

# NextGen Highways

ESIG - Spring Technical Workshop 2021

NGI Consulting  
Morgan Putnam, Ph.D.

# NGI Consulting

- ▶ NGI Consulting was founded by Morgan Putnam to help cities, corporations, and states envision a path towards next-generation infrastructure.

## Morgan Putnam, Ph.D.

- ▶ Created and led the [MN Solar Pathways](#) project. The project received national attention (e.g., [The Interchange](#), [Utility Dive](#), and [CleanTechnica](#)) for highlighting the value of overbuilding renewable capacity to address resource adequacy requirements during periods of low solar and low wind production.
- ▶ Developed the vision and partnerships needed to improve utility interconnection processes for distributed energy resources (see [white paper](#).)

# NextGen Highways

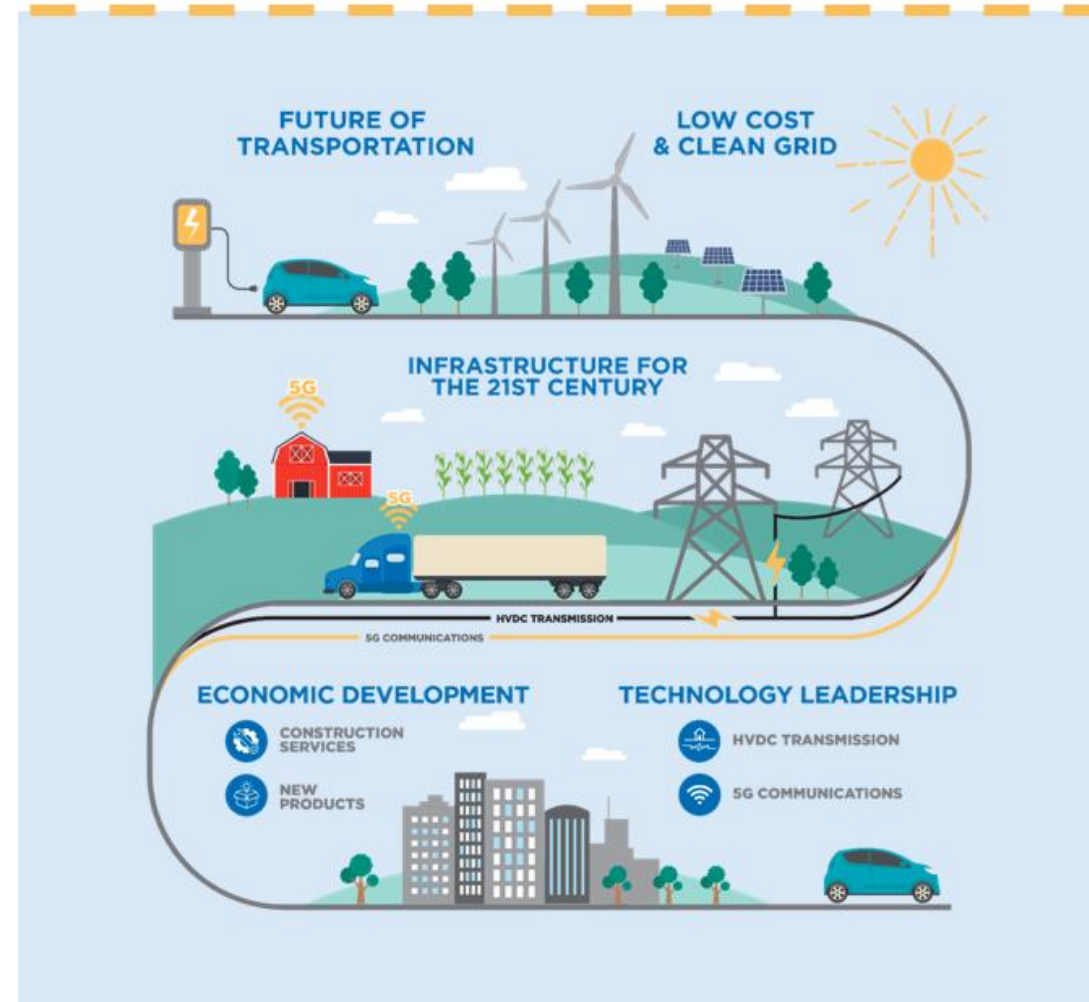
NextGen Highways are highways with the strategic co-location of:

- ▶ electric transmission lines
- ▶ ZEV charging/fueling infrastructure
- ▶ fiber, 5G, and other communications infrastructure

as discussed in this white paper

## Next Generation Highways

CO-LOCATING THE TRANSPORT OF VEHICLES,  
ENERGY, AND INFORMATION



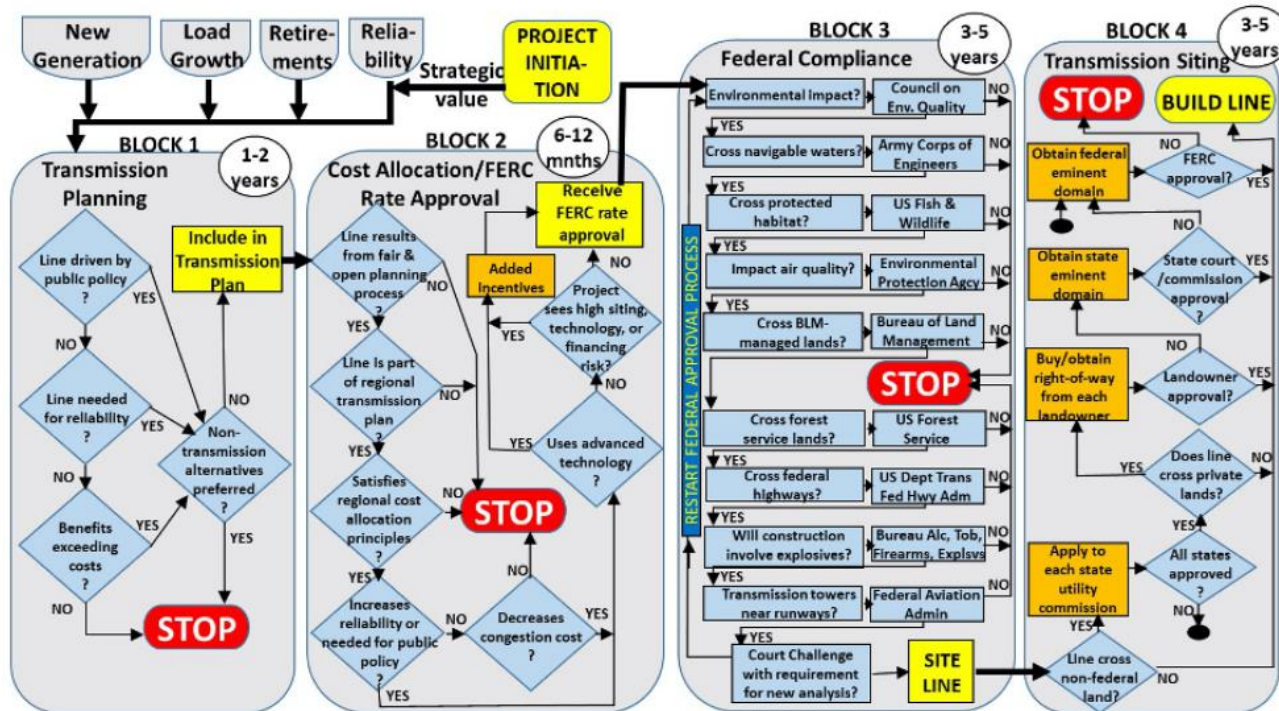
# June 2020 FERC Report to Congress: *Barriers and Opportunities for High Voltage Transmission*

**Some states have enacted laws and policies to promote the co-location of transmission in transportation corridors.**

- ▶ **Maine** passed a law in 2010 designating energy corridors for the development of transmission and other energy infrastructure along specific highway and pipeline rights-of-way.
- ▶ **New Hampshire** passed a law in 2016 designating energy corridors along, within, and under specific highway rights-of-way for the underground co-location of transmission and other energy infrastructure.

# Transmission Development Today

It's Complicated



To put it in  
Layman's Terms:

*Community Chest*

**GO TO JAIL**

Go Directly to Jail

DO NOT PASS GO

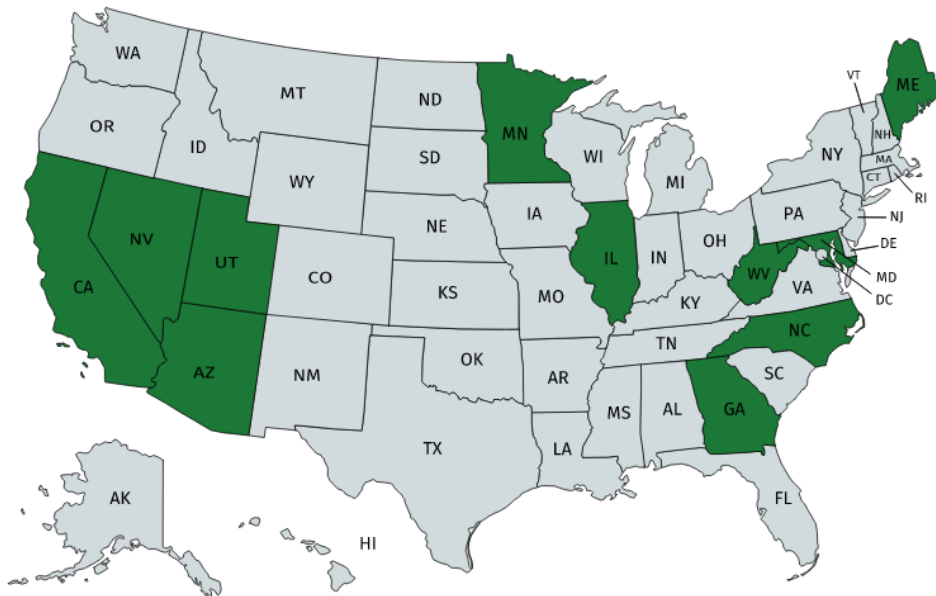
DO NOT COLLECT \$200



1935 PARKER BROTHERS INC.

# NextGen Highways are Expanded Dig-Once Legislation

- ▶ Dig-Once legislation currently requires the opportunity for fiber or fiber conduit to be placed in highway ROW during highway construction projects
- ▶ Is a bi-partisan cost-reduction policy that has been passed by eleven states; states that are as diverse as CA & WV



← States that have passed Dig Once legislation

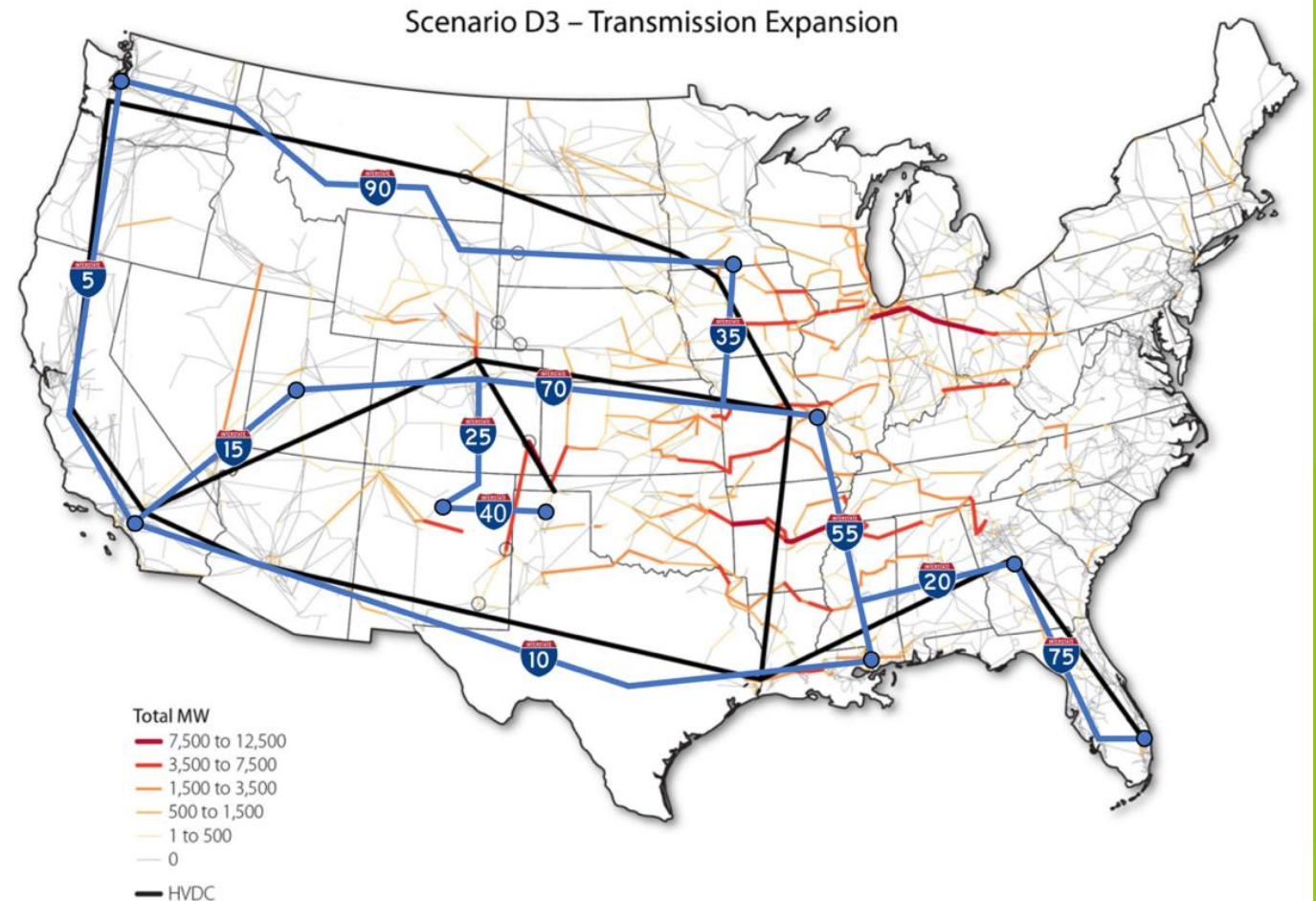


# NextGen Highways and a National HVDC Transmission Grid

The black lines in the figure represent an HVDC grid that could deliver \$1-2 of net benefits for every \$1 invested and enable 85% renewable penetration.

The dark blue lines represent the parts of the existing federal highway system that could be used for the construction of a nearly equivalent HVDC grid.

As can be seen, there is a strong overlap between the two.



# NextGen Highways and Urban Areas

I-405 Project  
(Transportation)

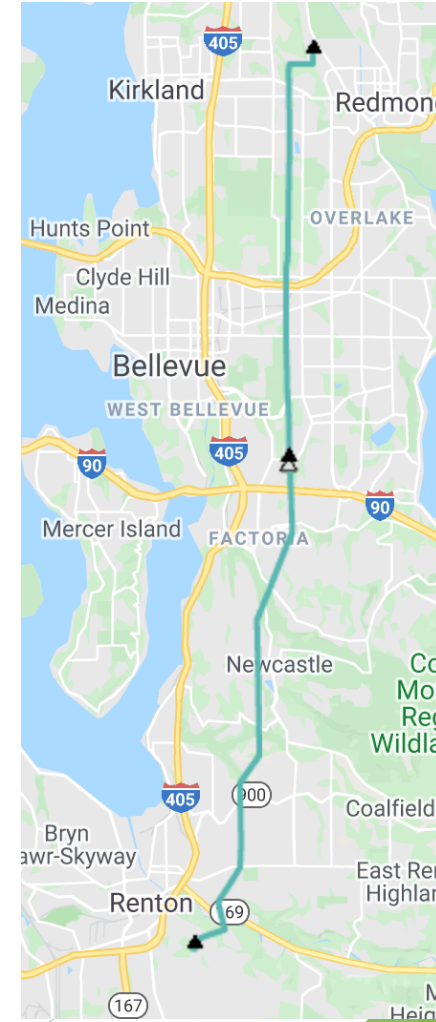


Transportation electrification inherently links transportation and grid infrastructure.

WA State is making 50-year infrastructure investments in transportation and grid infrastructure that don't consider that linkage.

The I-405 Master Plan was created from an EIS created in 2002. Electric vehicles were not considered in that EIS.

Energize Eastside  
(Transmission)





# Barriers to NextGen Highways

Historical barriers to co-location include:

- *Safety*: potential for vehicle collisions with the towers
- *Expansion*: preservation of the right of way for future expansion
- *State policies*: utility accommodation plans that prohibit/discourage co-location

# Overcoming the Barriers to NextGen Highways

1. Update DOT utility accommodation manuals & processes
2. Increase coordination between DOTs and utilities
3. And go underground with direct current transmission



## German Transmission Grid Operators Award Contracts for SuedLink Corridor

The Corridor is the largest ever underground cable project.

JUN 29, 2020



# Two Key Comments from CapX2050 Transmission Vision Report

**“Separate study processes that exist today for interconnection planning, economic planning, operational planning and annual reliability assessments may need to be combined into a more comprehensive study to increase certainty that future transmission plans are able to provide multiple benefits.”**

**Future planning efforts will need to be integrated across generation, transmission, and distribution...”**

**Just like the electric sector needs to integrate its planning process to provide multiple benefits, we need to integrate our planning processes across the energy, transportation and communication sectors.**

# Organizations Interested in Further Exploration of the NextGen Highways Concept



**GREAT PLAINS  
INSTITUTE**

Better Energy.  
Better World.



Americans for a  
Clean Energy Grid



NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY



A FORTIS COMPANY



**CLEAN GRID  
ALLIANCE**  
Delivering Midwest Renewable Energy



**CONSERVATION  
MINNESOTA**



SPECIALISTS IN POWER SYSTEM STUDIES



# Recent Support for Elements of NextGen Highways

*“[for heavy-duty EV fleets], switching to a medium/high-voltage, DC-based system could be less costly than adding a traditional solution,”*



## REIMAGINING THE GRID

December 2020



## A transportation, infrastructure and climate priority

*“I think it’s important for us to think about digging once and also potentially using those rights-of-way if we have to ground grid transmission wires or if we would like to get broadband to rural communities.”*





What about the cost?

# UG-HVDC is Competitive with OH-HVAC

On a \$/MW-Mile basis:

- SOO Green @\$2.5 Bn is \$7MM/mile and \$3,500/MW-mile
- AEP's OH-HVAC estimates are at \$3,600/MW-mile

Project	Type	kV	Cost Est.	Miles	Loadability	Loss/100 mi	\$/MW (delivered)/mile
SOO Green HVDC Link (IA-IL)	UG-HVDC	525	\$2,500 MM	350	2,100 MW	1.1%	\$3,538
AEP Data*	OH-HVAC	500	\$2.3-3.5** MM/ mile	300	900 MW	1.3%	\$3,600 -\$5,479***

\* American Electric Power's Transmission Facts (2008):

[https://web.ecs.baylor.edu/faculty/grady/13\\_EE392J\\_2\\_Spring11\\_AEP\\_Transmission\\_Facts.pdf](https://web.ecs.baylor.edu/faculty/grady/13_EE392J_2_Spring11_AEP_Transmission_Facts.pdf)

\*\* 2008 dollars

\*\*\* Adjusted for 2020 dollars at 2.5%/yr inflation

# Important Not Just to Consider Cost But Also Benefits

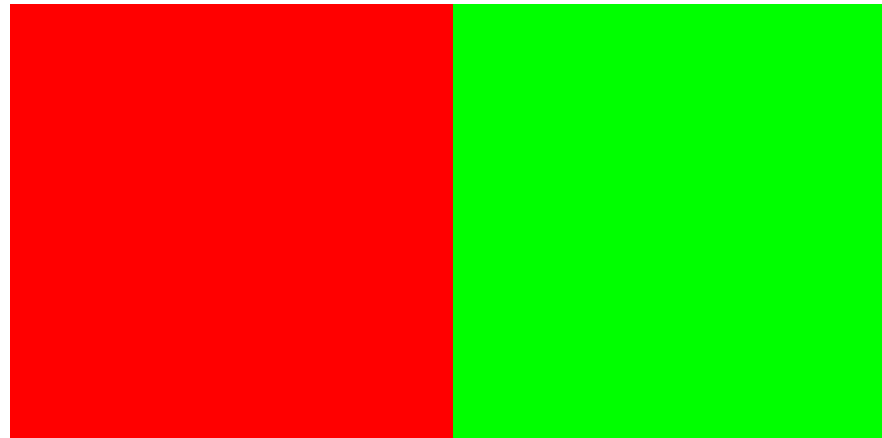
Overhead



Buried



Weather-Hardened  
Option to EMP-Harden  
Permitting Timeline  
Land Use (new build)



# Severe Weather Events



[Home](#) [Storm Center](#) [Entergy.com](#)

## Louisiana and Texas Transmission Update

“All nine transmission lines that deliver power into the Lake Charles area are currently out of service as a result of storm damage to multiple structures and spans of wire.

A significant number of transmission structures were damaged beyond repair and require complete replacement.”



# Wildfire Risk

## Kincade Fire

Largest fire in CA in 2019

A PG&E transmission tower is the believed source of the fire

Three million people without power due to system de-energization





# If Everything's Electric...

## Outages Are all the More Significant

During Texas's rolling blackouts and natural gas outages, the loss of heat led to knock-on property damage losses, citizens implementing extreme measures to stay warm, and loss of life



# Concluding Thoughts on Breaking the Transmission Logjam

## Step 1: Implement Common Sense Transmission Reform

- ▶ A lot of great work by Americans for a Clean Energy Grid and others to get needed changes at federal and regional levels

## Step 2: Build a Coalition of Supporters Outside of the Electric Sector

## Step 3: Have Lots of Eggs!

ACEG's Eggs

NextGen Highways Egg



# Questions?

NGI Consulting

Morgan Putnam, Founder

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# Fact 1: A Stronger Transmission Grid is Needed

- ▶ The economic and environmental benefits of a stronger transmission grid are becoming widely recognized
- ▶ As a result, there is buy-in for new transmission and for re-framing the way we view transmission investments

## Modernizing the Nation's Transmission Infrastructure

New WIRES Group Report: \$230  
- \$690 Billion Investment In US  
Transmission System Needed By  
2050 To Support A More  
Electrified Economy



## Fact 2: Transportation Electrification is Coming

engadget

The future of Daimler trucking is electrified and autonomous



\*Genentech is also a member of the Corporate Electric Vehicle Alliance.

TECH / TRANSPORTATION / CARS

**THE VERGE**

Amazon will order 100,000 electric delivery vans from EV startup Rivian, Jeff Bezos says





## Fact 3: Clean Vehicles Need a Strong Grid



### City grids risk being overwhelmed by EV growth

- Cities' increased reliance on electric vehicles (EVs) and electric buses could overwhelm their electric grids and result in outages, warned a new report from the Rocky Mountain Institute (RMI) and Seattle City Light.



### Daimler and PGE creating Electric Island for truck charging

> 1 MW per vehicle!!!

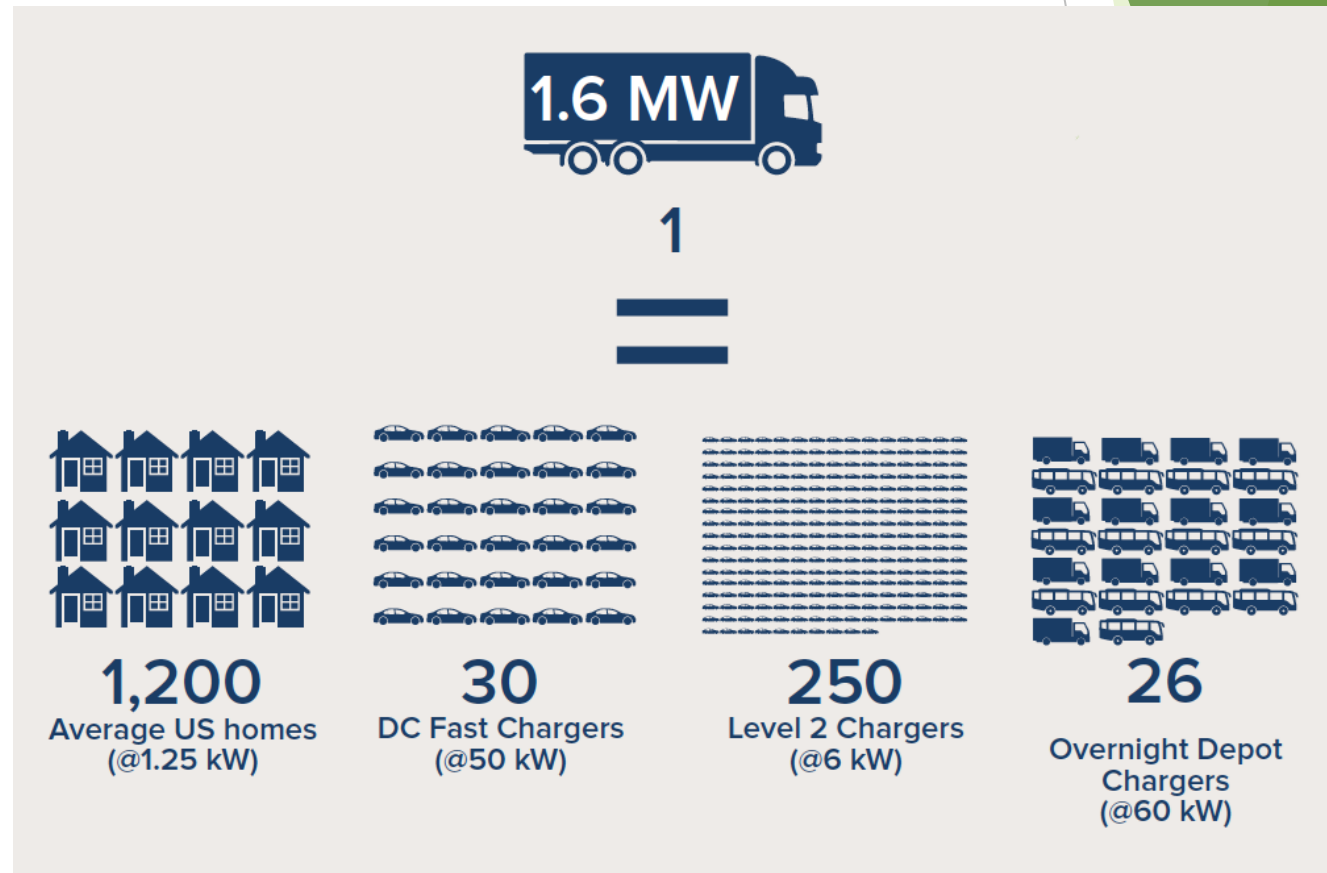
### WEST COAST CLEAN TRANSIT CORRIDOR INITIATIVE STUDY

Grid capacity does not exist along key transit corridors to serve heavy-duty charging needs

# A Visual Representation of Grid Requirements for Heavy-Duty Vehicles

Heavy-duty trucks have fundamentally different charging requirements.

And fleets of medium and heavy-duty trucks will require extensive grid upgrades, including new substations and transmission infrastructure.



<https://rmi.org/insight/seattle-city-light/>

\*Infographic taken from Rocky Mountain Institute's transportation electrification study for Seattle City Light.

## Considering These Facts...

### *New Transmission should be Co-Located with State and Federal Highways*

- ▶ Ensures that significant power will be available to support transportation electrification
- ▶ Takes advantage of an existing right-of-way
- ▶ Buy-in is possible from many stakeholders for many reasons: economic, health, and social justice, etc.

# NextGen Highways are a Transportation Electrification Platform

There are many ways to power an electric drivetrain...

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Fast Charging Stations



Hydrogen Stations



even Wireless Charging Lanes



... but they all require a strong grid.

# NextGen Highways are a Communications Platform

AV  
Infrastructure

5G  
Infrastructure

Broadband  
Infrastructure

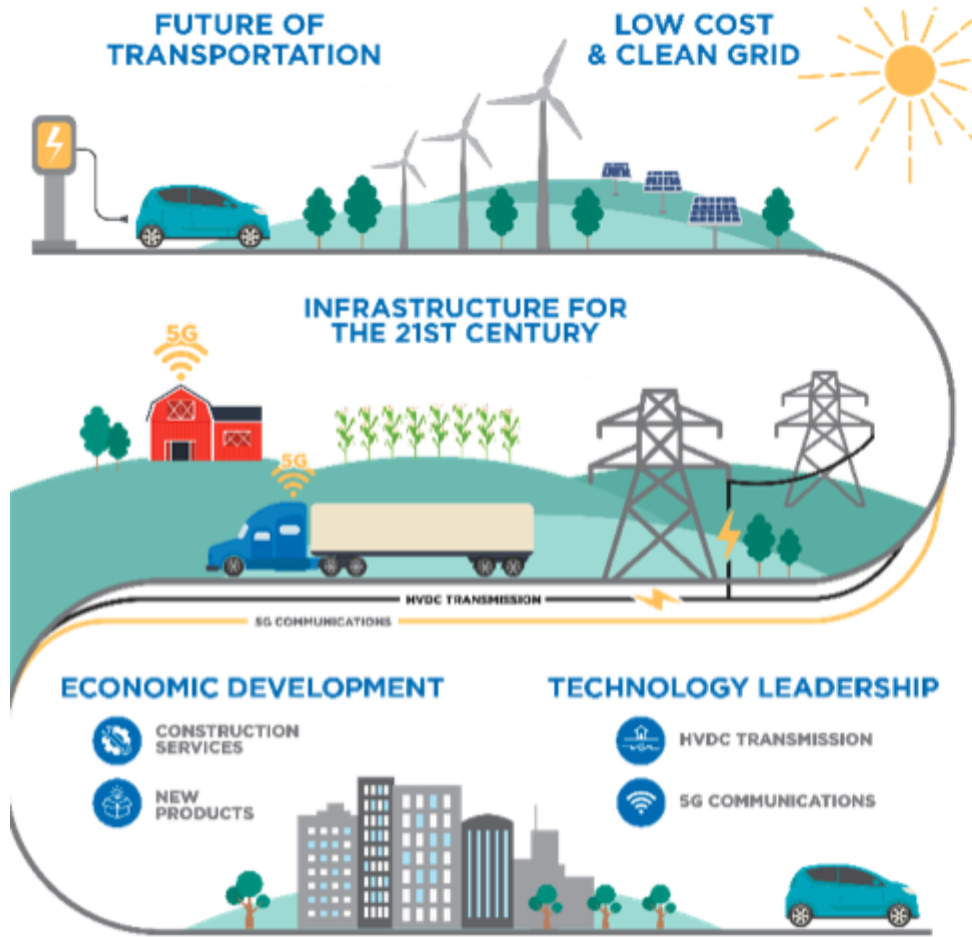
**How China's new highway for self-driving cars will boost its AV ambitions**

by IVAN MEHTA — 9 months ago in CARS





# Benefits from NextGen Highways



## UTILITIES / RENEWABLES

enable new transmission needed to support transition to renewable energy

## DOTs / EVs

support transportation electrification

## COMMUNITIES / EQUITY

improve air quality, reduce noise pollution

## ECONOMY / JOBS

create hundreds of thousands of new jobs

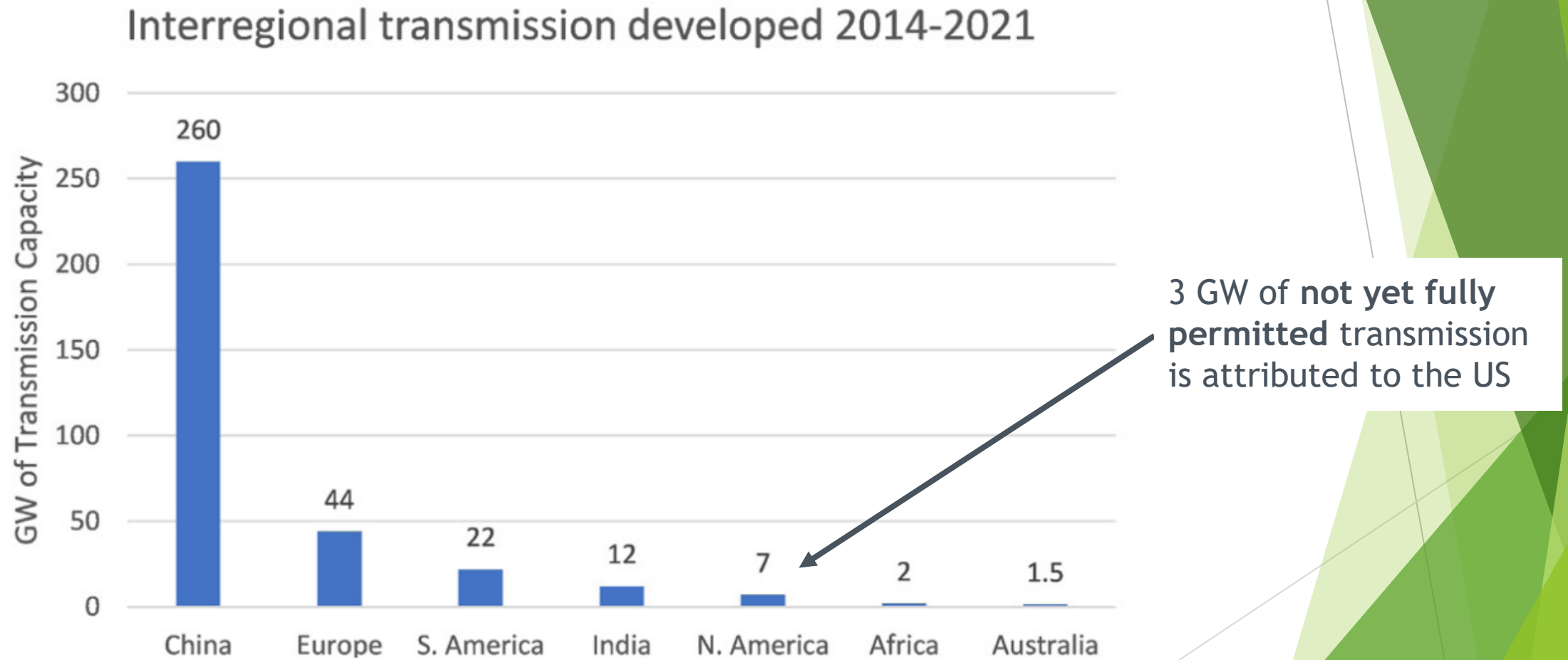
# State Support for Co-Location

## **2003 WISCONSIN ACT 89**

system, and protection of the environment, the following corridors should be utilized in the following order of priority:

- (a) Existing utility corridors.
- (b) Highway and railroad corridors.
- (c) Recreational trails, to the extent that the facilities may be constructed below ground and that the facilities do not significantly impact environmentally sensitive areas.
- (d) New corridors.

# The US is Worst than Last! We are DNF.



# HVDC Transmission Development using the Interstate Right of Way

Federal statutes, as well as federal and state guidance, encourage the collection of new transmission lines along existing transportation and other rights of way.



Federal Permitting Improvement Steering Council provisions in the FAST Act allow project sponsors to initiate NEPA under the Council's authority

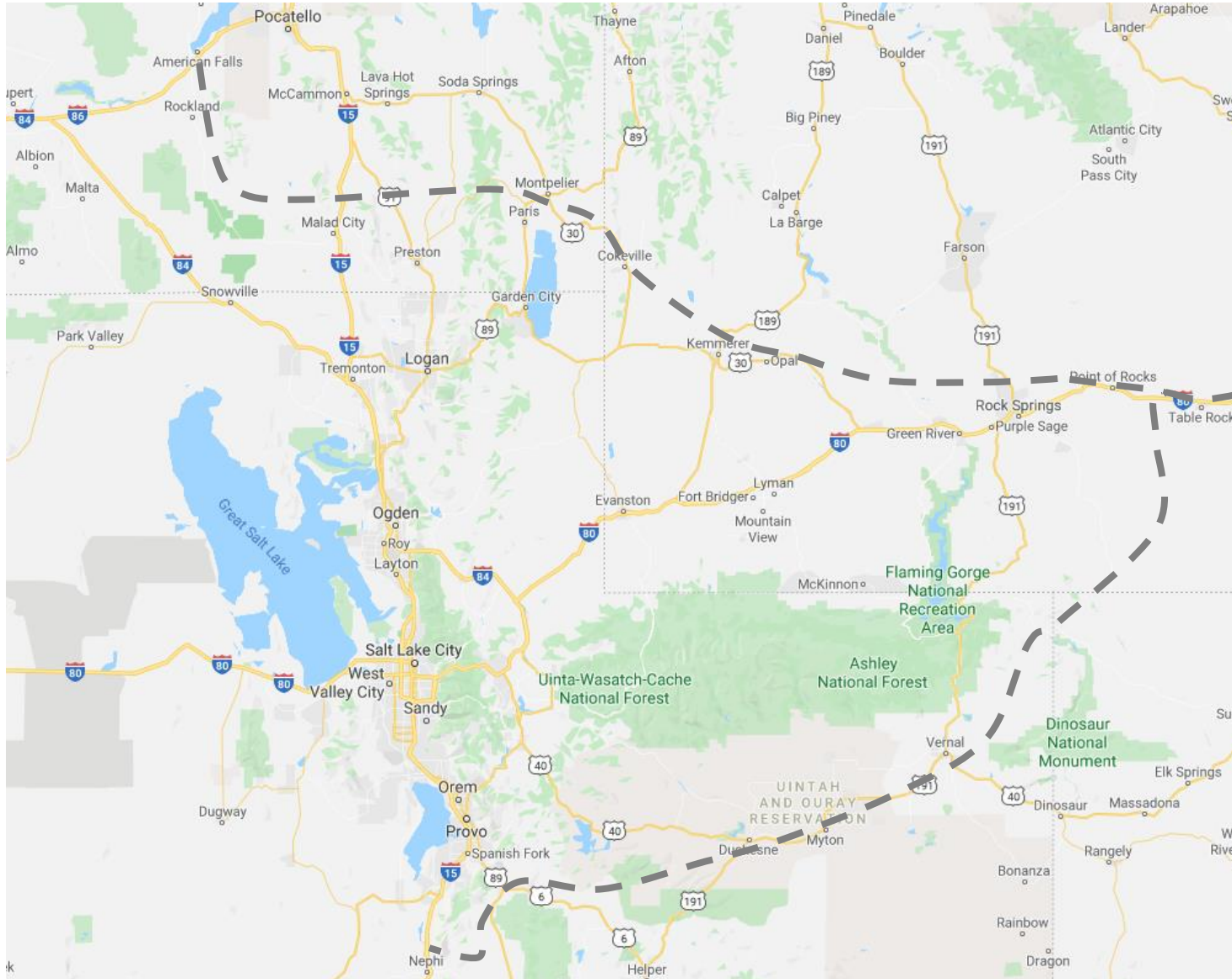


July 2020, the Council on Environmental Quality finalized first major overhaul to NEPA in 42 years.

EAs must be completed within one-year  
& EIS must be completed within two-years.

A significant opportunity  
for faster permitting!

# Case-Study: Energy Gateway Transmission Project



Planning started in early 2000's

Understandably did not consider vehicle electrification

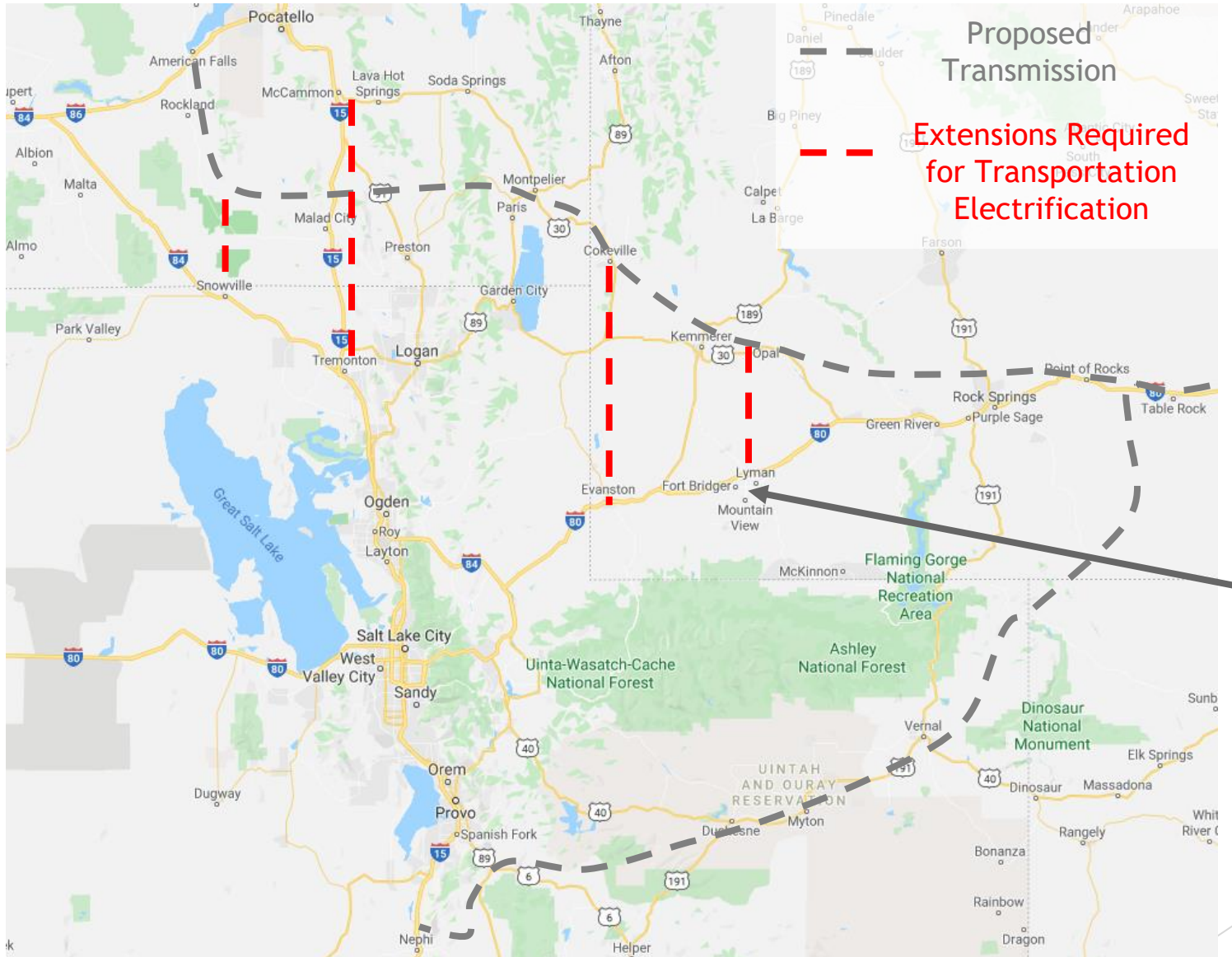
Proposed lines are far from major highways (I-80, I-84, and I-15)



The map displays two proposed transmission routes across Utah. The solid green line, labeled 'Proposed Transmission', starts in the northwest, follows the coast of the Great Salt Lake, passes through Ogden and Salt Lake City, and then heads south through Provo and Nephi. The dashed green line, labeled 'Alternative Route using I-80 and I-15', starts in the northwest, follows a path through the northern part of the state, and then heads south through the southern part of the state. The map includes major cities, highways, and natural features like the Great Salt Lake and various national forests and monuments.

An alternative route using I-80 and I-15 would prepare for an electrified transportation future

# Case-Study: Energy Gateway Transmission Project





# Some Motivation to Find Solutions

## More transmission? CapX 2050? They're NUTS!

Filed under: [Uncategorized](#) — posted by admin on August 19, 2019 @ 6:09 pm

