

EMERGING LEADERS FORUM

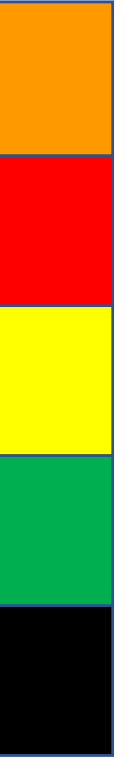


Understanding the Impact of the Energy Transition on the Distribution Grid

Doug Houseman

What does the transition include?

- DER – Generation, Storage, and Demand Side Management
 - Transportation to electricity
 - HVAC to electricity
 - Moving any other fossil fuel usage to electricity
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- It doubles or triples the electricity use, in some cases it increases by as much as five times.



What does circuit review tell us?

- Most circuits are at or above 90% loading at least 500 hours a year
- 5KV and 10KV circuits will need to be split into several pieces and become their own circuits –OR- have the voltage upgraded
- Most 15 KV circuits will not support more than 40% EV penetration
 - This assumes no HVAC conversion or other electrification
- Because of charging behavior PV hurts rather than helps without storage

Based on 20,000 actual circuits

What do you want to think about ?

Target voltage	34.5kV
Years of residential load growth	5
Day or night	Day
Percentage of firm circuit is planned	100%
Allowable overload on substation transformers	10%
Percentage reduction from circuit peak load when the new load is operating	60%
Current assumed load per customer (fully diversified) (kVA)	2.8
Additional load from electrification beyond EV & electric heat/hot water (kVA per residential customer)	0
Annual increase (decrease) in existing load	0%
Annual energy waste reduction	0%
Increase in percentage of circuit underground	0%
Average distance between substations (miles)	2.5
Average distance between feeder tie points for loop scheme (miles)	1.5
Residential heat pumps - air source (kW)	4
Residential heat pumps - ground source (kW)	3
Percent air source heat pumps (remainder is ground source)	85%
Residential hot water (kW)	10
Diversification of heat/cooling	50%
Diversification of hot water heating	80%
Indirect/overhead cost percentage (of direct costs)	12%
Average residential EV charger size (kW)	19.2

- There is a lot to know and think about
- There are many possible scenarios
- Not all circuits are created the same, or have the same demographics
- For a utility with 1500 circuits, this is typically a 60 year program

Diversification of EV charging	50%
Average KW of commercial charging during open hours (kW)	50
Average KW of industrial charging during open hours (kW)	150
Residential Solar (kW)	12
Residential Solar (% adoption)	10%
Commercial Solar (kW)	20
Commercial Solar (% adoption)	10%
Industrial Solar (kW)	250
Industrial Solar (% adoption)	10%
Residential Batteries (kW)	5
Residential Batteries (% adoption)	10%
Commercial Batteries (kW)	250
Commercial Batteries (% adoption)	10%
Regionalized Input Parameters (Variables)	AREA #1
Average cars per residence	2.84
Percent of residential EVs	0.70%
Current front-lot percentage	30%
Rear-lot to front-lot conversion percentage	0%
Annual residential building\housing growth percentage	0.50%
Percent of residential premise electrification	34%
Ground mount solar size (MVA) - one per 4.4kV circuit	0
Ground mount solar size (MVA) - one per 13.8kV circuit	0

One outcome

Current Circuit Count	Total Circuits at Current Voltage	Total Circuits at New Voltage	Subs to be Rebuilt	Qty of New Subs
2,428	4,533	2,569	504	75
2020 Summer Peak Load (MVA)	New System Peak Load (MVA)	New Peak - Solar %	Sum of Existing OH Miles	Sum of OH Rebuild Distance (New voltage)
6,395	12,549	-60%	24,174	28,718
New Peak - EV %	New Peak - Water/Heat %	New Peak - Batt Storage %	Sum of Existing UG Miles	Sum of UG Rebuild Distance (New voltage)
112%	48%	0%	7,078	9,747
Total Estimated Construction Cost	Estimated Substation Cost	Estimated OH Distribution Cost	Estimated UG Distribution Cost	
\$44,666,106,000	\$2,965,536,000	\$11,129,460,000	\$30,571,110,000	
Total Estimated Construction Manhours	Estimated Substation Manhours	Estimated OH Distribution Manhours	Estimated UG Distribution Manhours	
84,322,423	5,071,136	39,945,574	39,305,713	



QUESTIONS