



# ***Doubling Renewables in the APEC Region***

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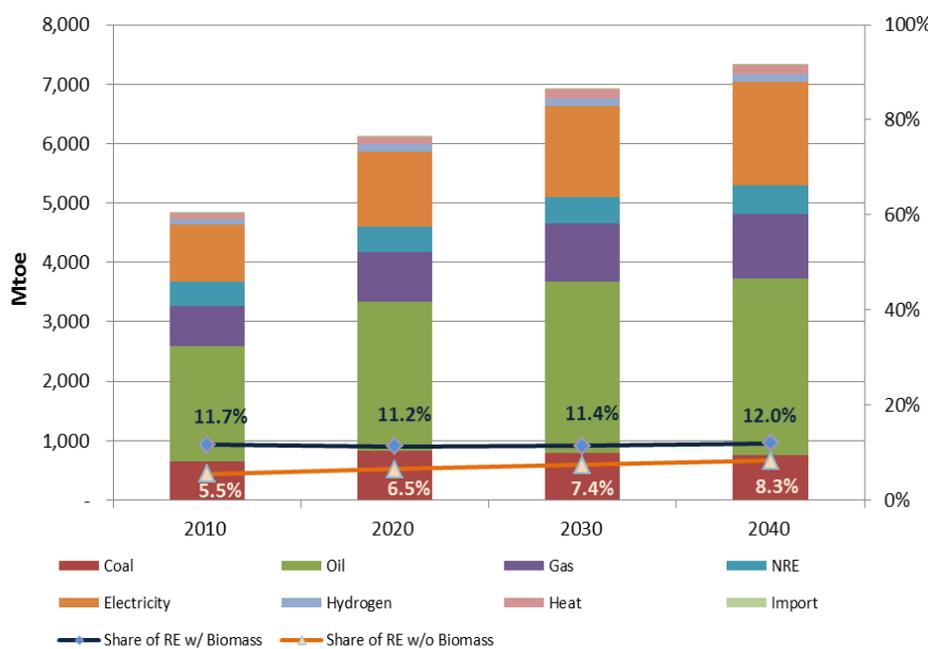
# Beijing Declaration, 2014

The APEC Leaders have introduced a goal of “**doubling the share of renewables in the APEC energy mix, including in power generation, from 2010 levels by 2030**”.

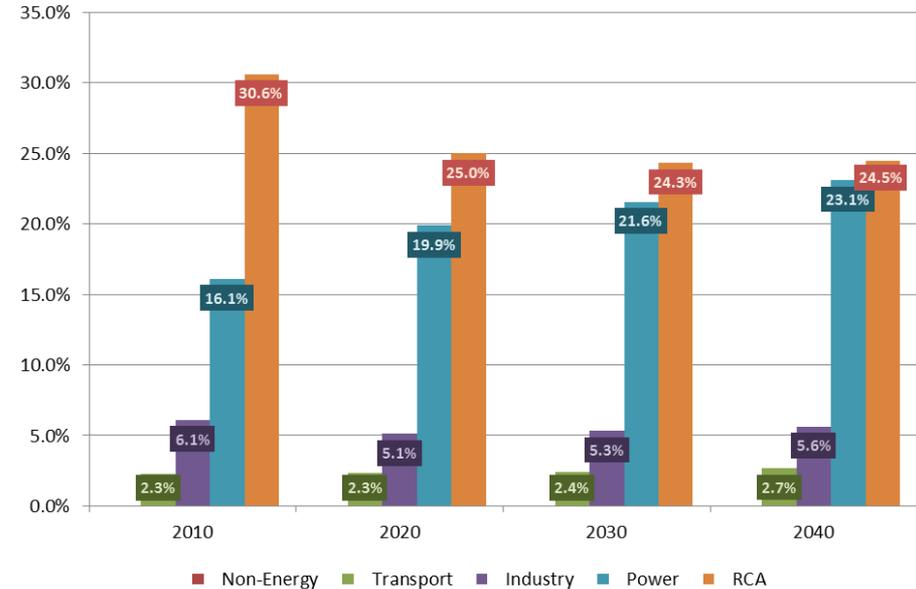
# Renewables in Business-as-Usual (1)

- Under BAU, renewable energy's share of Total Final Energy Consumption (TFEC) in 2030 remains the same as the 2010 level of 11.4%.

### Total Final Energy Consumption (TFEC)



### The Share of Renewable Energy by Sector



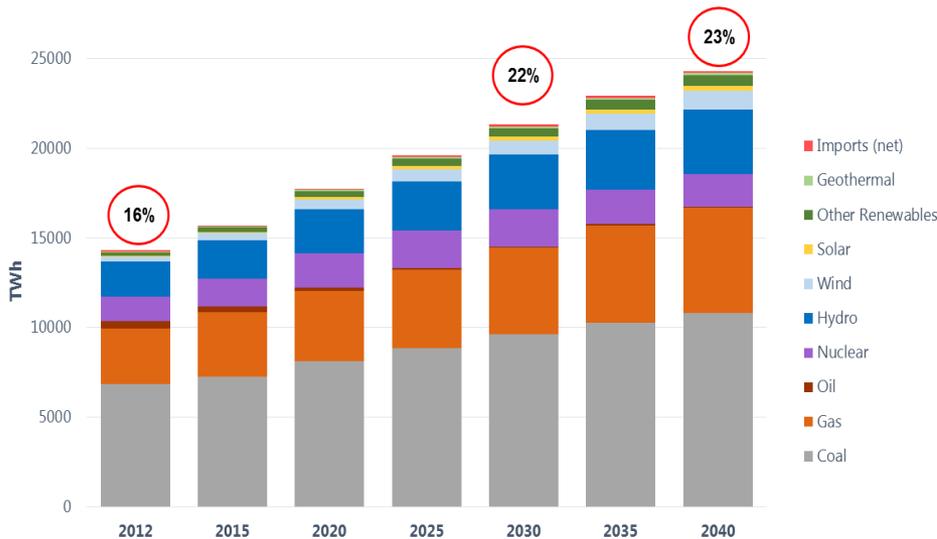
**Note: The share of RE in TFEC by sector excludes electricity. Such is included in the power sector.**

Source: APERC Analysis

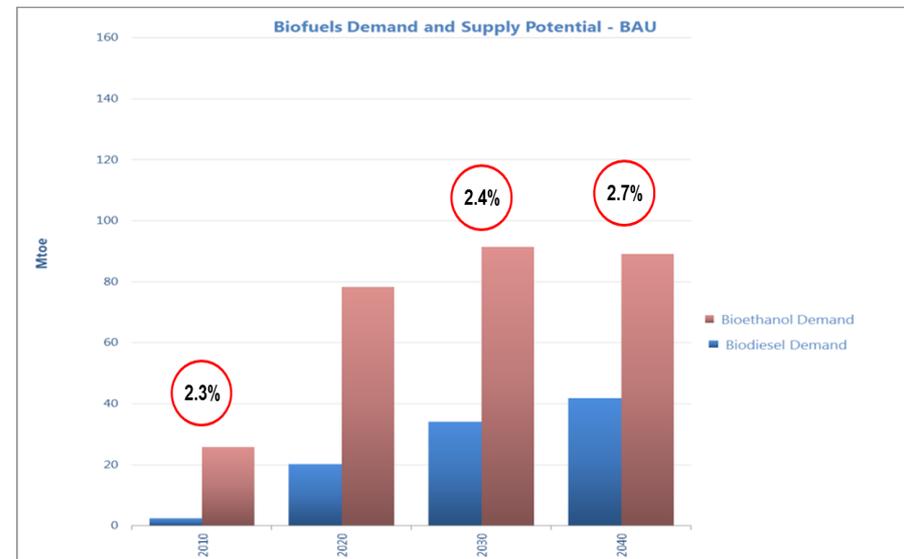
# Renewables in Business-as-Usual (2)

- In power generation - BAU, renewables share of the generation mix is expected to increase from 16% in 2010 to 22% in 2030.
- In transport, the share of biofuels remains at the current share of 2.4% in 2030.

**Total Power Generation Mix**



**The Share of Biofuels in Transport Sector**





# High Renewables Scenario

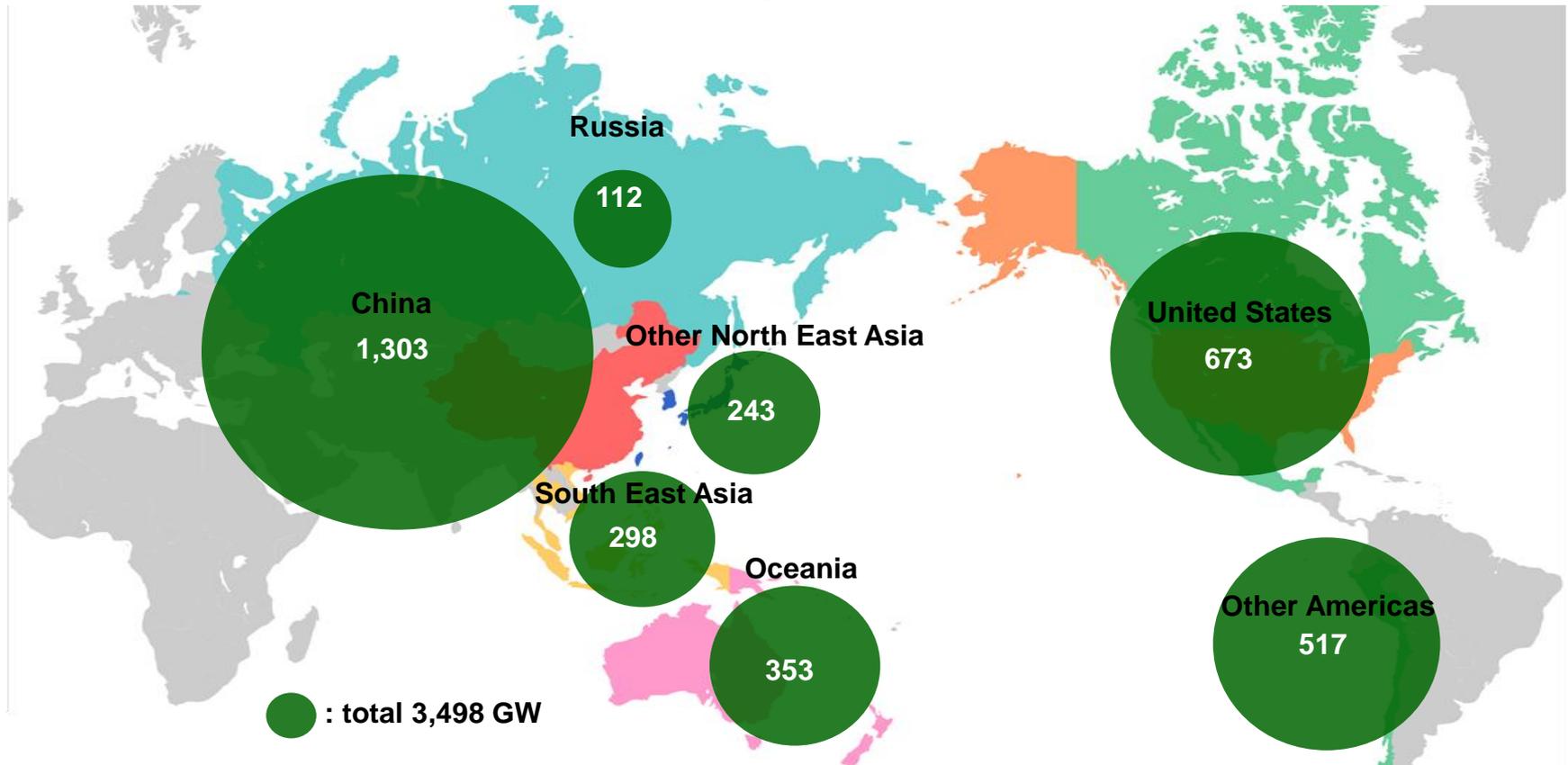
- This scenario considers only high renewables use in the electricity and transport sectors due to model limitations for projected renewable heat use.
- The target of renewable energy's share of the APEC region's energy mix in 2030 for selected sectors:
  - Power generation: 32% (double the share in 2010 of 16%).
  - Transport: 4.6% (double the share in 2010 of 2.3%).



# *Power Generation*

# Estimated Potential of Renewable Energy

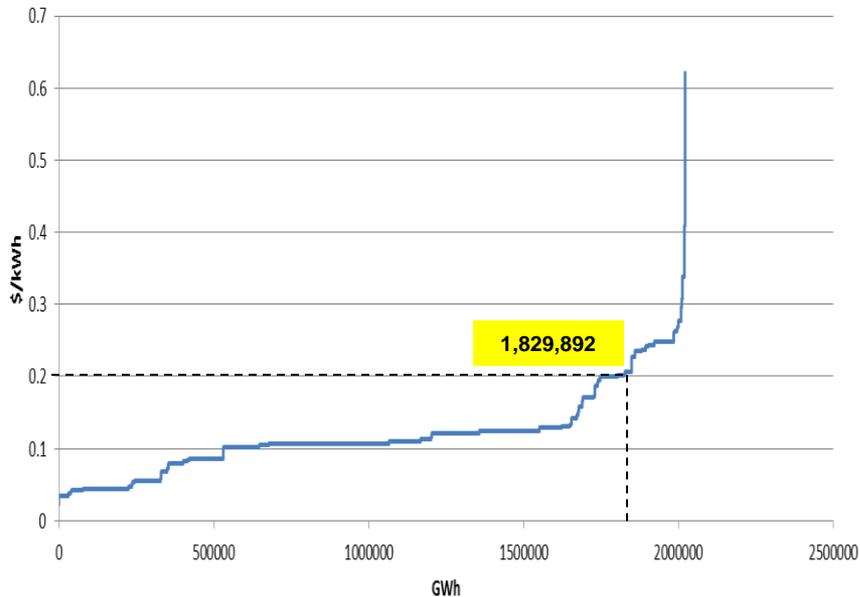
The potential is estimated by considering many factors such as the government targets, plans, projections and/or calculations using other sources or references.



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Note: **Oceania** (Australia, New Zealand and PNG), **Other Americas** (Canada, Chile, Mexico and Peru), **Other North East Asia** (Hong Kong, Japan, Korea and Chinese Taipei), **South East Asia** (Brunei Barussalam, Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam) Source: APERC Analysis

# Cost Curve of RE Technology in 2030



Renewable Technology	The Lowest Cost		The Highest Cost	
	Cost (\$/kWh)	Economy	Cost (\$/kWh)	Economy
Hydro	0.034	Canada	0.144	Japan
Wind on-shore	0.066	New Zealand	0.261	Russia
Geothermal	0.044	US	0.207	Indonesia
Bio-power	0.068	Philippines	0.249	Japan
PV Utility 1	0.086	China	0.409	Russia
Wind off-shore	0.152	US	0.243	Japan
PV Roof 1	0.130	China	0.338	Canada
PV Utility 2	0.126	China	0.449	Russia
CSP	0.139	Chile	0.351	Canada
PV Roof 2	0.170	China	0.378	Canada

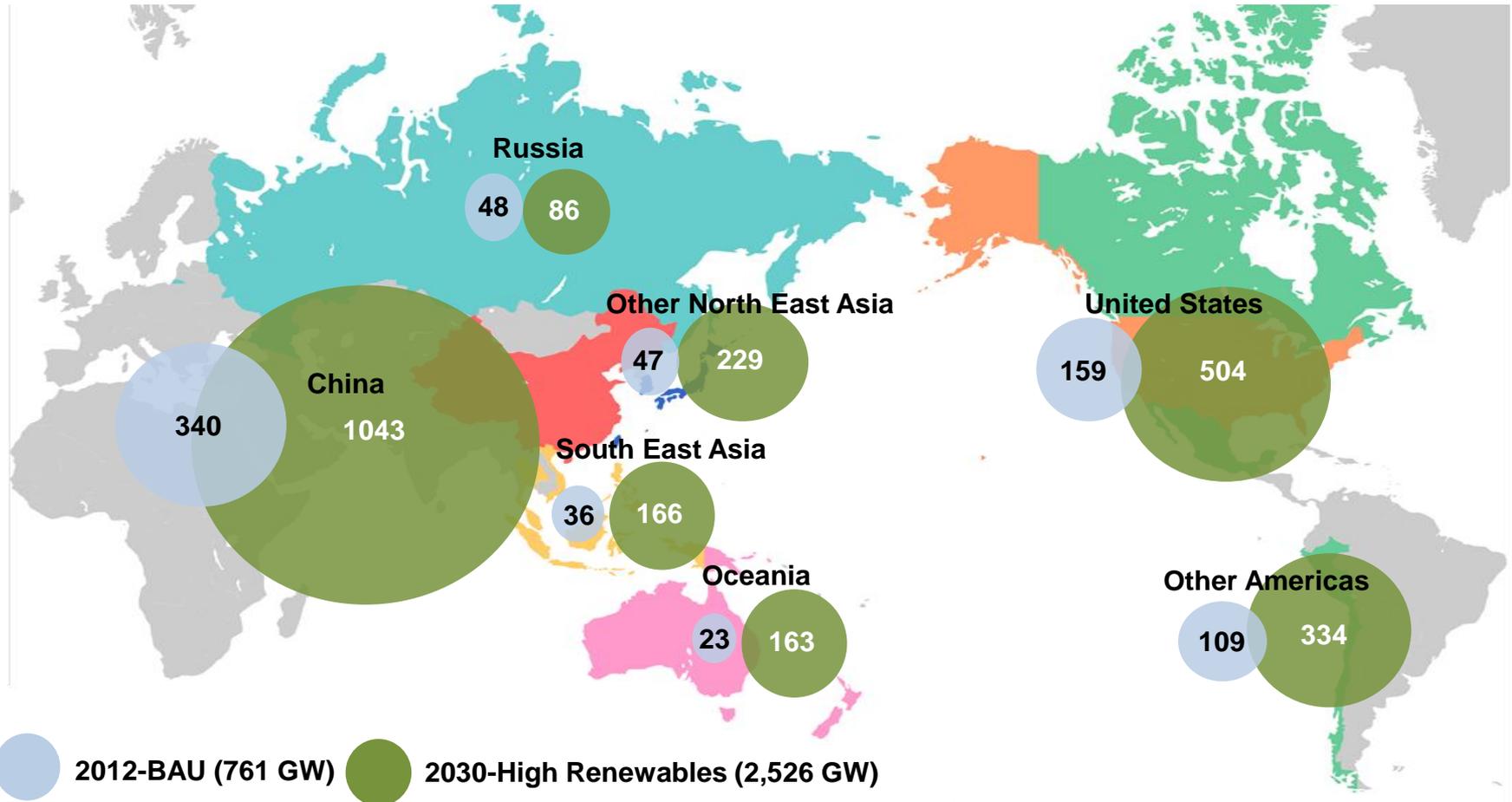
Source: APERC Analysis

This cost curve is calculated without any subsidy or incentive from government.

**Note:**

- Solar PV 1 and Wind 1: without storage and without additional cost to the grid.
- Solar PV 2 and Wind 2: with storage and there is additional cost to the grid.

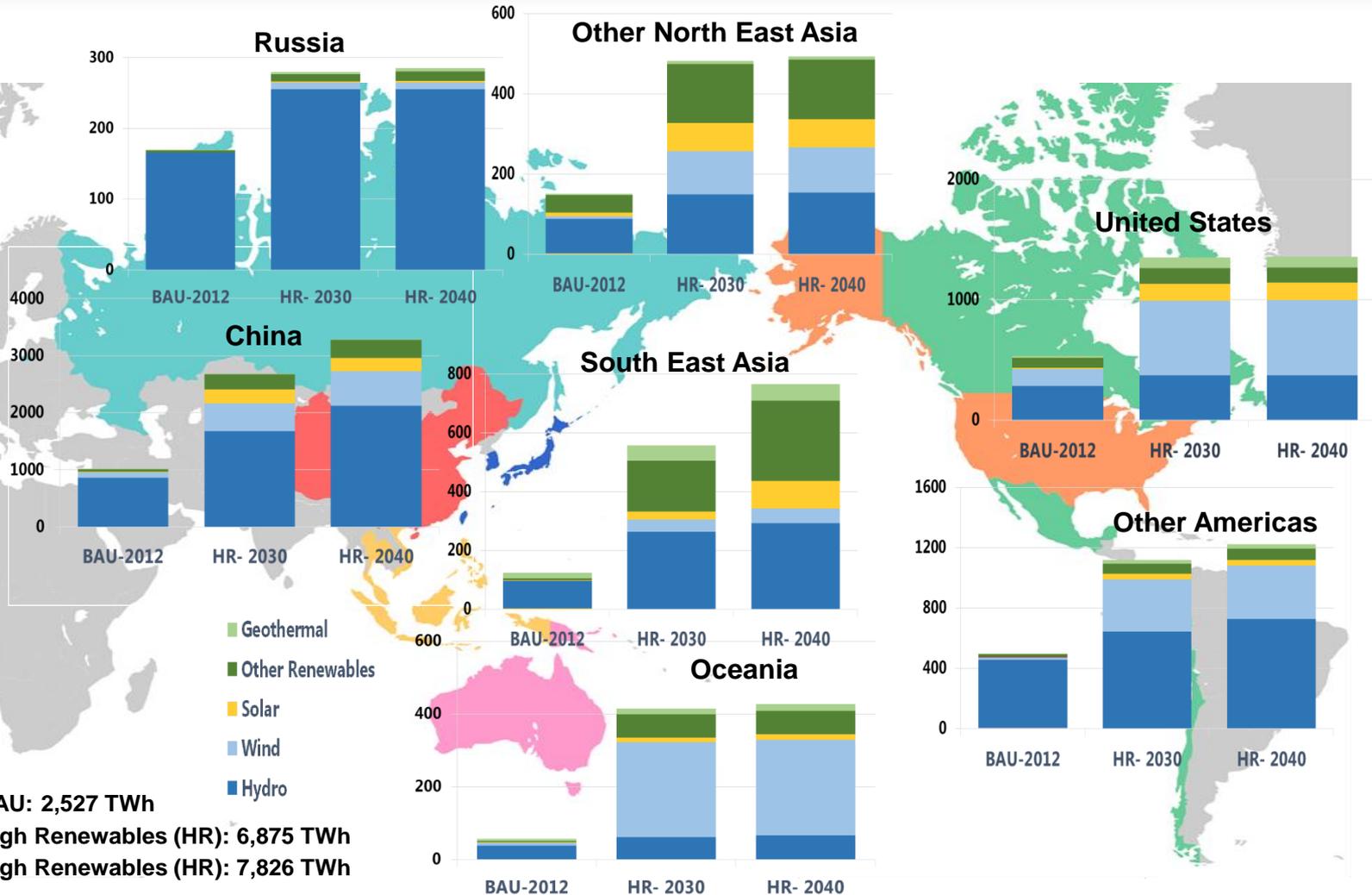
# Achieving a Doubling of RE Power in 2030



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Source: APERC Analysis

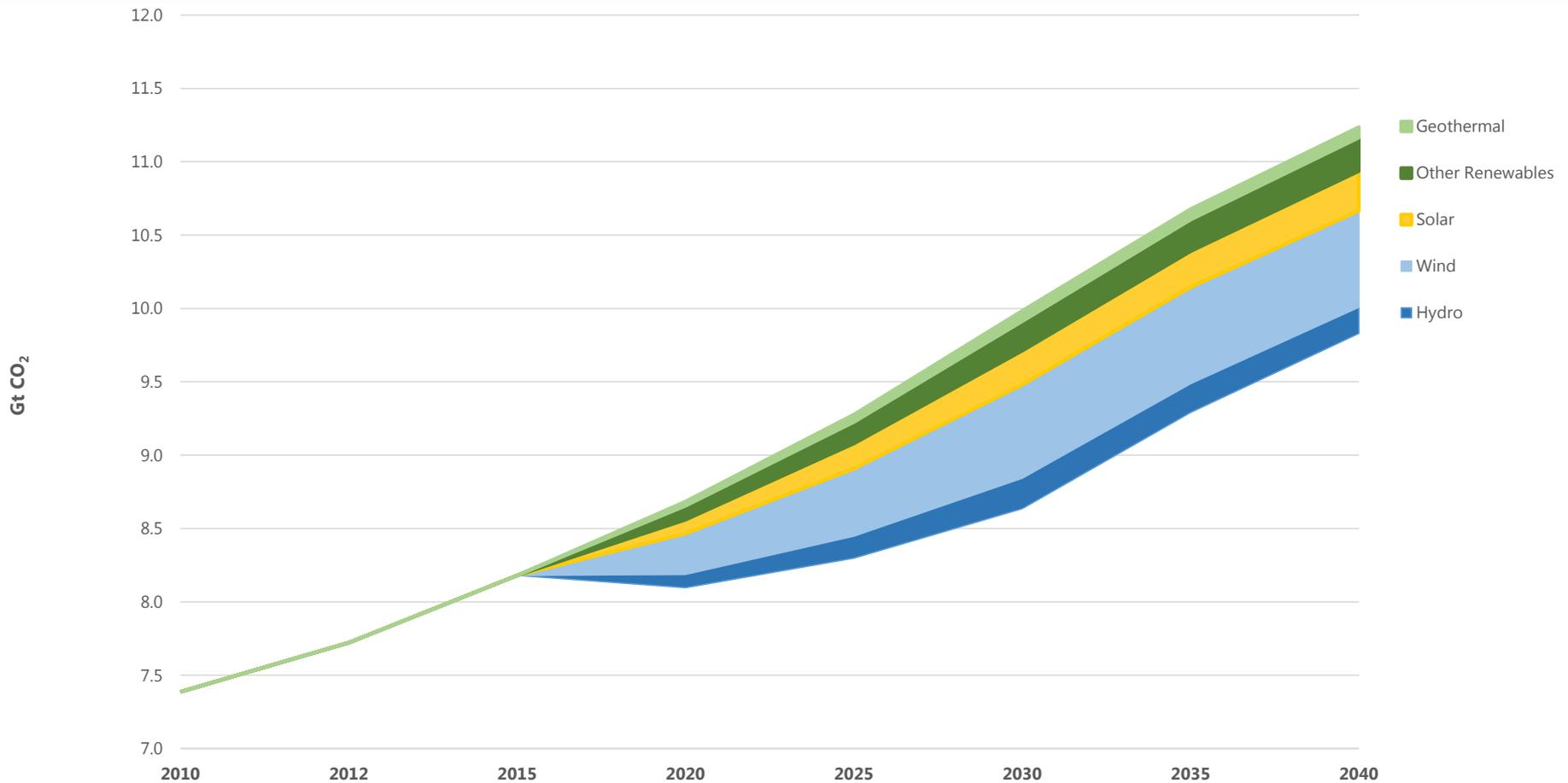
# Renewables in 2030 and 2040 - Generation



Source: APERC Analysis

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# CO2 Emissions Reduction for HiREN in APEC

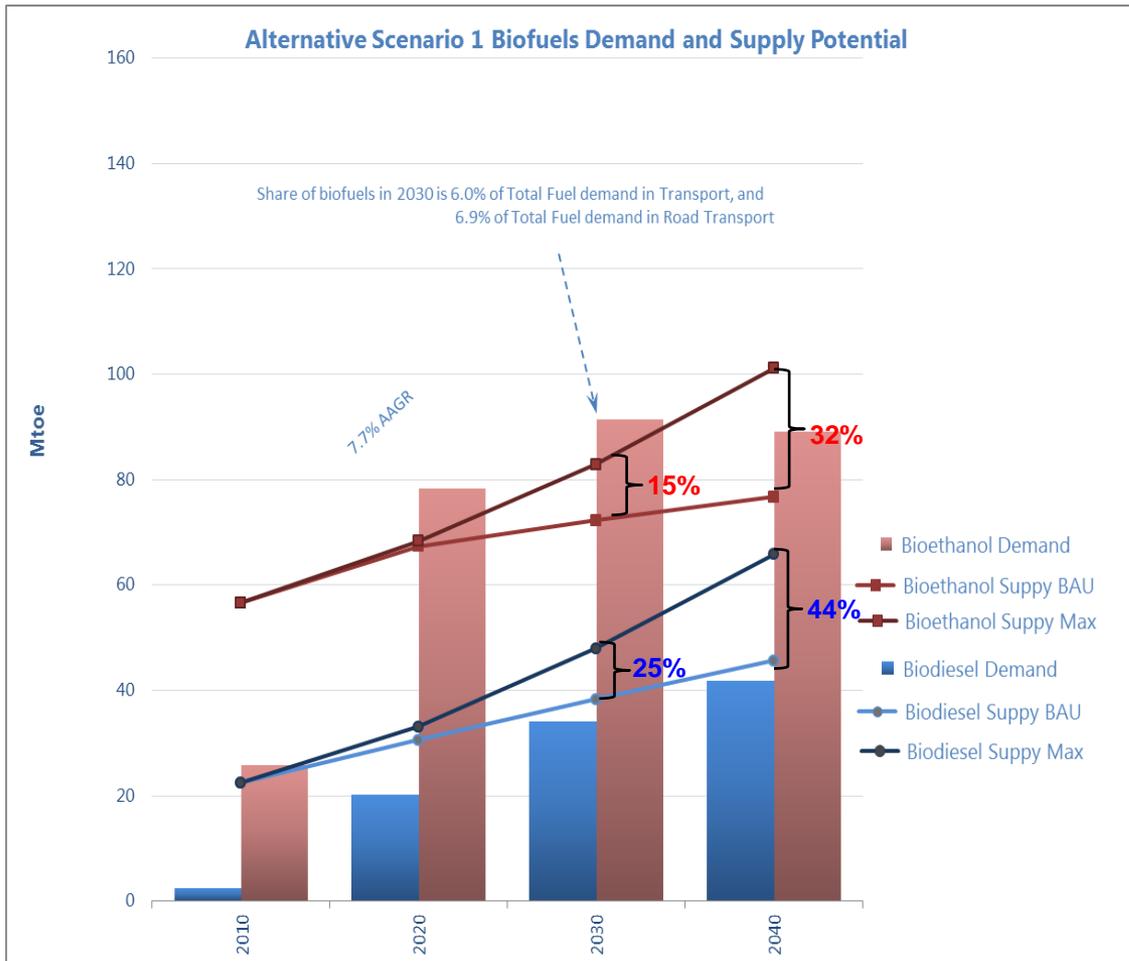


- In HiREN CO<sub>2</sub> emissions are 13.5% and 12.5% lower than BAU in 2030 and 2040



# *Transport Sector*

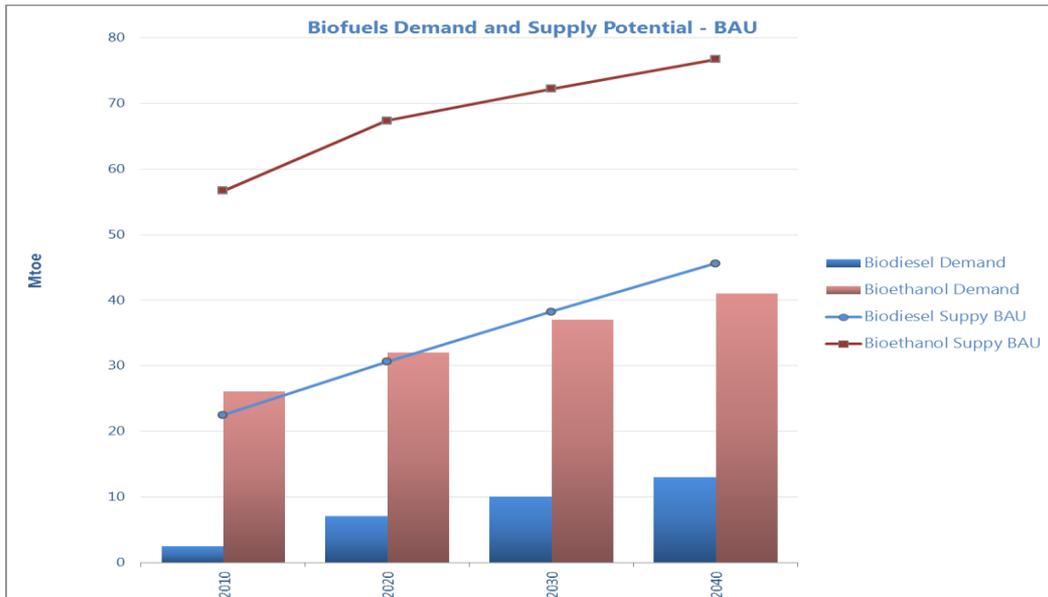
# Biofuels Supply Potential (1)



Source: APERC Analysis

- Bioethanol supply in High Renewables Scenario could reach 15% and 32% in 2030 and 2040, respectively, compared to BAU Case.
- Biodiesel supply in High Renewables Scenario could reach 25% and 44% in 2030 and 2040, respectively, compared to BAU Case.

# BAU Biofuels Demand

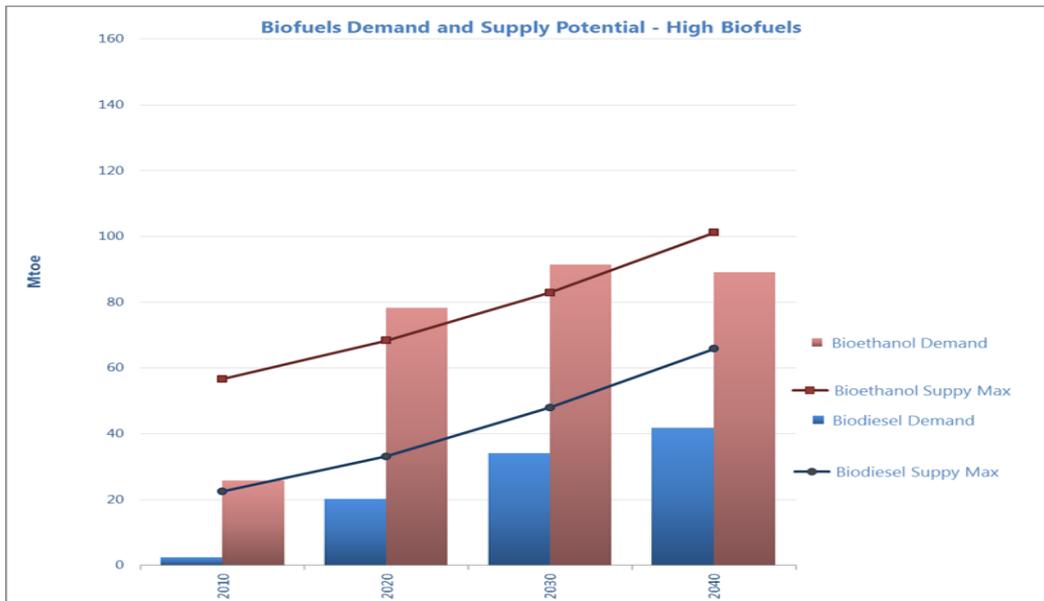


- In the BAU scenario, the share of biofuels will remain the same in 2012 and 2030.
- The BAU demand of bioethanol is about 51% of the BAU supply for bioethanol in 2030.
- The BAU demand of biodiesel is only 26% of the BAU supply for biodiesel in 2030.

	2010	2020	2030	2040
<b>BAU Demand, Bioethanol (Mtoe)</b>	<b>26</b>	<b>32</b>	<b>37</b>	<b>41</b>
<b>BAU Demand, Biodiesel (Mtoe)</b>	<b>2</b>	<b>7</b>	<b>10</b>	<b>13</b>
<b>BAU Supply, Bioethanol (Mtoe)</b>	<b>57</b>	<b>67</b>	<b>72</b>	<b>77</b>
<b>BAU Supply, Biodiesel (Mtoe)</b>	<b>22</b>	<b>31</b>	<b>38</b>	<b>46</b>

Source: APERC Analysis

# High Biofuels Demand

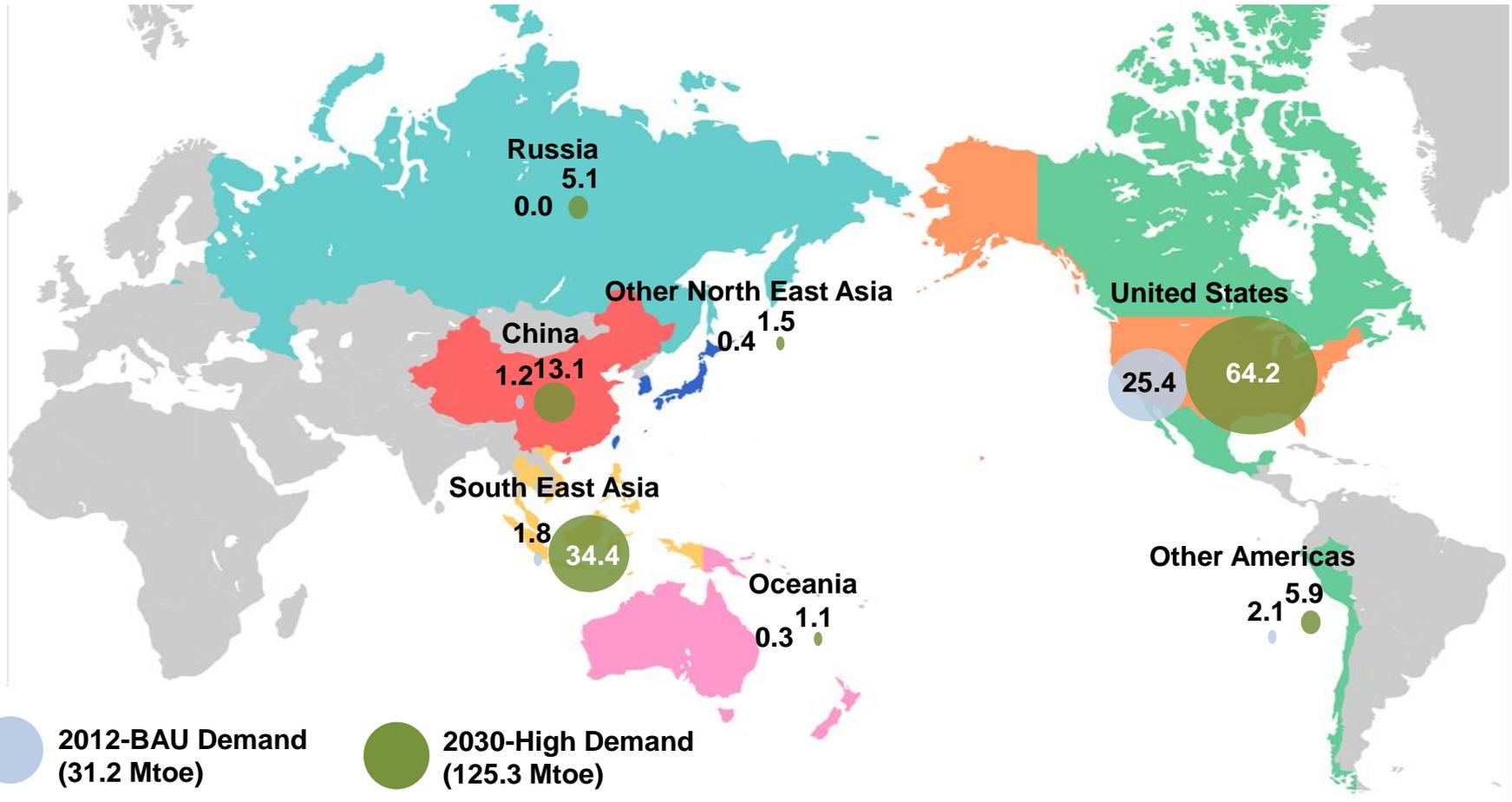


	2010	2020	2030	2040
High Bioethanol Demand (Mtoe)	26	78	91	89
High Biodiesel Demand (Mtoe)	2	20	34	42
High Supply, Bioethanol (Mtoe)	57	68	83	101
High Supply, Biodiesel (Mtoe)	22	33	48	66

Source: APERC Analysis

- Just considering the gov't blend targets, the share of biofuels will more than double from 2.2% in the total transport demand in 2010 to 6.0% in 2030, and 2.6% in the total road transport demand to 6.9% for the same period.
- However as only 1<sup>st</sup> generation biofuels are assumed in the model, supply potential for bioethanol in high supply does not meet the demand by 2020 onwards.

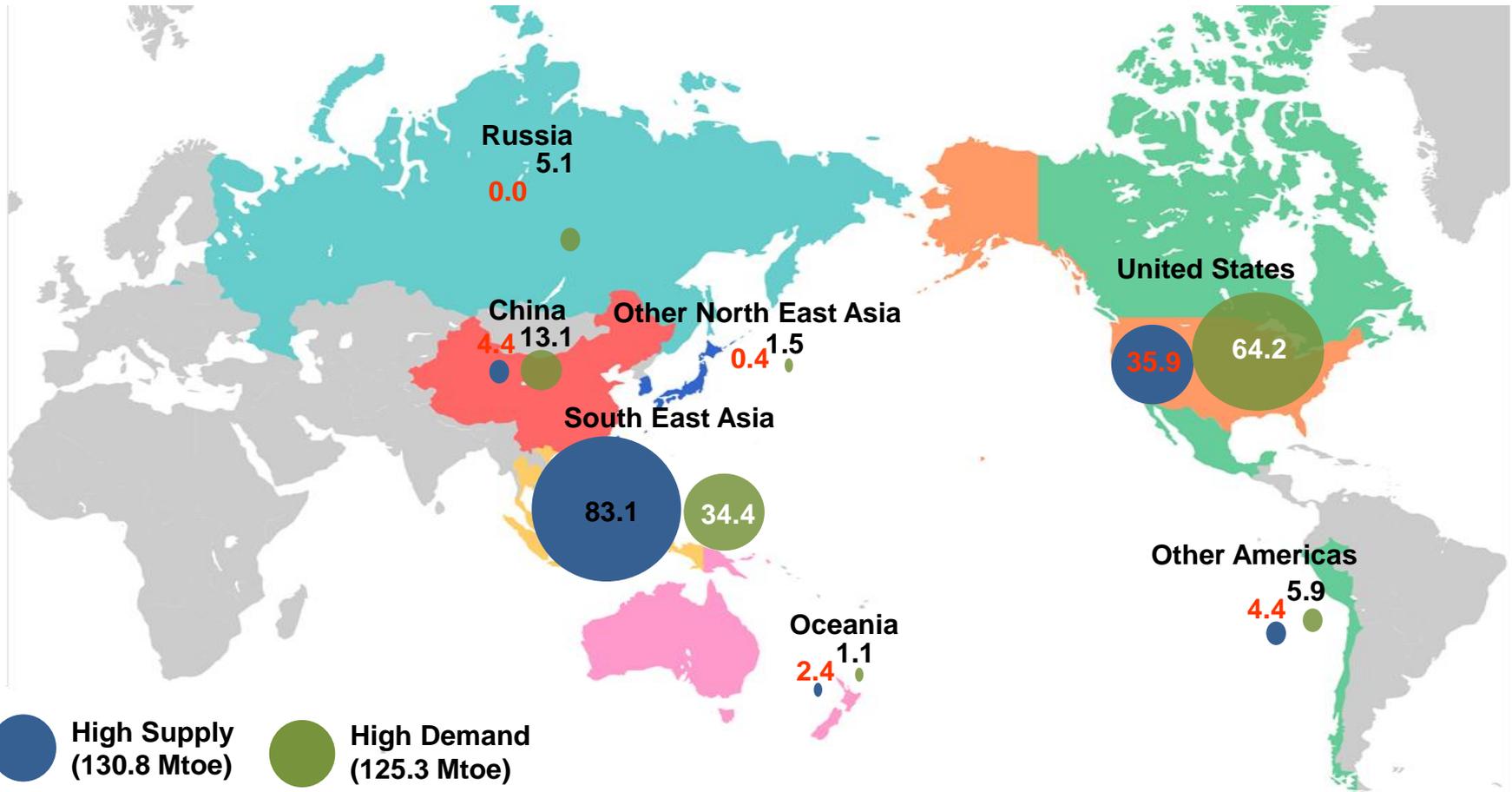
# Achieving a Doubling of RE Transport in 2030



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Source: APERC Analysis

# High Demand and Supply in 2030



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Source: APERC Analysis



# Conclusions

- The APEC doubling goal of renewable energy in power generation is achievable in 2030 under the high case. However, it requires nearly 100 GW per-year of additional renewable generation capacity between 2015 to 2030.
- Although Hydro is still the prominent technology to be developed to 2030, Wind and Solar see significant increases. An estimated 764 GW of wind and 472 GW of solar will need to be added between 2015 and 2030 to reach the High Renewables Scenario.
- China will account for the largest share of renewable power additions (41%) followed by the United States (21%).
- Though the doubling goal of renewable energy in transport sector is achievable with just the government blend targets, the share of Biofuels under the High Renewables Scenario rises to 6% in 2030 from just 2.2% in 2010.
- However as only 1st generation biofuels are considered in the model, high supply potential for Bio-ethanol will not meet the demand from 2020 onwards and imports will be needed to satisfy demand.
- To meet the APEC doubling goal in transport sector, economies will need to start developing and deploying advanced Biofuels and governments should support research, development and demonstration (RD&D) as well as providing policy support for commercial-scale advanced biofuel plants, particularly for Bio-ethanol.