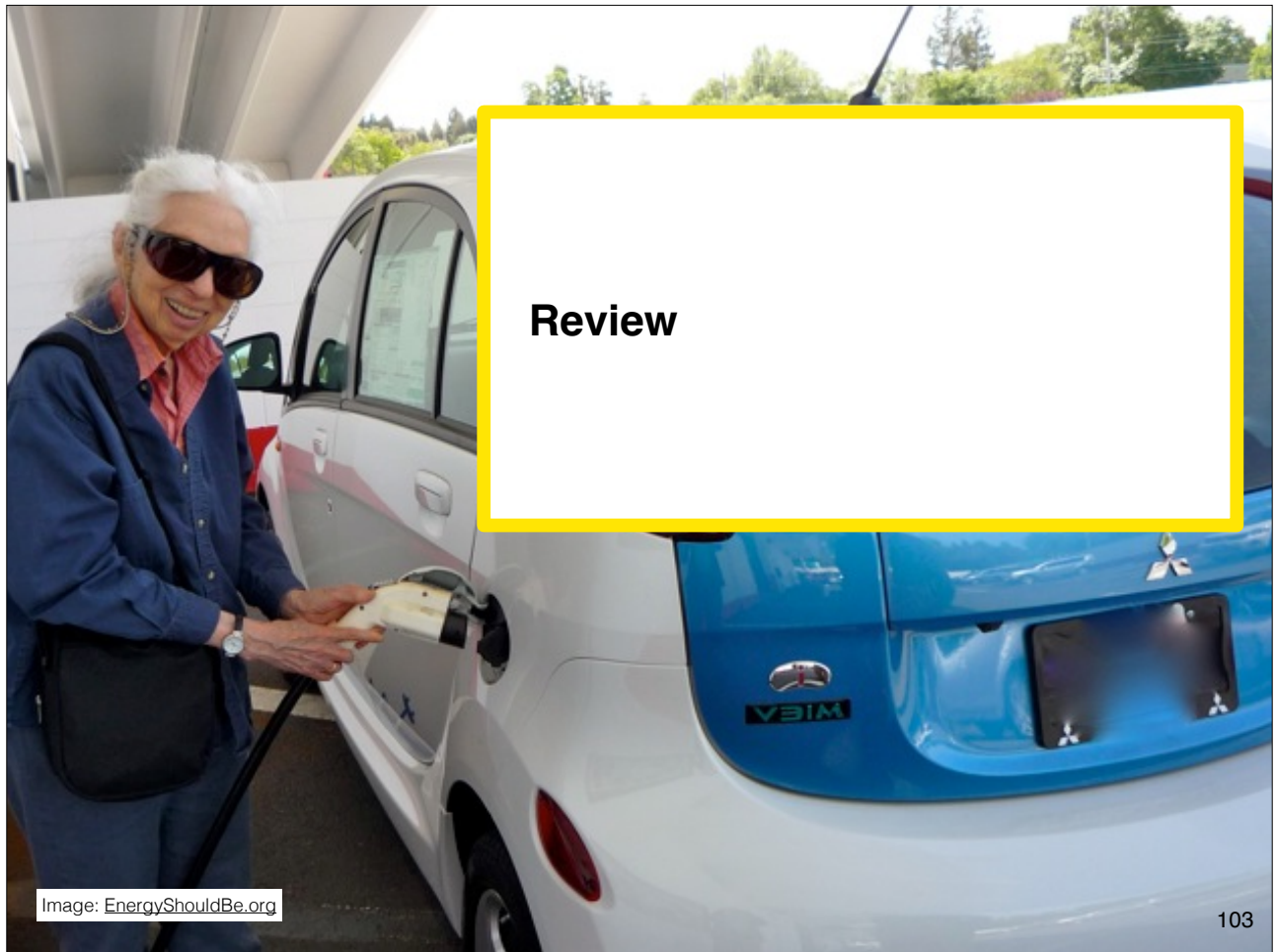


Image: EnergyShouldBe.org

### My Daughter Bakes Really Great Cakes!

Like most bakers, she follows a recipe.



### Colorado Energy Recipe

- 1 part 100% Renewable Electricity
- 1 part *Electrify All* - Everything Else

#### Just Colorado - Annual

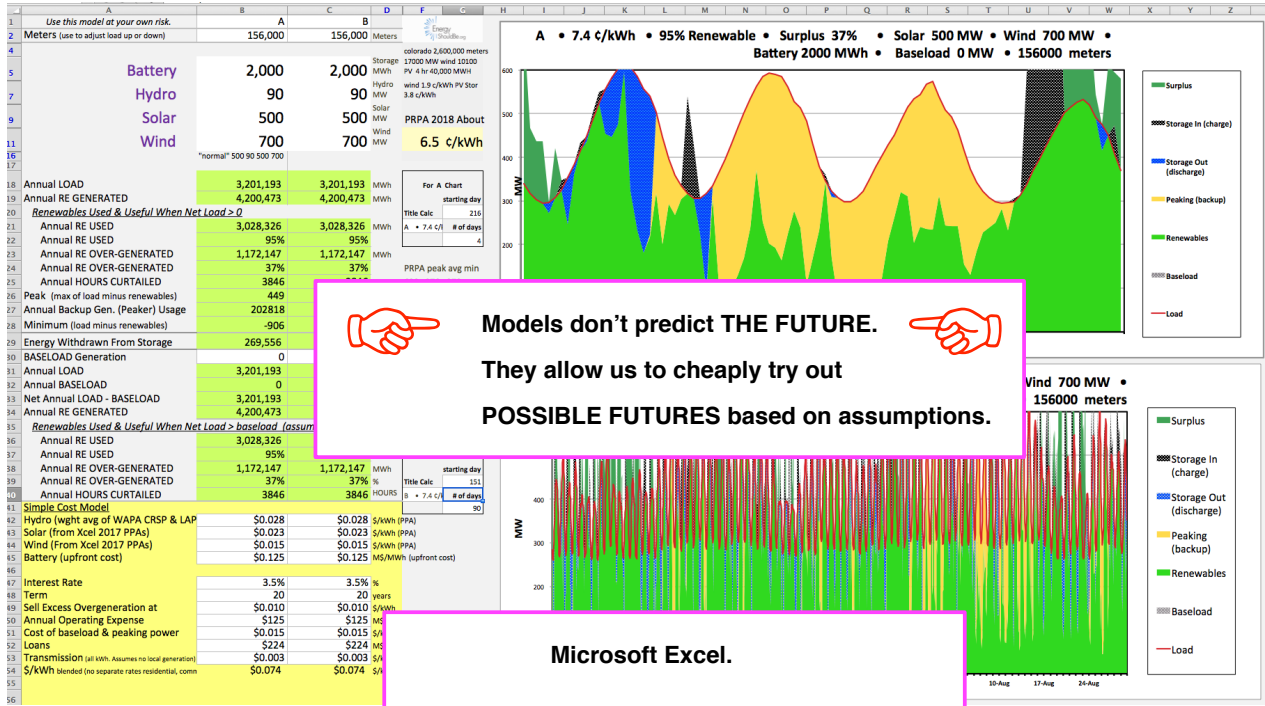
	Colorado Climate Impact	Electricity or Fuel Cost Now Billions	Increase in electricity to <i>Electrify All</i>	Electricity Cost to <i>Electrify All</i> 10 ¢ / kWh
<b>Electricity</b> coal + fossil gas to make electricity	1/3	\$5.5 B	<i>No Change</i>	\$5.5 B 95% renewable
<b>Transportation</b> gasoline diesel	1/3	\$6.5 B	30%	\$1.8 B
<b>Comfort Heat</b> Buildings & Water fossil gas NOT used for electricity	1/3	\$1.5 B	20%	\$1.2 B
<b>Total</b>		<b>\$13.5 B</b>	<b>50%</b>	<b>\$8.5 B</b>

**\$5 Billion Savings per year!**

Notes: Most of data from 2016 EIA with analysis by EnergyShouldBe.org. The electricity use to electrify transportation is conservative. 10 cents per kWh is the blended cost of Colorado electricity. Divide EIA Table 10 all Colorado revenue by MWh Sales. The climate impact is a rough estimate based on actual CO2 output and a guess at the impact of methane leakage.

The most speculative number is the electricity to electrify nat. gas use. This is based on using heat pumps with a COP of 3. Air source heat pumps are available now (2019) for Colorado at that COP.

# Modeling Electric Grids and Renewables - PRPA Data



Models don't predict THE FUTURE. They allow us to cheaply try out POSSIBLE FUTURES based on assumptions.

Microsoft Excel.  
Email Ken for a free copy



## Compare For and Non-Profit Self-Generators. Colorado.

	Long Term Goal	100% Renewables Goal	95% Renewables Plan	% Colorado Served Retail	Blended Rate (cents/kWh)	
<b>PRPA non-profit</b>	<b>100% non-carbon</b>	<b>2030</b>	<b>2020 no more cost than BAU!!!</b>	<b>6%</b>	<b>8.0</b>	<b>Lowest Rates in CO. Excellent Reliability.</b>
<b>Xcel for profit</b>	<b>100% reduction in carbon dioxide</b>	<b>2050</b>	<b>N/A</b>	<b>54%</b>	<b>9.5</b>	<b>If Xcel charged PRPA's rates we would save about \$400 Million per year on electricity. Bigger is not better.</b>

PRPAs Goal and Plan is HISTORIC.  
We need to spread the word.  
I'll speak to any group of any size...

If Xcel charged PRPA's rates we would save about \$400 Million per year on electricity. Bigger is not better.

Source: EIA Table 10 2015 retail sales by utility. Blended rate for Tri-State and PRPA are a weighted average for Colorado retail utilities by MWh sales. % Colorado served is by number of customers (meters). Number of customers turns out to track well with MWh sales. "?" means data not available.




Above 30% of electricity from wind and solar there will be surplus. Why?



When there is lots of solar and/or lots of wind, and little use of electricity there will be surplus!



 Selling the surplus, even for cheap, keeps rates low.

Images pixabay.com



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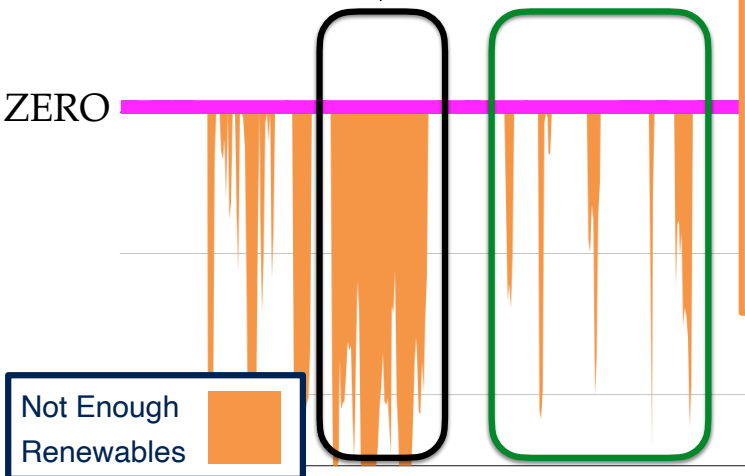
## Reliability During “Dark-Calms” at OK Cost

Grand Canyon of *Dark-Calms* for 2017 expensive to fill. Added storage used once or twice per year.

A Narrow canyon is low-cost to fill. Added storage used many times per year.

95% Renewables. 7 days of 2017. Includes big storage.

ZERO



### Reliability

These canyons must be filled with fossil gas generation or even more storage or ????. “Grand Canyons” are expensive to fill with storage.

Images: Energy Should Be 2017 data for PRPA. Chosen for “grand canyon” of dark calms. Size and number of “Grand Canyon Dark-Calms” varies year to year.



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### Eye-Poppingly

“The (plan) includes ~~unprecedented~~ low pricing across a range of generation technologies including wind at levelized pricing between \$11-18/MWh, solar between \$23-\$27/MWh, solar with storage between \$30-\$32/MWh...”

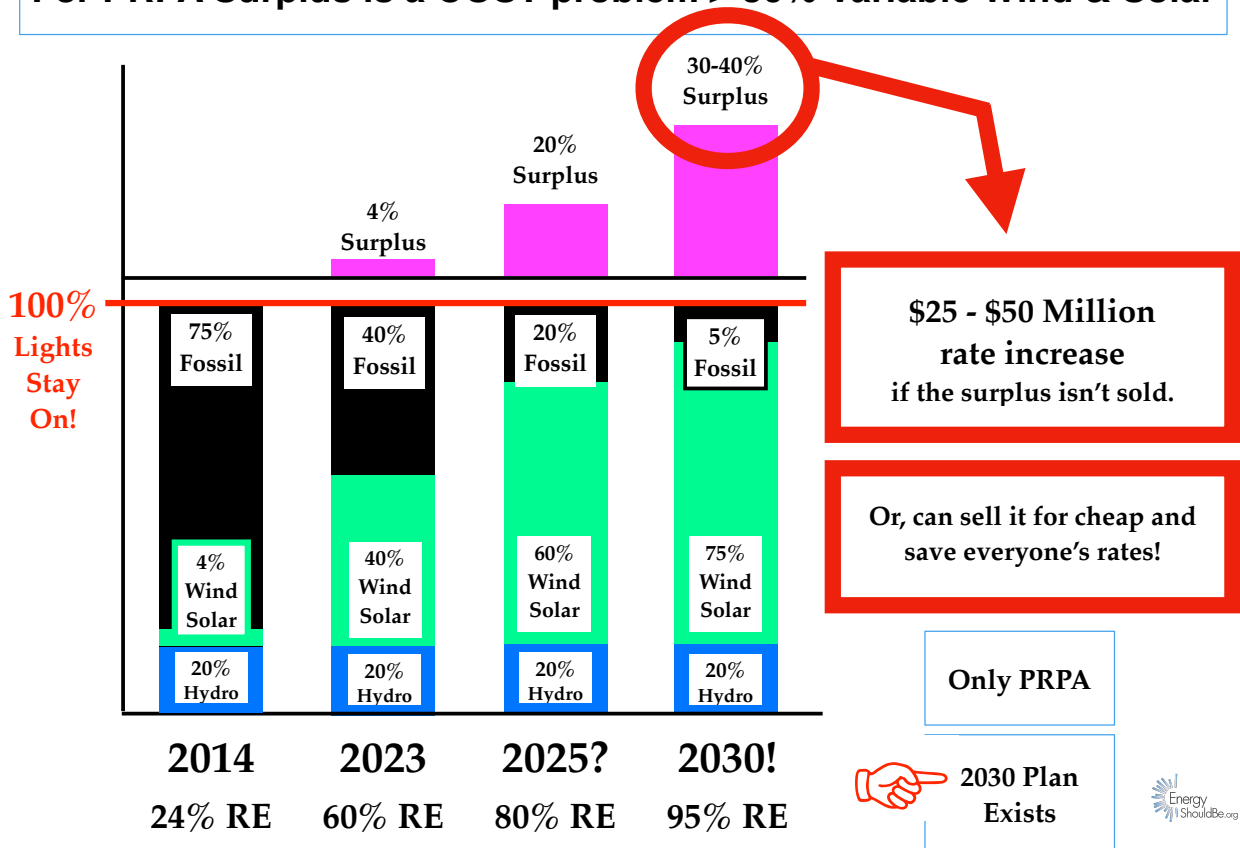
- Xcel

**In 2022, Xcel Colorado 55% Renewables**

 **Left 95% of bids on the table.**

Xcel Energy (bottom P 51) <https://www.documentcloud.org/documents/4546891-Xcel-Energy-Electric-Resource-Plan-120-Day-Report.html>

### For PRPA Surplus is a COST problem > 30% Variable Wind & Solar





## Sell Surplus Renewables for Cheap to Who?

**\$25 - \$50 Million  
rate increase  
if the surplus isn't sold.**

Called "curtailment".  
Turning off wind & solar.

**Or, can sell it for cheap and  
save everyone's rates!**

"Sell for cheap" to who??

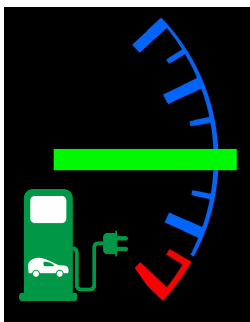
- Other utilities.  
**Energy Imbalance Market**
- Existing customers.
  - Business
  - Residential



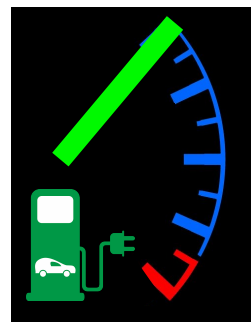
111

## Ecar Charging Modeling Assumptions "Cheap 2 Charge from Surplus" Program

*Always* Wake to  
**120 Miles (50%)**



Cheap 2 Charge  
"Fill Er Up!"  
**240 Miles (100%)**



120 miles of additional range when full

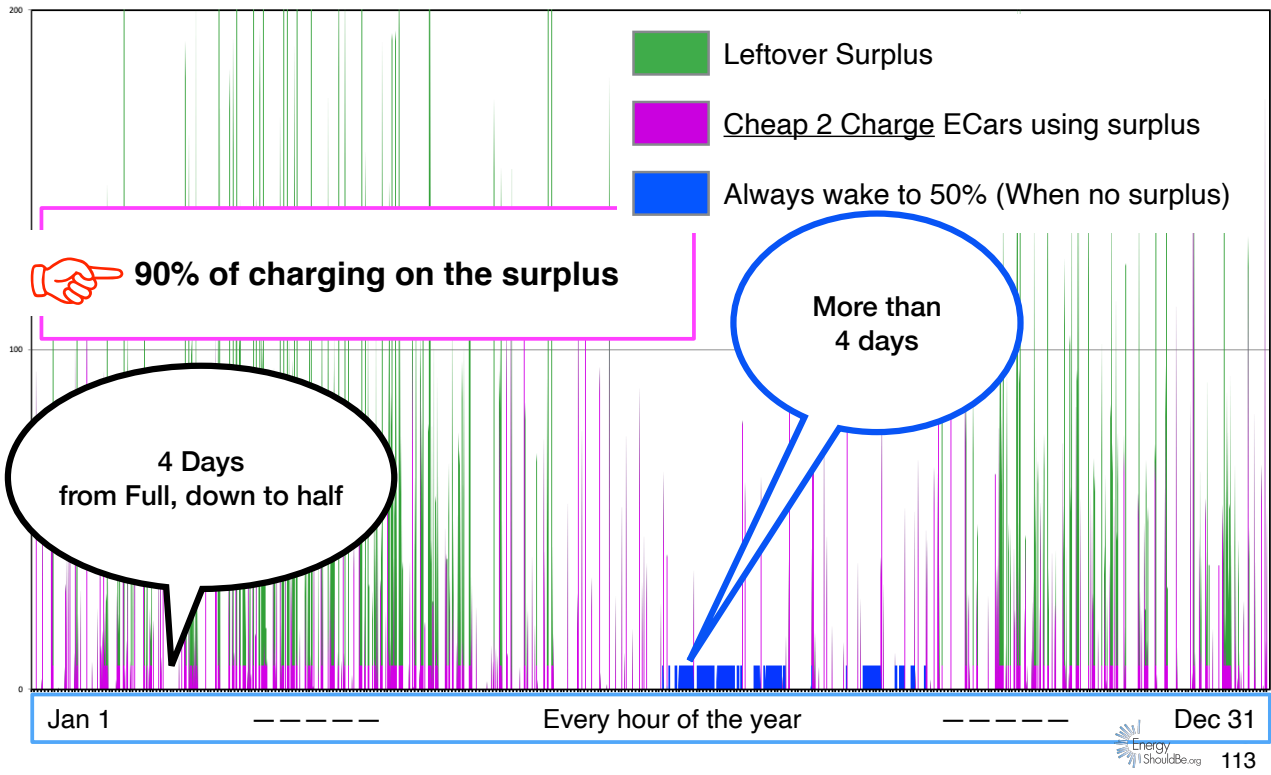
4 days from Full to Half at 30 miles per day



## Rewarding Flexible Use of Surplus Electricity

Wind & solar PRPA 2023.

60% Renewable. 20,000 Plug-ins.



**Do Ecar chargers exist today that allow charging when the sun is shining or wind blowing?**


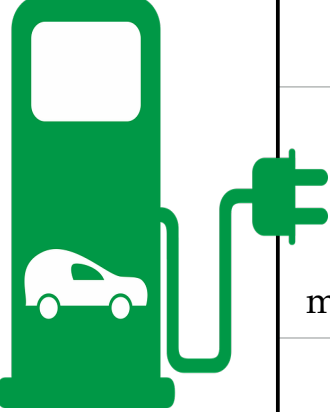
**When surplus electricity?**

**Cheap 2 Charge?**

- Yes
- Almost
- No



## Ecar Fuel Savings per Year

	Cost per mile	15,000 miles per year	Savings per year
	10 ¢	\$1,500	-
	US residential rate 3.5 ¢	\$500	\$1,000
	On Surplus <i>Cheap 2 Charge</i> 1 ¢ most of year, then 3.5 ¢	\$200	\$1,300
	FREE	FREE	\$1,500

Images: [pixabay.com](http://pixabay.com)

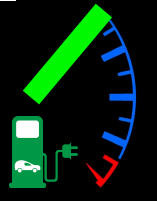


10¢ per mile gasoline is at \$3.00 / gallon and 30 MPG.

Electricity at national average 12 ¢ per kWh and an Ecar at 3.5 miles per kWh. 1 ¢ per mile is about 3 ¢ per kWh electricity.



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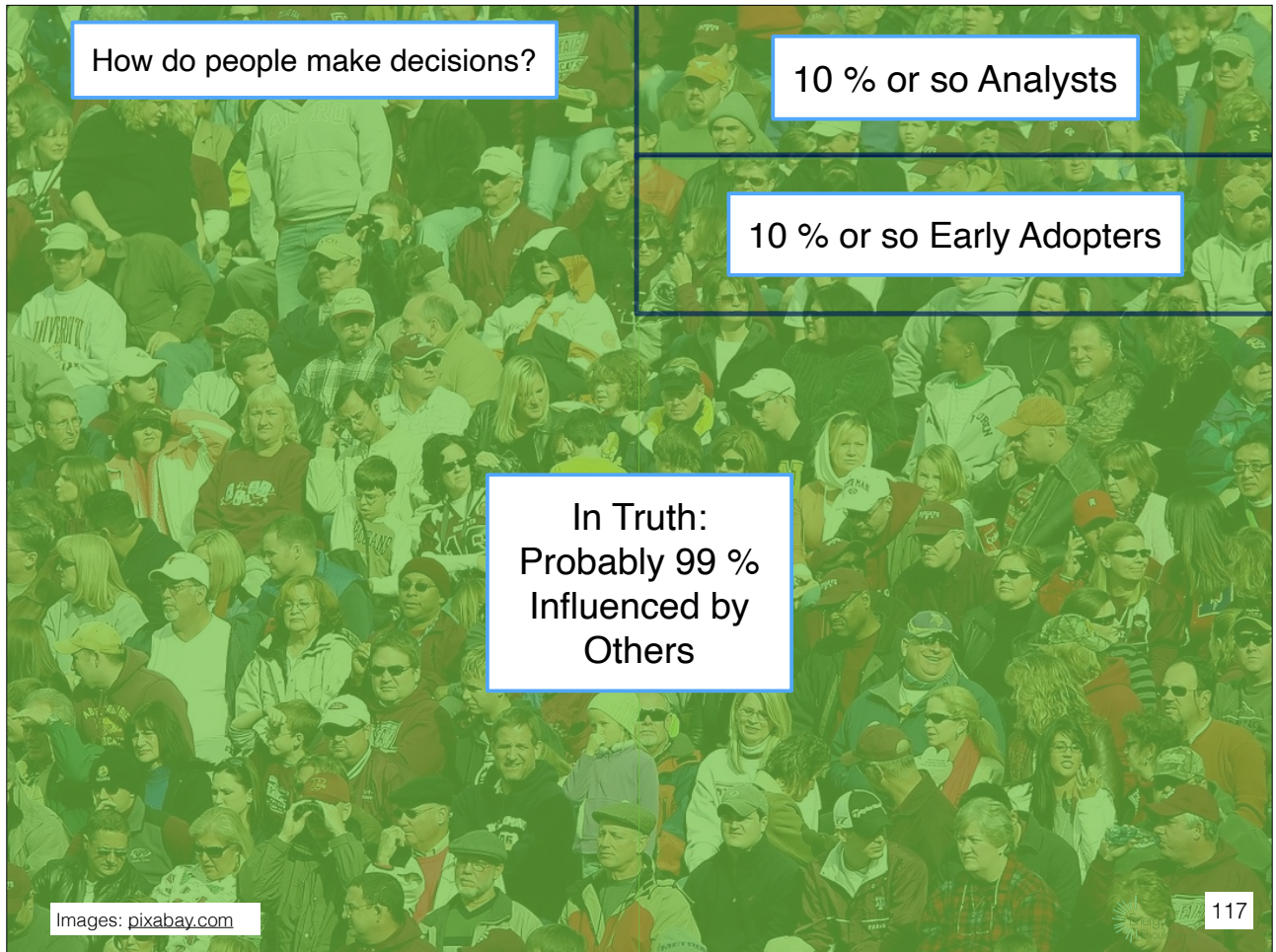
## Best Choice to Use the Surplus. Storage & Impact. Just PRPA.

	How Used <i>Storage lasts...</i>	Energy Use per day per car...	Impact per year
	Electric car <i>4 days.</i>	30 miles about 9 kWh/day	270,000 vehicles. Roughly <b>30%</b> of total electricity use all transportation - commercial and residential.
	Hot water heater. <i>1 - 2 days.</i>	3 people 6/kWh/day for electric resistance. Heat pumps use less - about half to a third.	110,000 homes. Roughly <b>8%</b> of total electricity use.
	Pre heat/cool home or business. <i>A few hours.</i>	TBD	TBD

Images: [pixabay.com](http://pixabay.com)



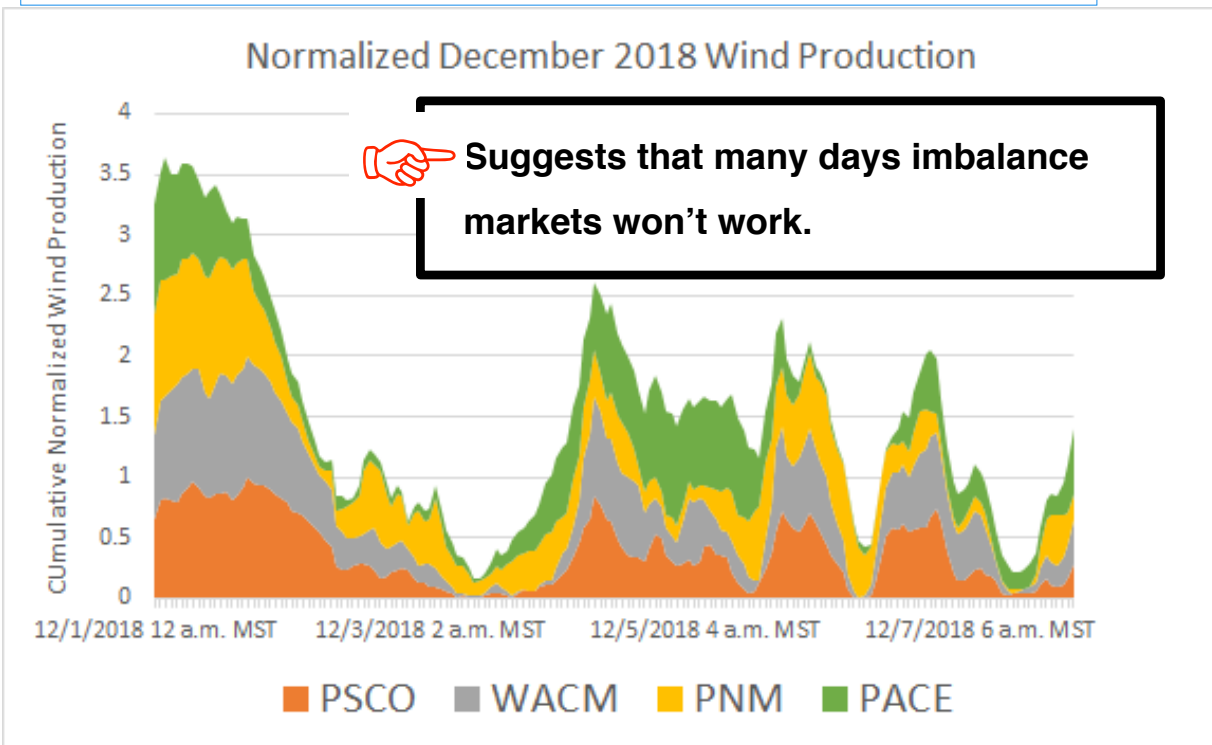
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**ECAR♥.ORG**  
😊 **PLUG INTO** 🌿 + ☀️

**ECAR♥.ORG**  
**MY NEXT CAR PLUGS IN**

## 7 Days. Just Wind. 4 Neighboring Balancing Authorities



## Actions

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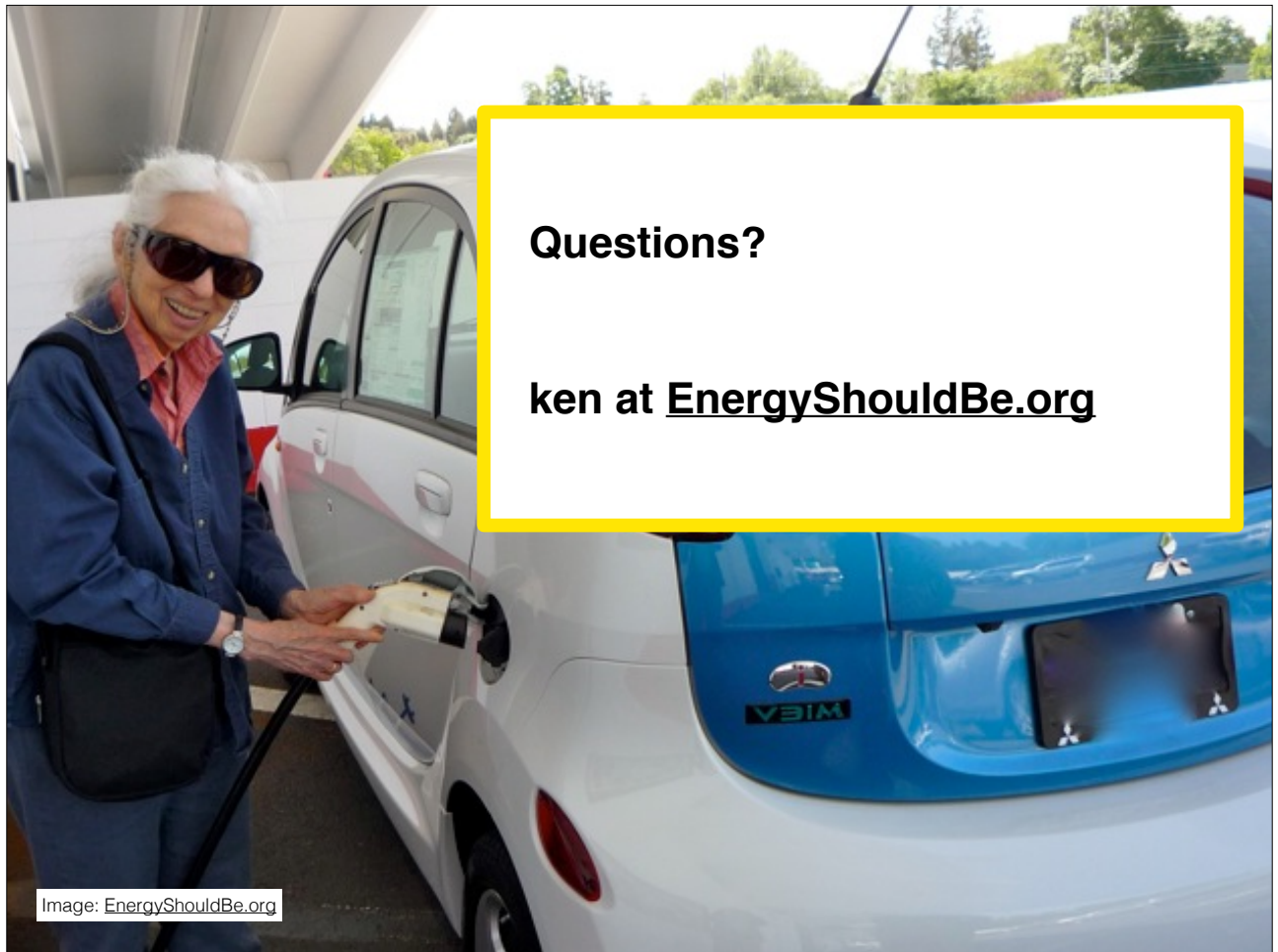


Image: EnergyShouldBe.org

**Questions?**

**ken at [EnergyShouldBe.org](http://EnergyShouldBe.org)**