



Energy Systems in Transition

Clean Energy Innovation: Issues and Trends for State Consideration

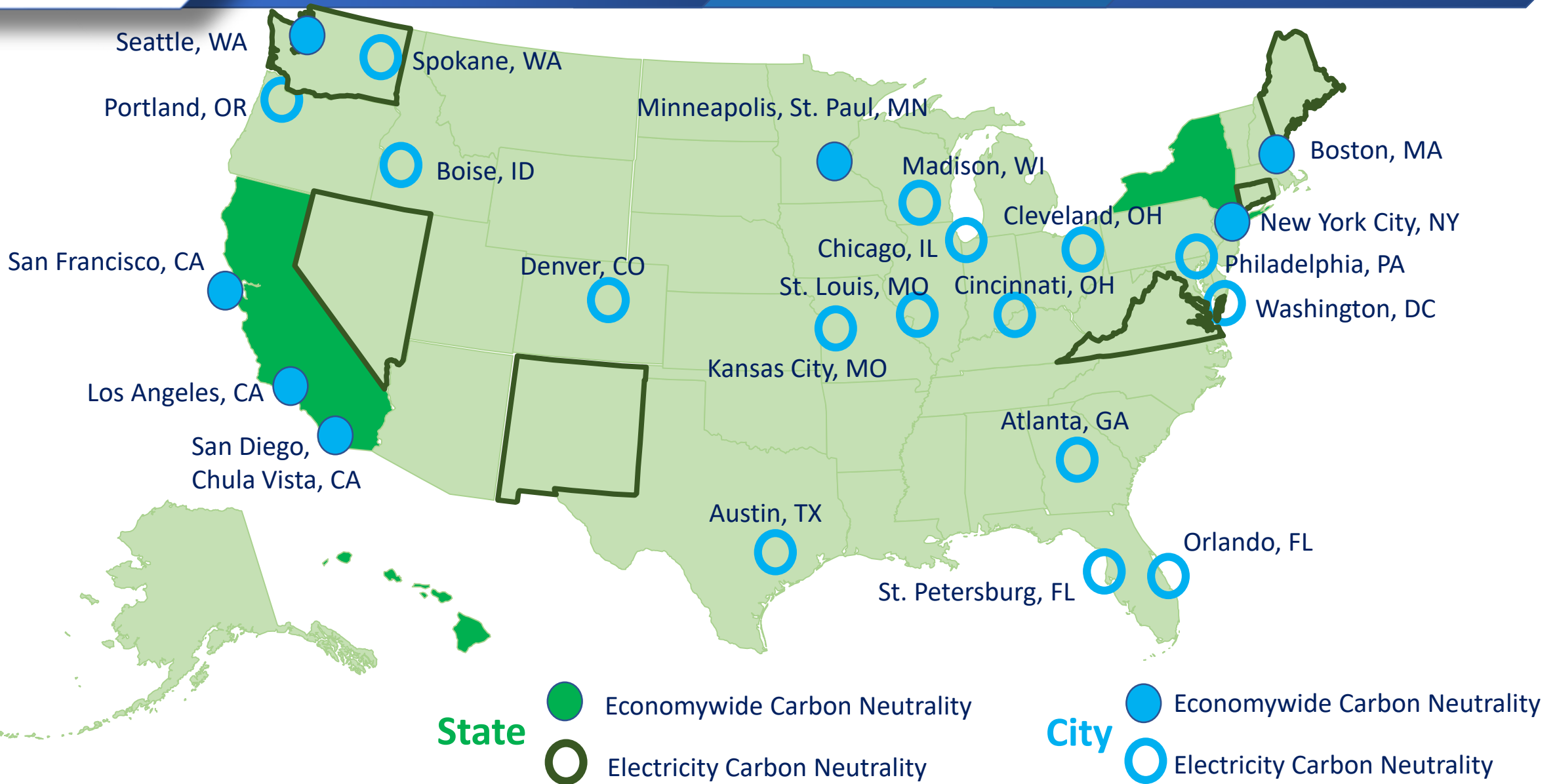


ENERGY FUTURES
— **INITIATIVE** —

Melanie Kenderdine
Principal, Energy Futures Initiative
NASEO Annual Conference
Washington, DC
February 6, 2020



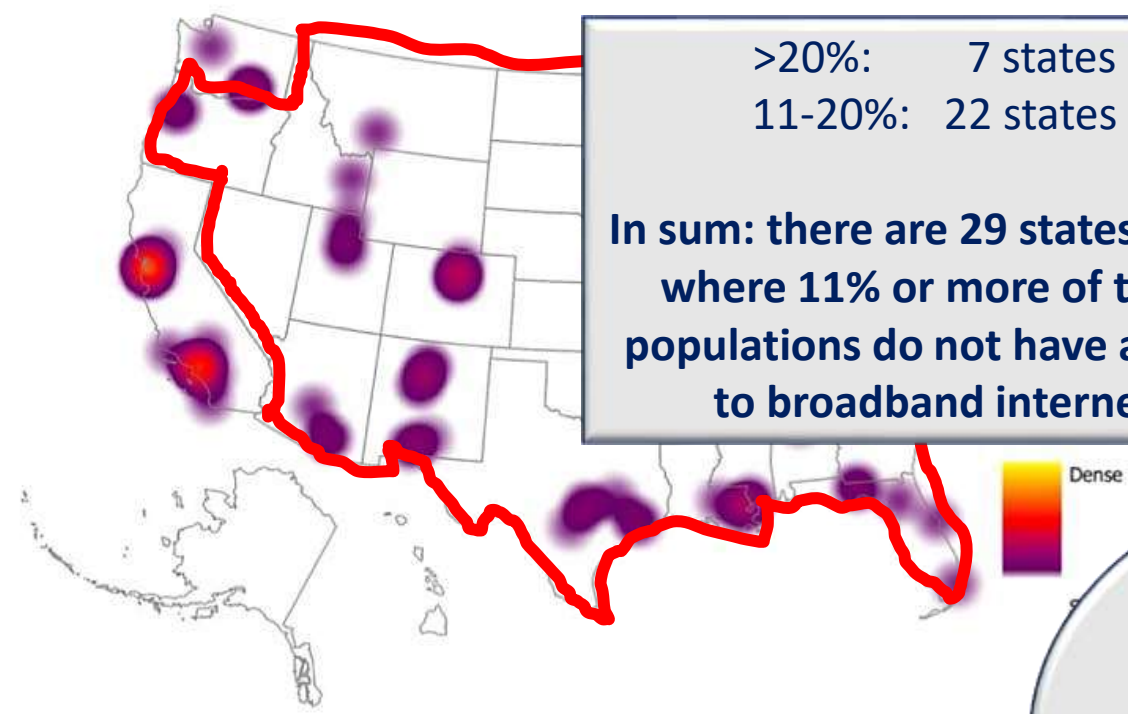
Expanding State/Local Government Initiatives





Innovation Resources Not Evenly Distributed: Regional Approaches Are Needed

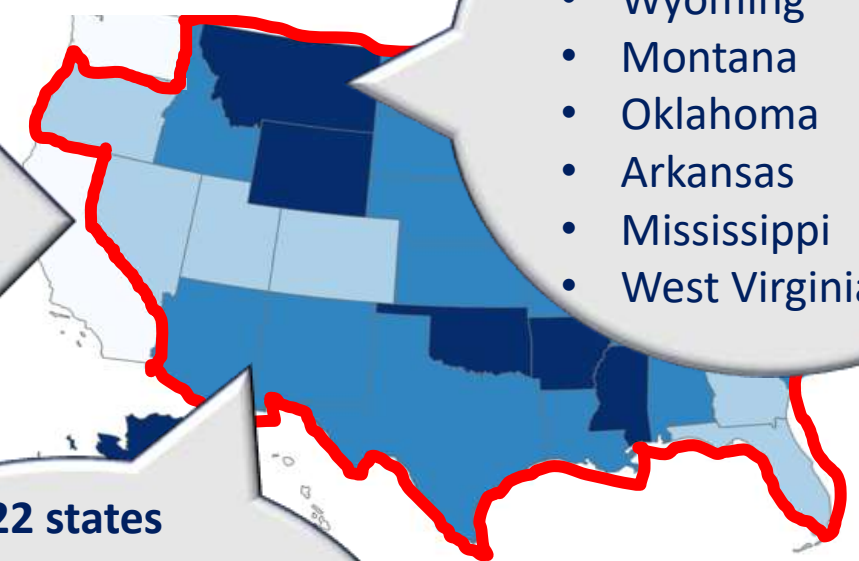
EFI'S REGIONAL CLEAN ENERGY INNOVATION INDEX



>20%: 7 states
 11-20%: 22 states

In sum: there are 29 states (58%) where 11% or more of their populations do not have access to broadband internet

PERCENT OF POPULATION WITHOUT BROADBAND ACCESS



State Population Without Broadband

- ≤5%
- 6-10%
- 11-20%
- >20%

- 7 states**
- Alaska
 - Wyoming
 - Montana
 - Oklahoma
 - Arkansas
 - Mississippi
 - West Virginia

- 22 states**
- Idaho
 - Arizona
 - New Mexico
 - Texas
 - Louisiana
 - Kansas
 - Nebraska
 - South Dakota
 - North Dakota
 - Minnesota
 - Maine
 - Missouri
 - Iowa
 - Wisconsin
 - Michigan
 - Indiana
 - Kentucky
 - Tennessee
 - Alabama
 - South Carolina
 - Virginia
 - Vermont

Broadband access and innovation ecosystems are essential to support/enable “decentralization,” e.g., distributed generation. Regional programs and policies should support regional ecosystems and broadband access to help create clean energy and economic growth. Regional programs and policies should support clean energy jobs, and clean energy and economic growth.

Mountain Region, 9.5

Largest %: Coal, 40.8	2 nd Largest %: N. Gas, 28.5
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Non-Hydro Renewables:
12.6% (7.2, 4.0)

W. North Central Region, 9.8

Largest %: Coal, 52.6	2 nd Largest %: Wind, 20
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Non-Hydro Renewables:
22.1% (21, 0)

E. North Central Region, 10.1

Largest %: Coal, 44.8	2 nd Largest %: Nuclear, 25.8
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Non-Hydro Renewables:
5.5% (4.5, 0.1)

New England Region, 17.5

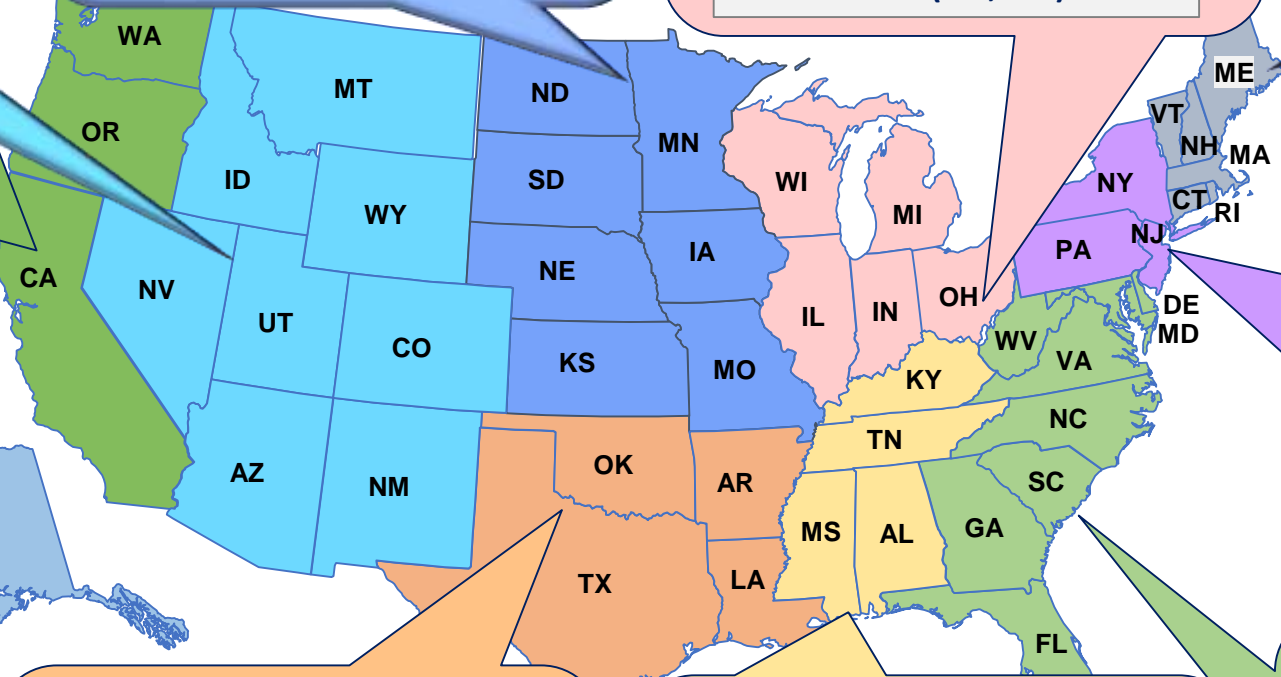
Largest %: Natural Gas, 48	2 nd Largest %: Nuclear, 29.7
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Non-Hydro Renewables:
11.3% (3.5, 1.5)

Pacific Contiguous Region, 13.8

Largest %: Hydro, 38.1	2 nd Largest %: N. Gas, 31.7
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Non-Hydro Renewables:
20.2% (7.4, 7.3)



Source: EIA Website, accessed 060119
Data are for 2018
% Wind % Solar
Avg. retail electricity price, cents/kwh

Mid-Atlantic Region, 12.6

Largest %: Natural Gas, 39.1	2 nd Largest %: Nuclear, 37.3
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Non-Hydro Renewables:
3.6% (1.9, 0.3)

South Atlantic Region, 9.9

Largest %: Natural Gas, 44.2	2 nd Largest %: Nuclear, 24.7
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Non-Hydro Renewables: 4.4
% (0.3, 1.7)

W. South Central Region, 8.4

Largest %: Natural Gas, 49.3	2 nd Largest %: Coal, 23
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Non-Hydro Renewables:
15.4% (14.1, 0.5)

E. South Central Region, 9.3

Largest %: Natural Gas, 36.4	2 nd Largest %: Nuclear, 22.4
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Non-Hydro Renewables: 2.0
% (0, 0)

Pacific Non-Contiguous, 25.5

Largest %: Petroleum Liquids, 45.6	2 nd Largest %: Natural Gas, 19.6
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Non-Hydro Renewables:
9.6% (4.2, 1.3)



Metals/Minerals Demand for Clean Energy Technologies

Light Emitting Diodes (11)

Wind (10)

Aluminum, Chromium, Copper,

CCS (8)

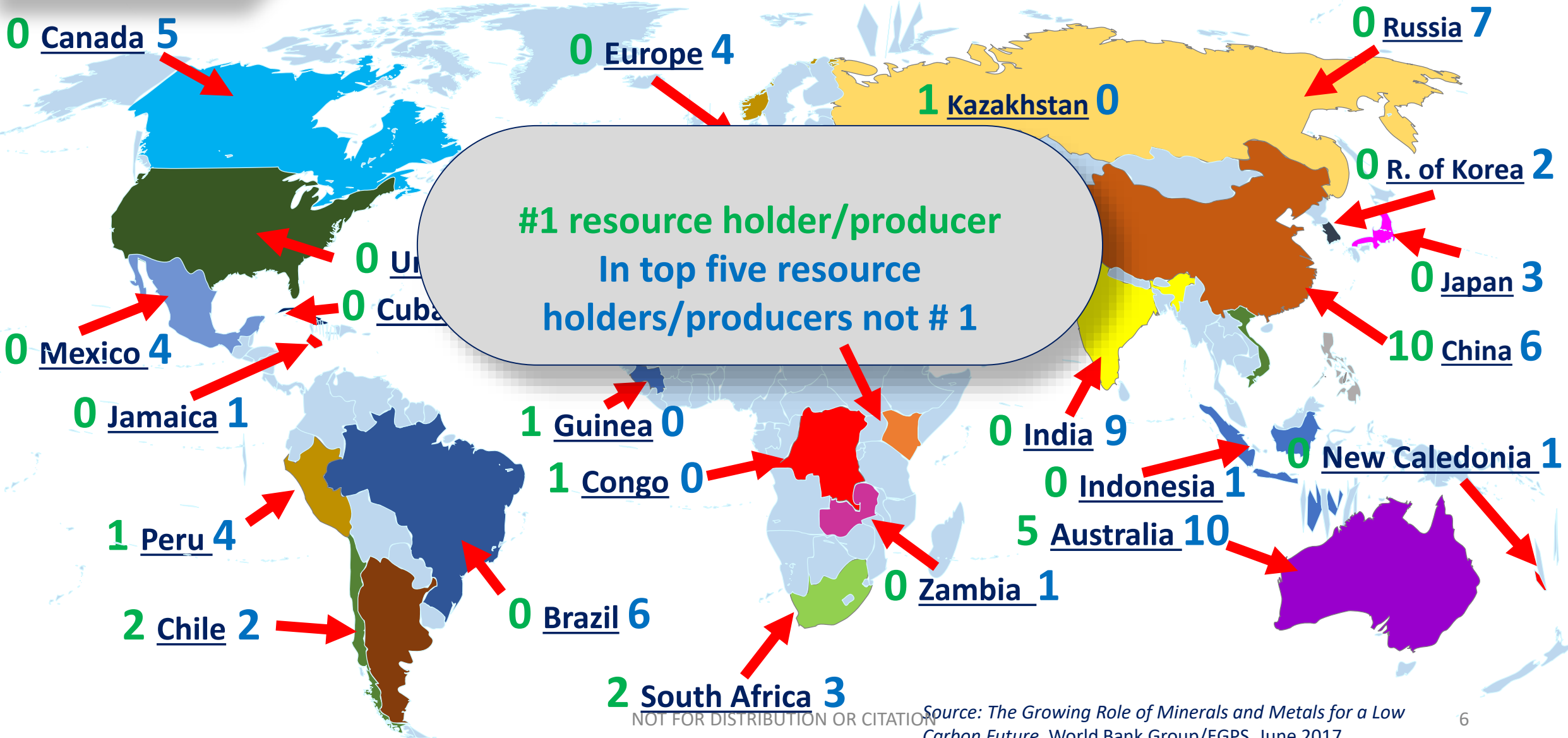
In 2017, UNEP calculated that **low carbon technologies will need over 600 million metric tonnes more metal resources in a 2° C scenario compared to a 6° C scenario where fossil fuel use continues on its current path.**

(It also concluded that the 2° scenario would save more than 200 million cubic meters of water ...)

Silver, Zinc



Select Metals, Minerals and Processes for Wind, Solar and Battery Storage Technologies

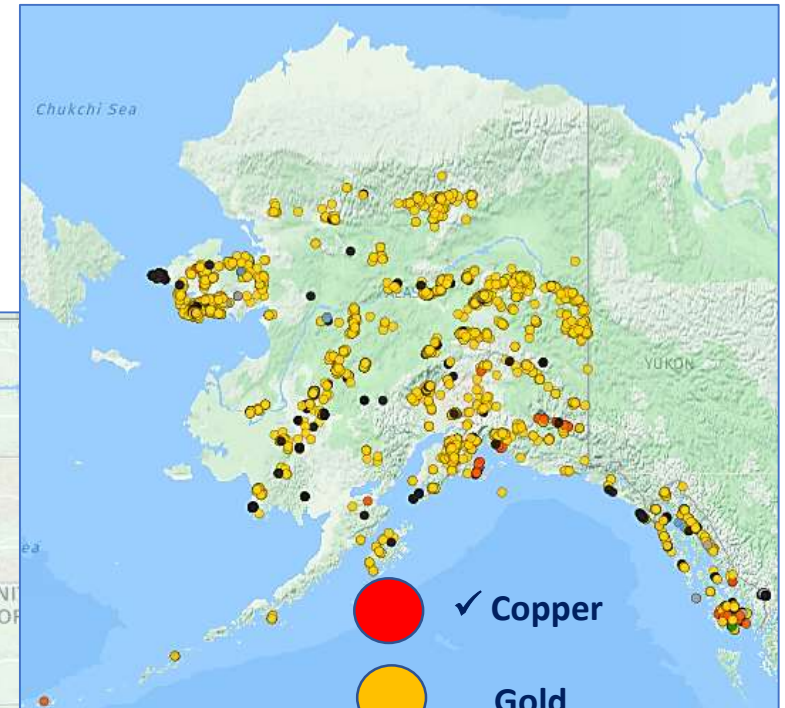
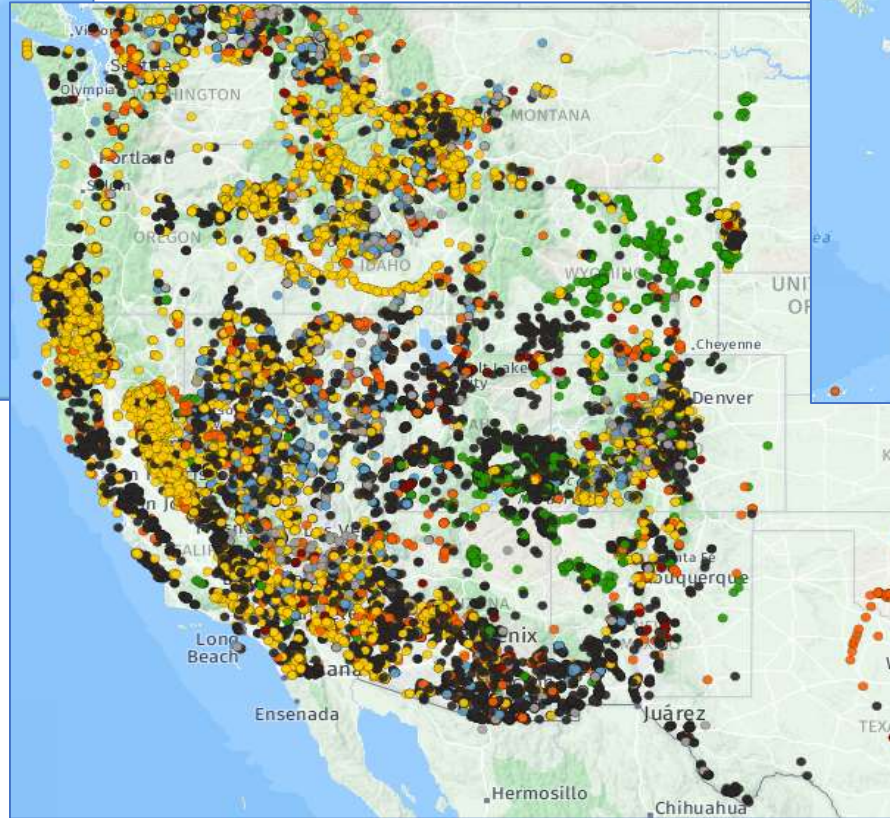
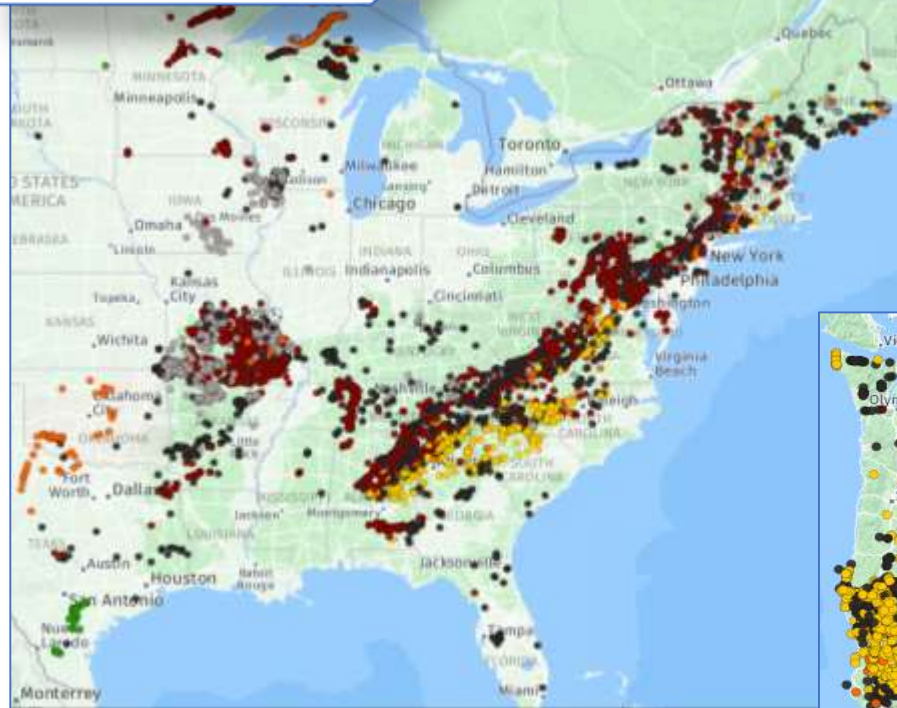


Source: The Growing Role of Minerals and Metals for a Low Carbon Future, World Bank Group/EGPS, June 2017

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Inactive Metal Mines in the US: Copper, Gold, Iron, Lead &/or Zinc, Silver, Uranium, Others



- ✓ Copper
- Gold
- ✓ Iron
- ✓ Lead &/or Zinc
- ✓ Silver
- ✓ Uranium
- ? Others

https://skytruth-org.carto.com/viz/751b8218-5f4a-4ad9-89dd-f2b5b0f5a318/embed_map

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Mission, Principles and Elements of a Green Real Deal

Mission of GRD

Provide a framework for accelerating deep decarbonization of energy systems by mid-century in ways that minimize costs, maximize economic opportunities and promote social equity.

