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The Compatibility of Renewable Energy with Airports and Airspace

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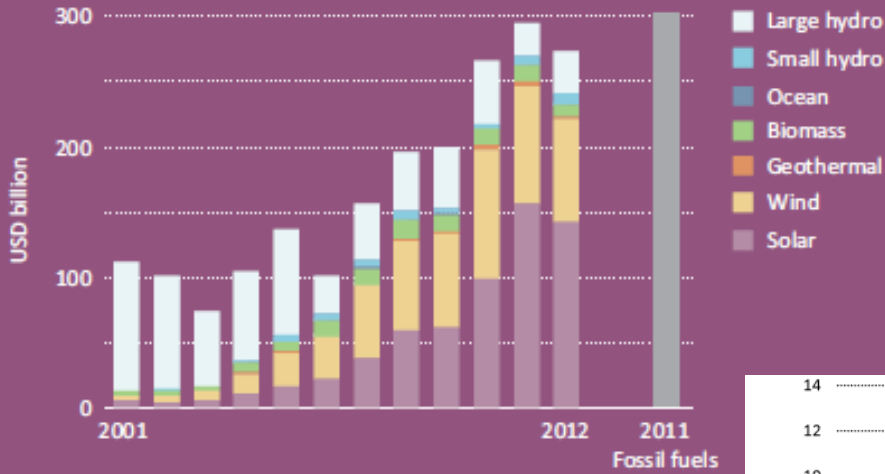
Renewable Energy Use Worldwide

- 19% of world final energy consumption / 2011
- 50% of new electric generation / 2012
- EU – 20.6% of peak capacity / 2012
- US – 49.5% of new electric generation / 2013
- BRICS – 36% of world capacity / 2012

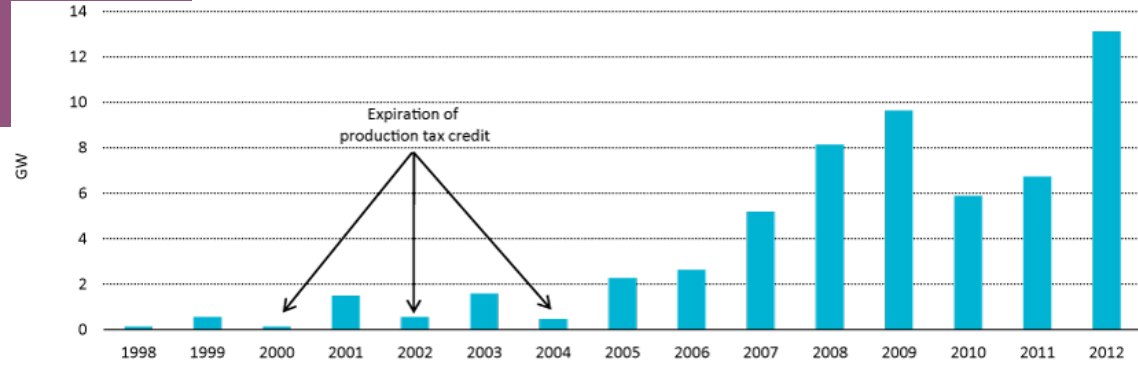
Source: IEA 2013



1.3 Annual capacity investment worldwide



New wind energy installations in the US



Source: IEA 2013



Renewable Energy and Airports

- Airport power demand is high
- Land and buildings for siting
- Open landscape to capture power
- Utility infrastructure exists
- Lease land or generate power on-site
- Fulfills economic and environmental objectives



Solar

- Low profile, compatible with airports
- Flexible siting options, buildings or land
- Sun shines everywhere, all sites possible
- Glare is most critical siting factor
- FAA has developed glare model, guidance



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Wind

- Difficult to site near Airports, large structures
- Airspace penetration, radar shadow
- A few successful examples
- Building-integrated, more of a symbol
- Medium size turbines in testing



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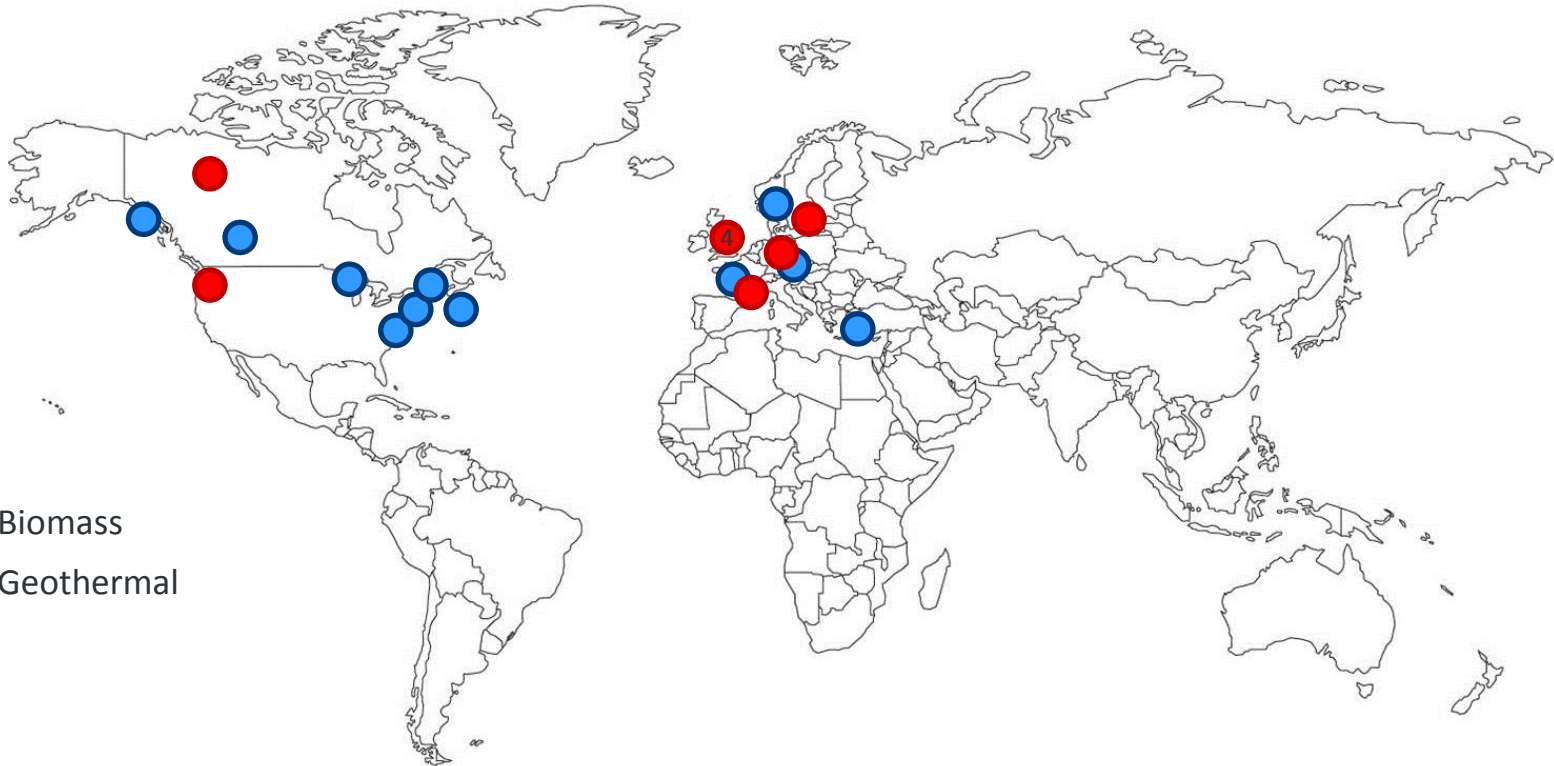
Geothermal

- Success with ground source heat pumps
- Systems underground, in buildings
- Typically coupled with new construction
- Reduces need for conventional heating
- Paris-Orly, Calgary, Portland Maine



Biomass / Biofuel

- Requires new or retrofitted facility
- Viable where wood waste fuel available
- Landfill gas a few where facility proximate
- Waste to Energy, Anaerobic digestion
- Challenge: transporting fuel to airport





Marine Hydrokinetics

- Technology less mature than others
- Projects demonstrated in Bay of Fundy, Scotland, US Northwest and Maine
- Demonstration at airports possible



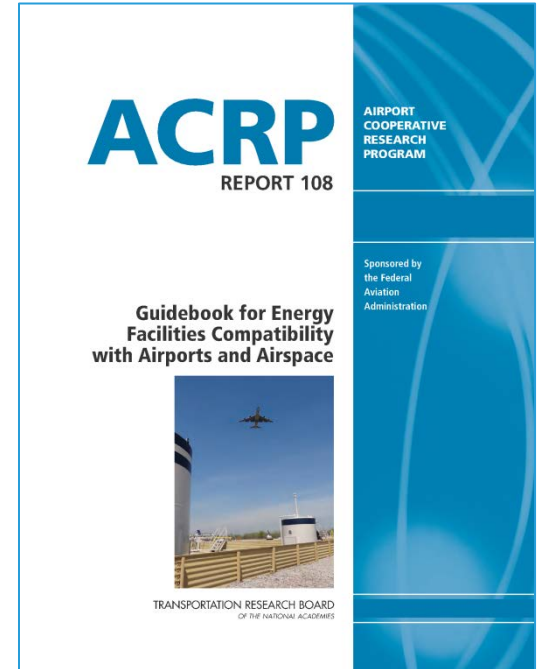
Fuel Cells

- Flexible siting, startup conventional fuels
- Ideal for backup generation
- Can provide stationary and mobile power
- FedEx Ground Service Equipment Pilot



Siting Guidance

- Airports looking to develop energy (solar, oil and gas)
- Off-airport project (wind power, combined cycle power plants)





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Questions?

