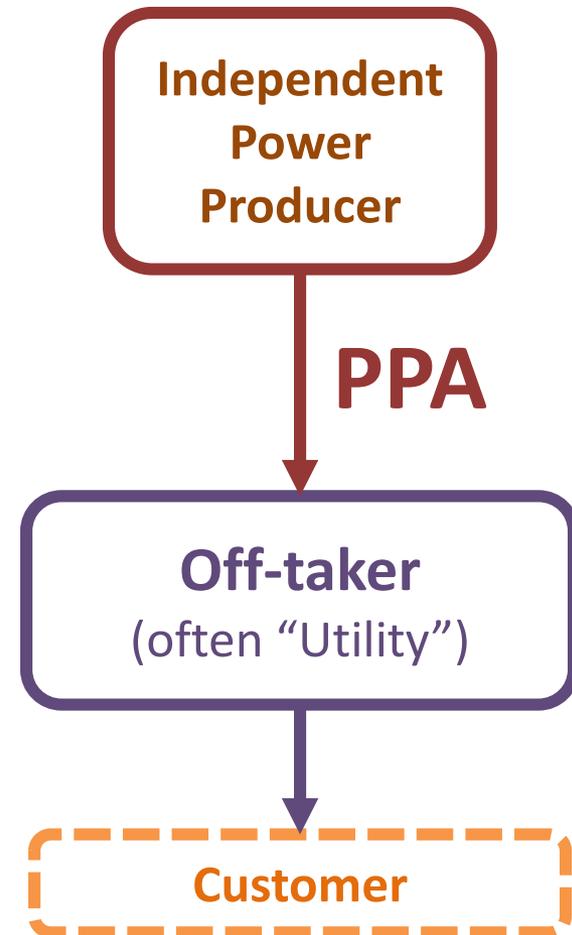
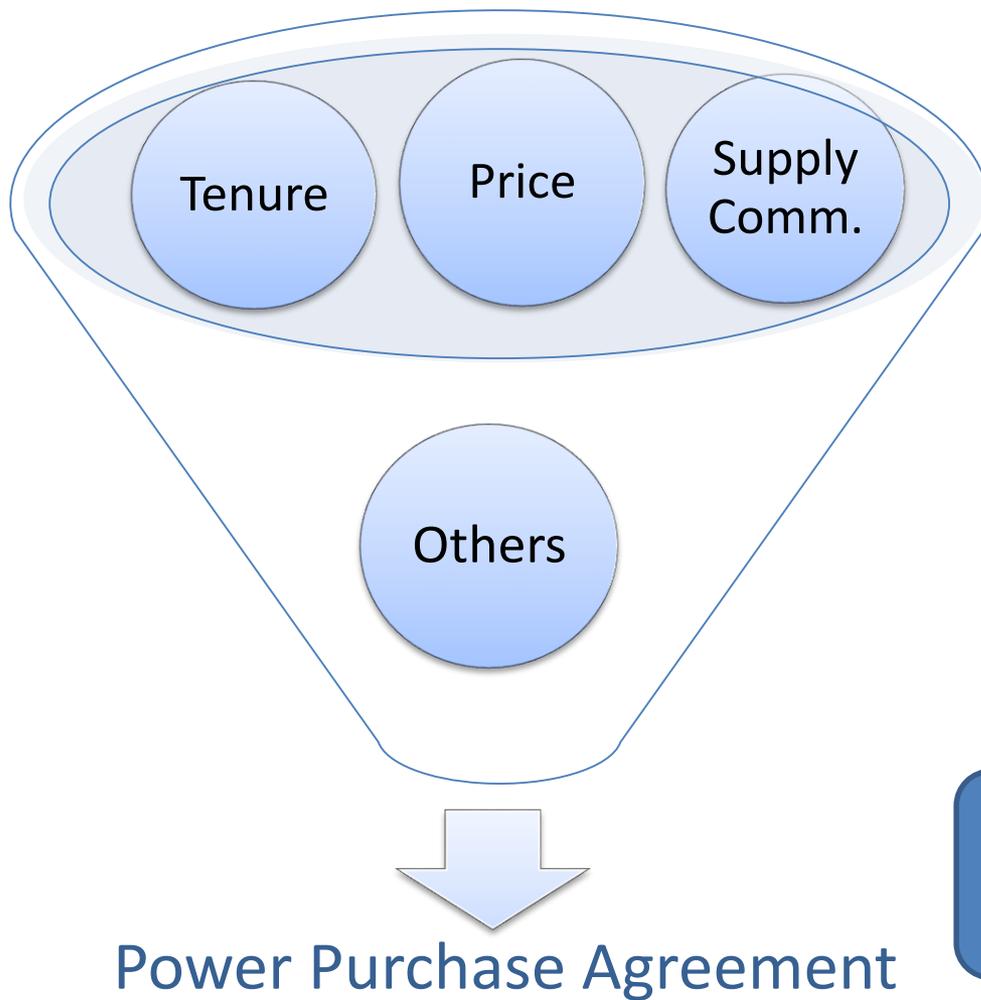


Power Purchase Agreements for Variable Renewable Energy

May 2018

- Power purchase Agreements (PPA) is an important contract that governs the sale and purchase of power
- Key to bankability of the project
- Addresses uncertainty in demand and pricing
- Provides reliable long-term clarity on roles, responsibilities, costs, revenues as well as probability and significance of associated risks for stakeholders





PPA design details vary (examples for wind projects)

Price (USD/MWh)

- » Brazil: 53.9
- » Chile: 45.3
- » Mexico: 35.8
- » Panama: 90.6

Tenure (years)

- » Brazil: 20
- » Chile: 20
- » Mexico: 15
- » Panama: 15

Supply Commitment

- » Brazil: annual
- » Chile: 3 daily blocks
- » Mexico: annual
- » Panama: monthly, 24/7

Others include price adjustment; currency risk; policy/regulatory risks; dispute settlement; ownership transfer

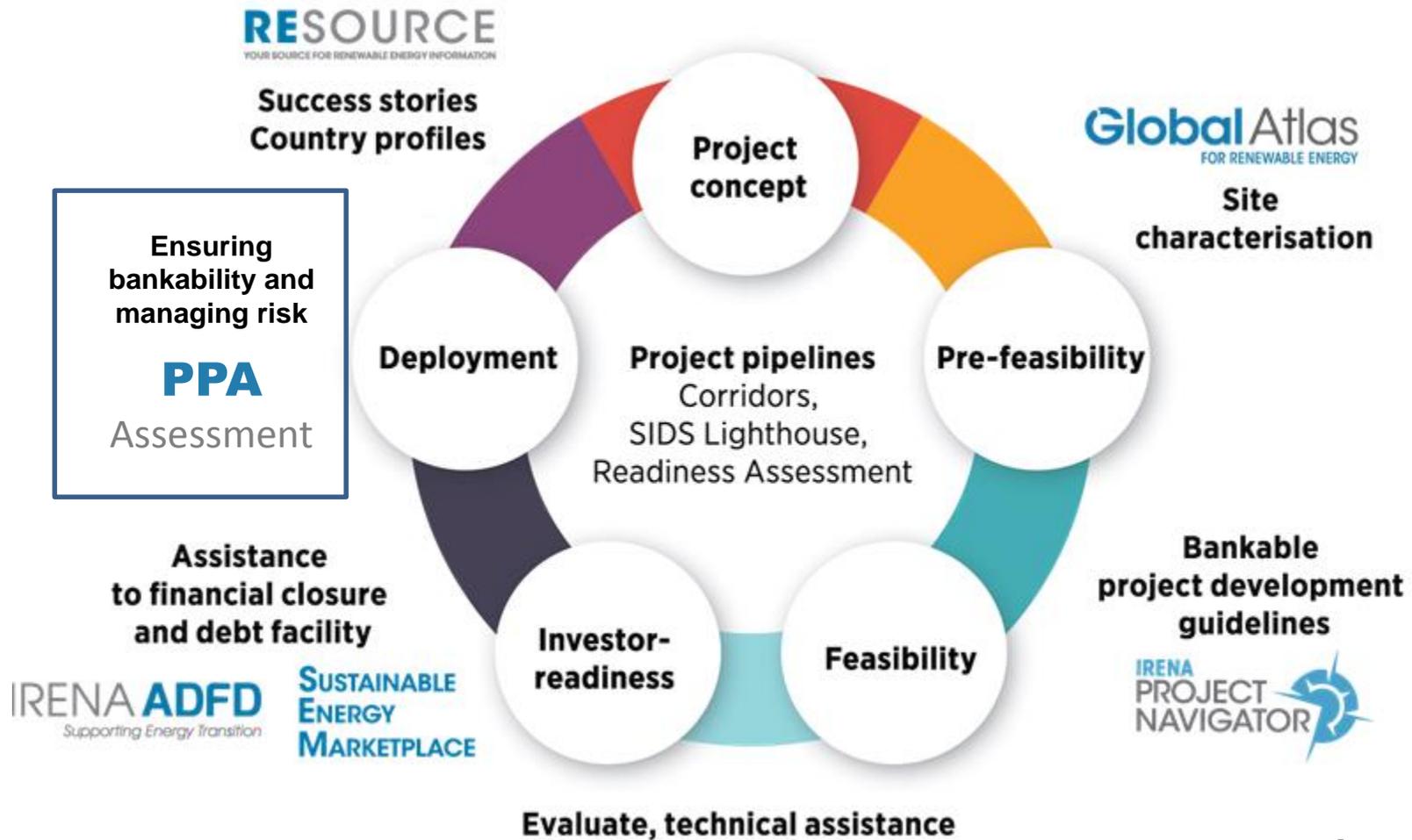
Three unique generation characteristics of wind and solar PV

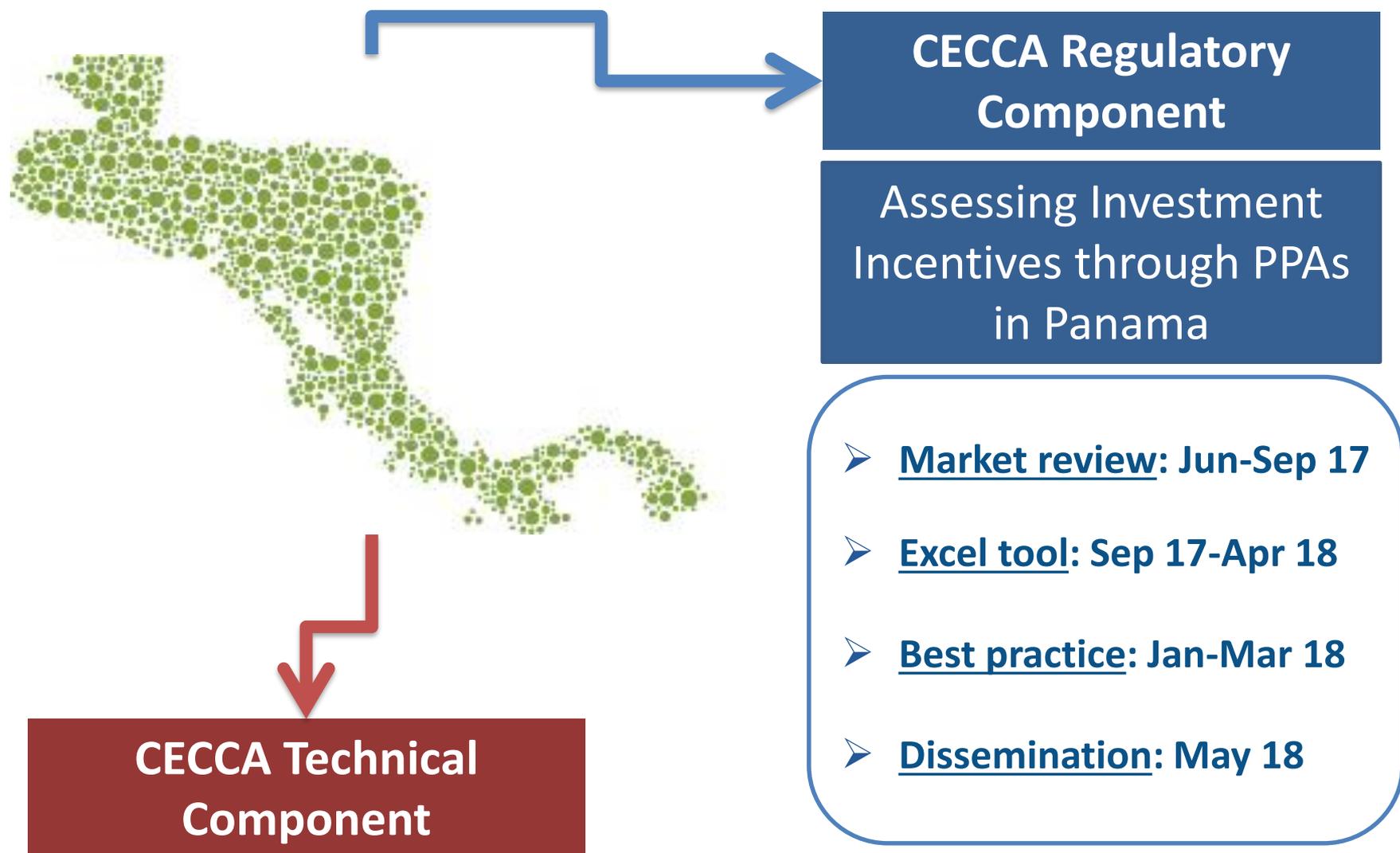
- ❑ Variability (how much generation and at what time)
- ❑ Uncertainty (how predictable the generation)
- ❑ Location-constraint (how to coordinate grid and generation)

→ Supply and purchase commitments

→ Curtailment clauses

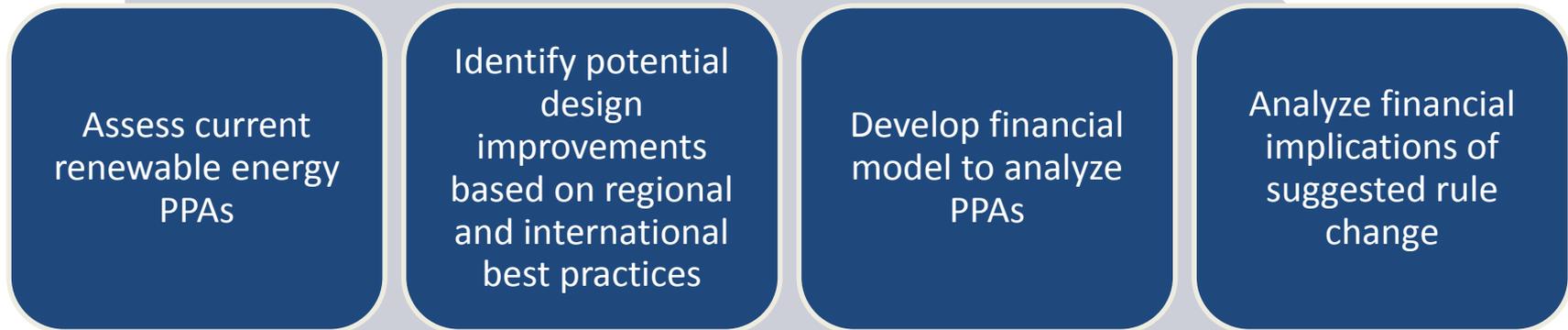
→ Requirements for dispatch procedures





Assessing Investment Incentives through PPAs - Panama

Analyze exiting RE PPAs and identify design improvements



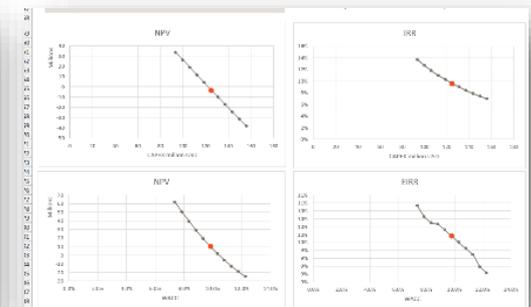
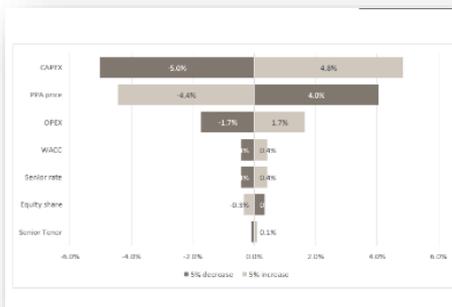
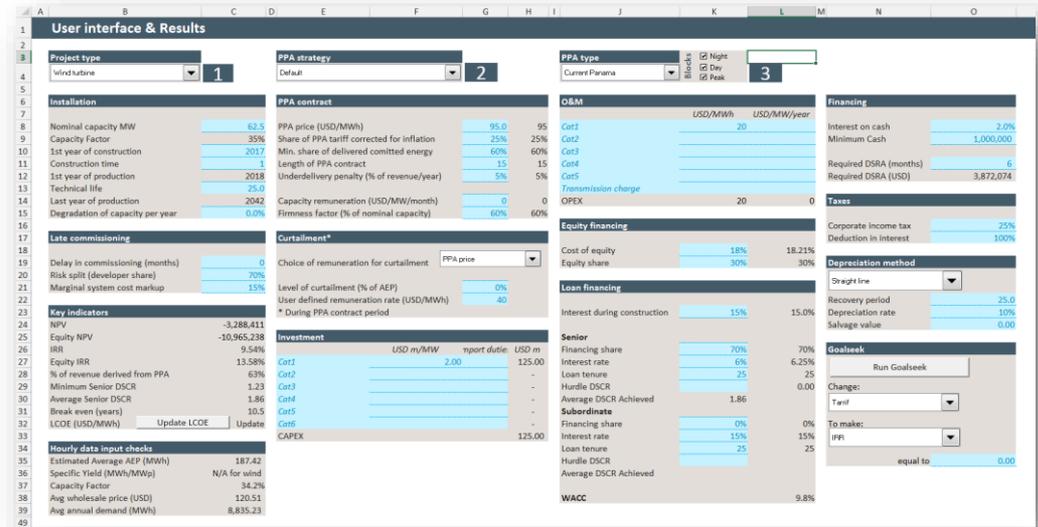
Develop financial analysis to assess the impacts of different rule changes

IRENA – PPA Assessment Tool

- The assessment tool was developed to analyze the financial implications of design changes to PPAs

- Developed in Excel for greater flexibility and acceptance

- Designed from the ground up by IRENA with consultants COWI



Key results

- Excel-based financial model developed to analyse different PPA designs
- Best RE PPA practices from the region and EU compiled and analysed
- Model applied in Panama – results are being finalized
- Contracts that **accommodate the seasonality and daily cycles of RE production** are key to enhancing investment incentive and reduce wholesale market interfaces (risk)

- Validation and feedback from local stakeholders
- Further investigation on time block bidding and power curve bidding contracts
- Developing actionable recommendations for Panamanian policy makers on future PPA design
- Expanding the model to include other RE technologies

Muchas Gracias!