Changing Landscape of Wind Energy Tariff

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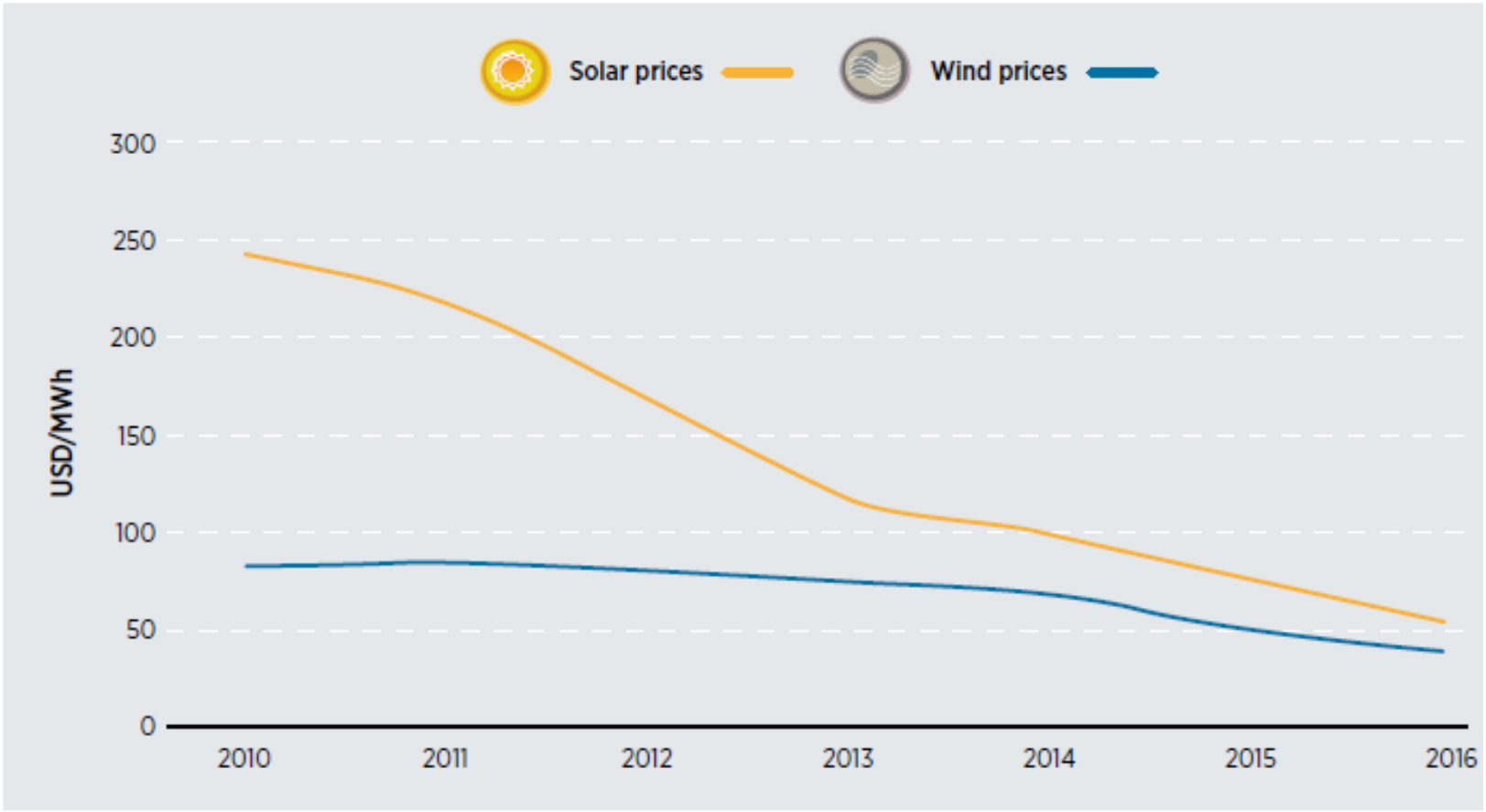
Agenda

- Wind Tariffs from auctions in Americas
- Wind Tariffs from auctions in Africa, Europe and Asia
- PPAs in USA
- Tariffs in Mongolia, Philippines, Sri Lanka, Vietnam

Average Auction Price for Onshore Wind ~$40/MWh in 2016

Figure 1 Average prices resulting from auctions, 2010-16



Source: IRENA, 2017.

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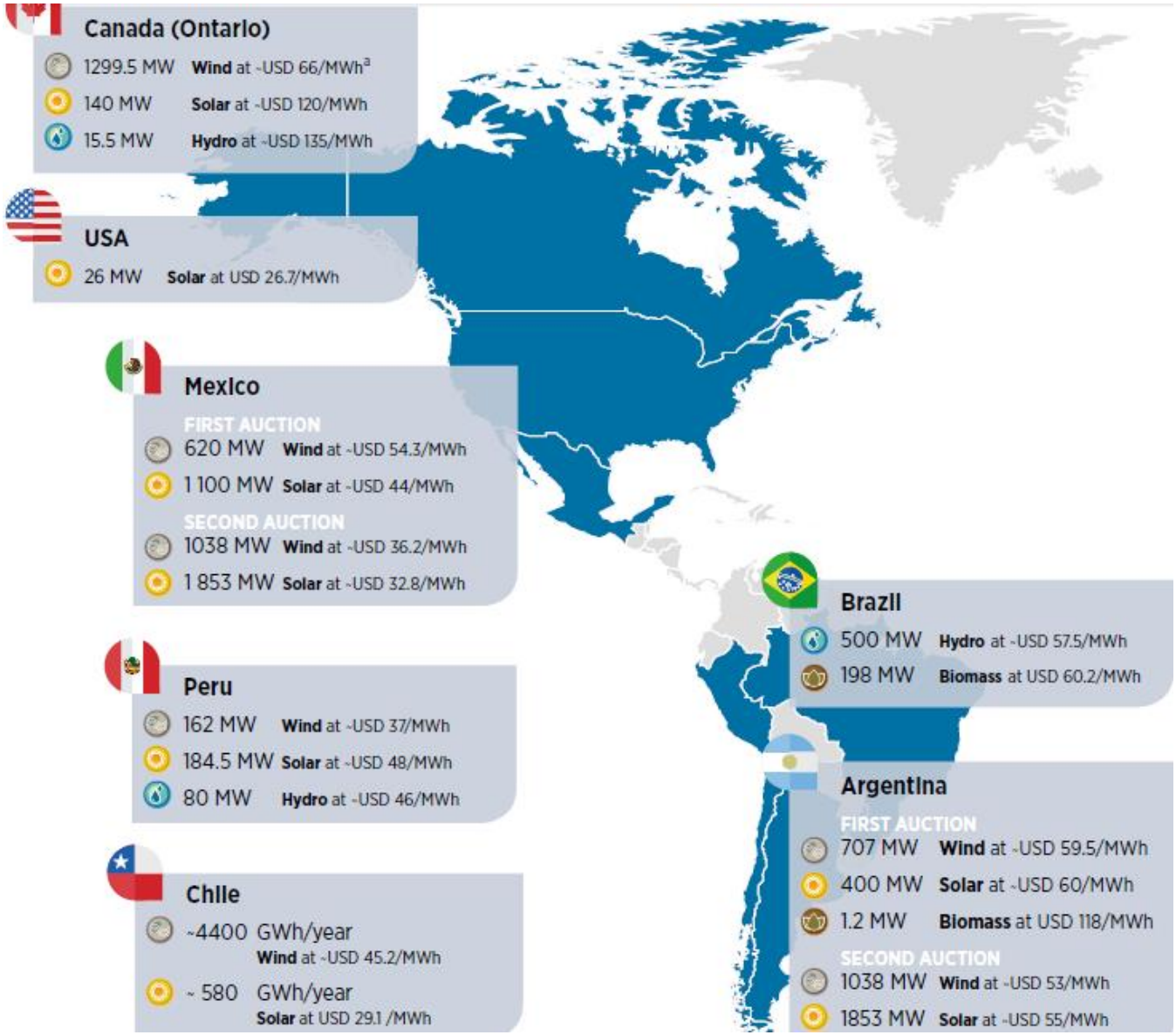
RE Auction Prices in Americas



Canada: $66/MWh

Mexico: $36.2/MWh

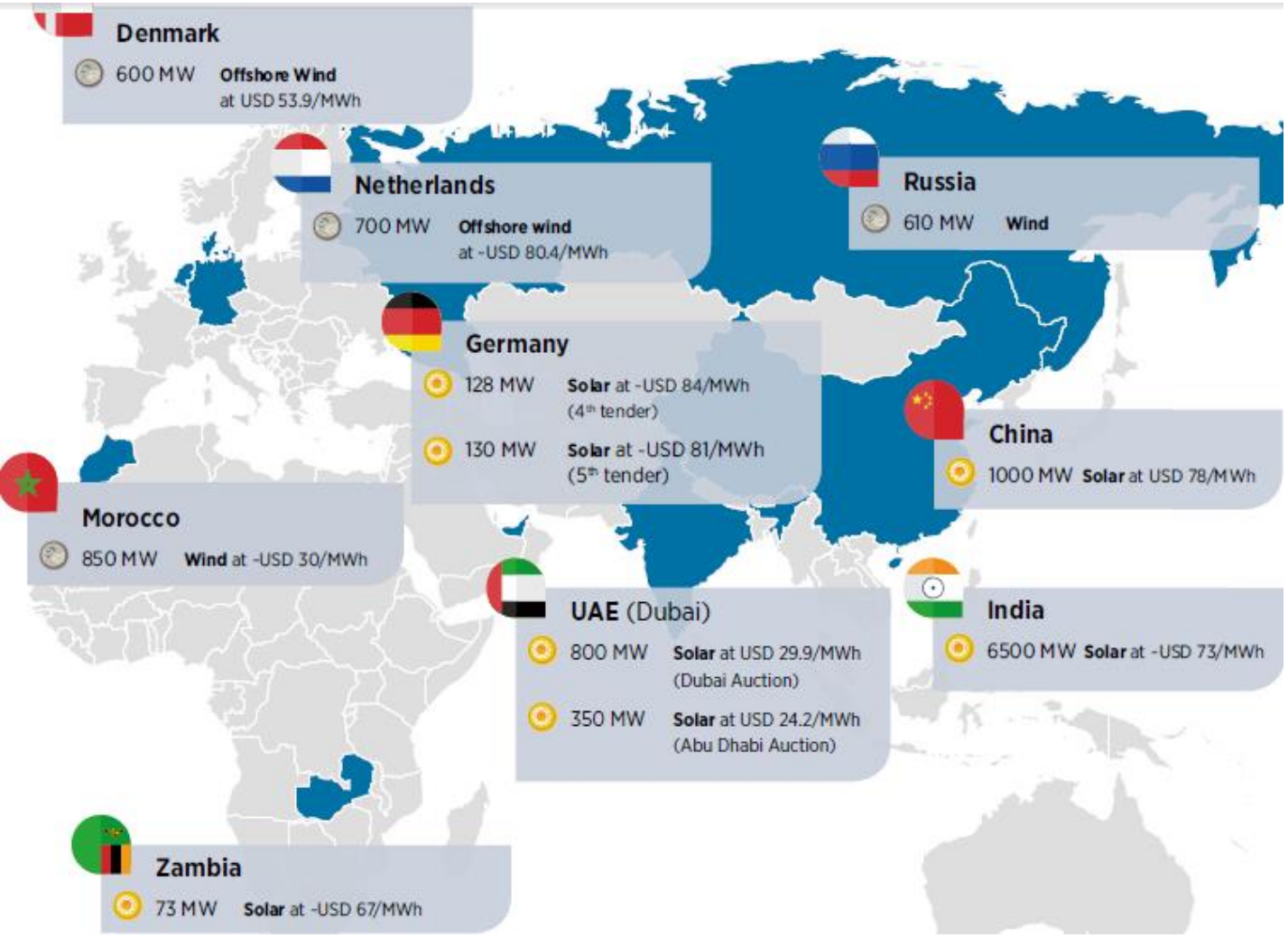
Peru: $32/MWh

Chile: $45.2/MWh

Argentina: $53/MWh

Source: IRENA, 2017

RE Auction Prices in Africa, Europe and Asia



Onshore wind auction

Morocco: $30/MWh

India: $53/MWh

Offshore wind auction

German: $66/MWh

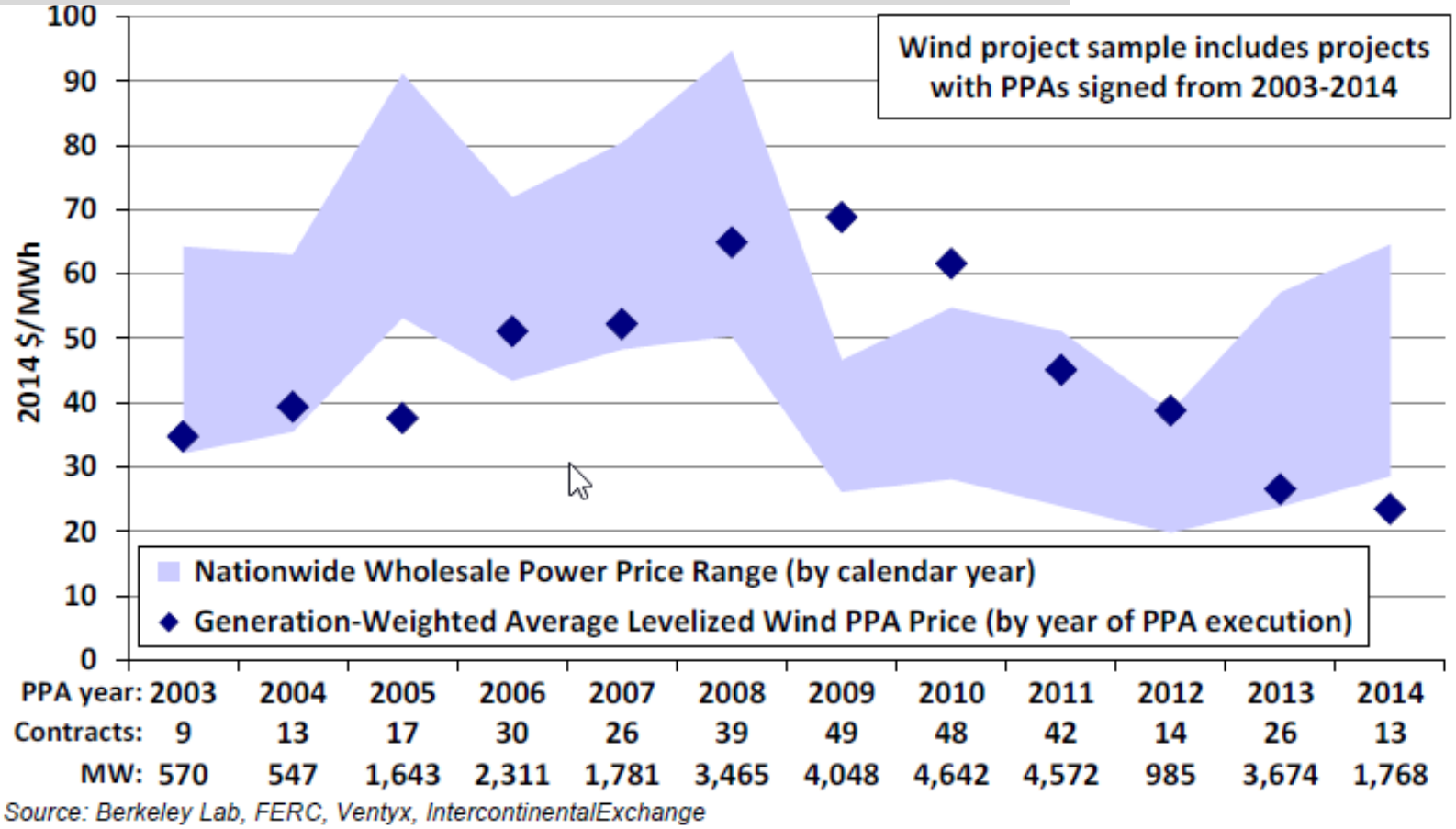
Dutch: $60/MWh

Denmark: $53.9/MWh

Source: IRENA, 2017

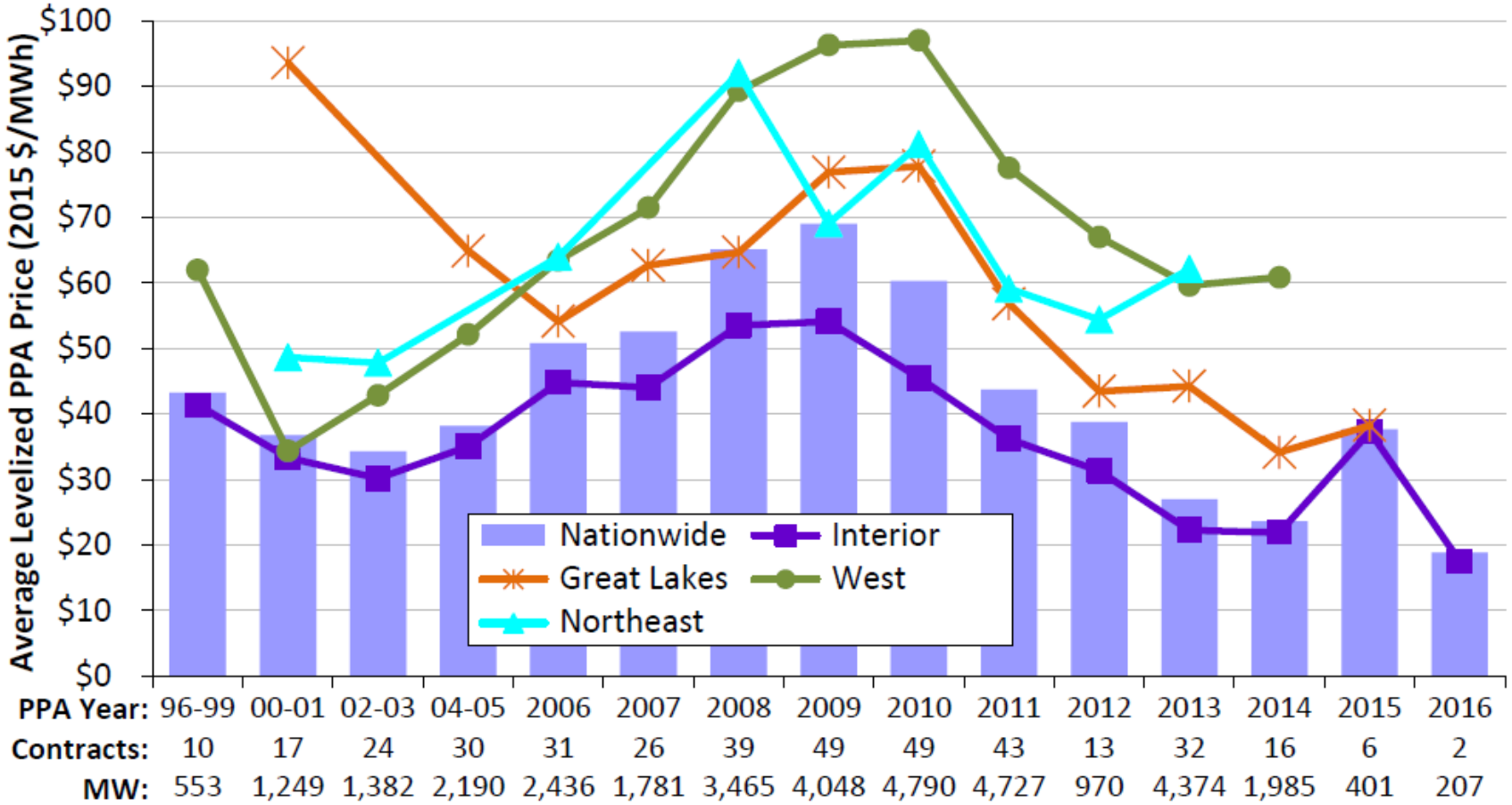
Average levelized long-term PPA in US

- Average PPA in 2014 was $24/MWh, less than wholesale price
- Other incentives (PTC=$23/MWh for 10 years): $15/MWh



Source: LBNL, 2016

PPA Prices in Regions of US



Source: Berkeley Lab

Figure 48. Generation-weighted average levelized wind PPA prices by PPA execution date and region

Source: LBNL, 2016

Tariffs in Mongolia, Philippines, Sri Lanka, Vietnam

Country	Tariff Per MWh	Comments
Mongolia	$80 to 95	FiT. Limited load, inflexible grid
Indonesia	~$70 for S. Sulawesi $120 to 150 for NTT	Auction with ceiling tariff of 85% of local generating cost
Philippines	$190, ph 1 $160, ph 2	FiT with quota of 200 MW Quota has been fulfilled Future tariff not announced
Sri Lanka	$150 (expired)	FiT, limited to 10 MW or less Auction for bigger size projects
Vietnam	$78	FiT, limited uptake

Summary

- Wind tariffs are local
- Unsubsidized tariffs of $50 to $65/MWh are achievable under the following conditions:
  - Wind speed of greater than 7 m/s at hub height
  - Project size of greater than 100 MW
  - Good grid connectivity
  - Good logistics infrastructure
  - Good licensing and permitting regime
  - Good local talent pool
  - Low cost of financing, for example 70% debt with 7.5% interest of 10 year duration
  - Low overall uncertainty in AEP and low risk
  - Low O&M cost, for example $10 to $15/MWh
  - PPA terms that include take-or-pay

What are the components of effective wind energy policy?

Policy	Description
Tariff/Incentives	Supply-side: How much producer get paid? Demand-side: How is the buyer incentivized?
Wind resource exploitation	How can we optimize total system cost? How can policy help reduce lead time and cost of wind development? Preferred wind project zones, or wind corridors.
Grid integration	Guaranteed interconnection, priority dispatch Grid code for interconnection of variable power Upgrade transmission, substations, dispatch systems
Licensing	One-stop-shop that coordinates all licensing, approvals and permits
Public relations and human resource	Public awareness campaign to increase acceptance and counter myths Universities and training institutes so work is done by in-country personnel

What leads to effective wind energy policy?

Characteristics	Description
Comprehensive	Each component of policy must balance the competing needs for stakeholders for the policy to be effective.
Certainty for long-term	Wind projects may take several years from concept to commissioning, therefore certainty in policy for the long-term is an imperative.
Continuous improvement	In order to address changes in technology, ground realities and financial environment

Wind energy policy framework

Policy Components	Comprehensive	Certainty for Long-term	Continuous Improvement
Incentives	Demand- and Supply-side incentives	At least 10 year horizon	Update to FiT model and other incentives
Wind resource exploitation	Country-wide wind resource map	Wind energy corridors	Long-term measurement
Grid integration	Integrated energy master plan	Five, ten and twenty year scenarios	Responsive to congestion and curtailment.
Licensing guidelines	One-stop shop to manage myriad of licenses/permits	Transparent with clear requirements and criteria	Adjustments
Public awareness & human resource development	All key issues are addressed	Long-term communications and research program	Adjustments

Further Reading

1. Pramod Jain, Bo An, "Policy Enablers for New Wind Energy Markets," ADB Sustainable Development Working Paper Series, 2015
2. "Renewable Energy Auctions: Analyzing 2016," IRENA, 2017
3. Ryan Wiser, M. Bolinger, "2015 Wind Technologies Market Report," Lawrence Berkeley National Labs, USA, 2016
4. Pramod Jain, Wind Energy Engineering, second edition, McGraw-Hill, New York, 2016