Regional Perspectives on Renewable Energy Integration

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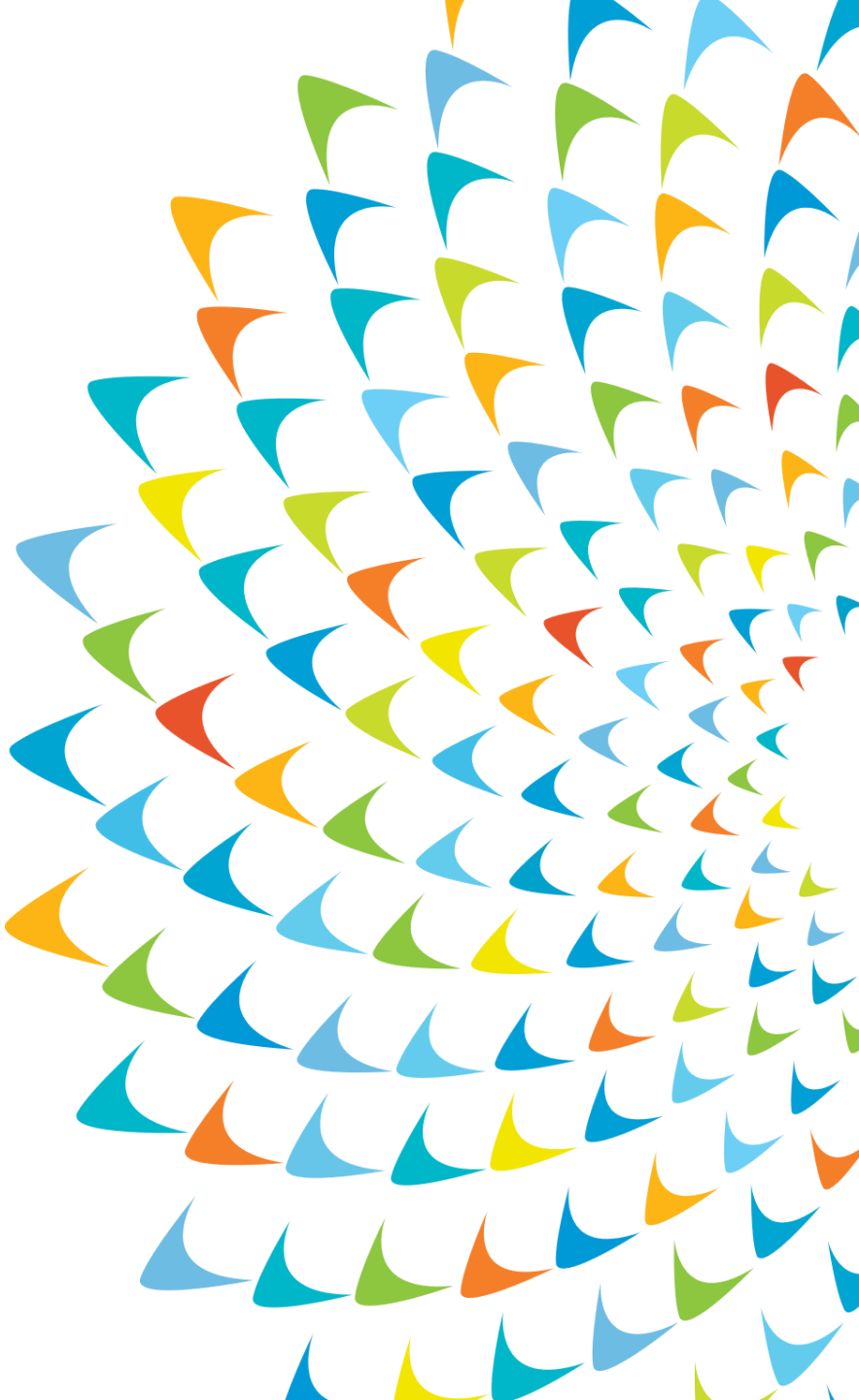
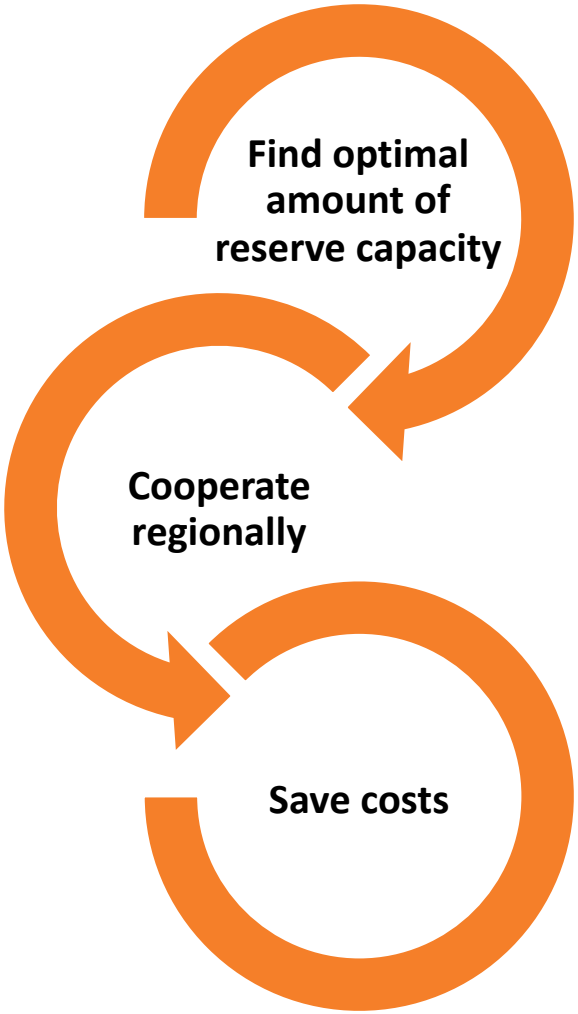


Overview

- Vision and Approach
- Regional Coping Mechanisms for Intermittent RES
- Operational Tools and Knowledge Building
- Overall Implications

Vision and Approach

Is there a regional solution to mitigate RES intermittency in Central Asia?

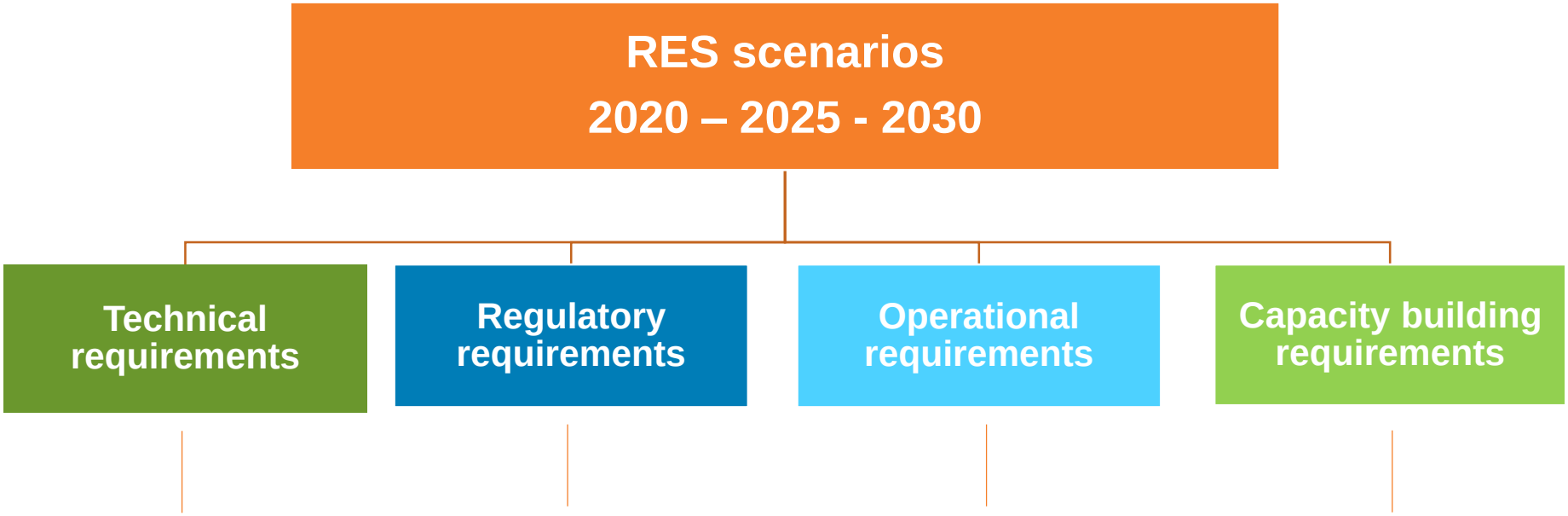


How much back-up capacity will be needed when renewables take off in Central Asia?

How much savings can each country make by sharing its reserves regionally?

What are the key ingredients for making regional cooperation work?

Comprehensive Approach



Cost comparison with regional cooperation versus without cooperation

Regional TA “Regional Cooperation on Renewable Energy Integration to the Grid” covers 7 geographically adjacent countries - Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan, Turkmenistan, Afghanistan, Pakistan

Regional Coping Mechanisms for Intermittent RES

Examined Capacity Reserves

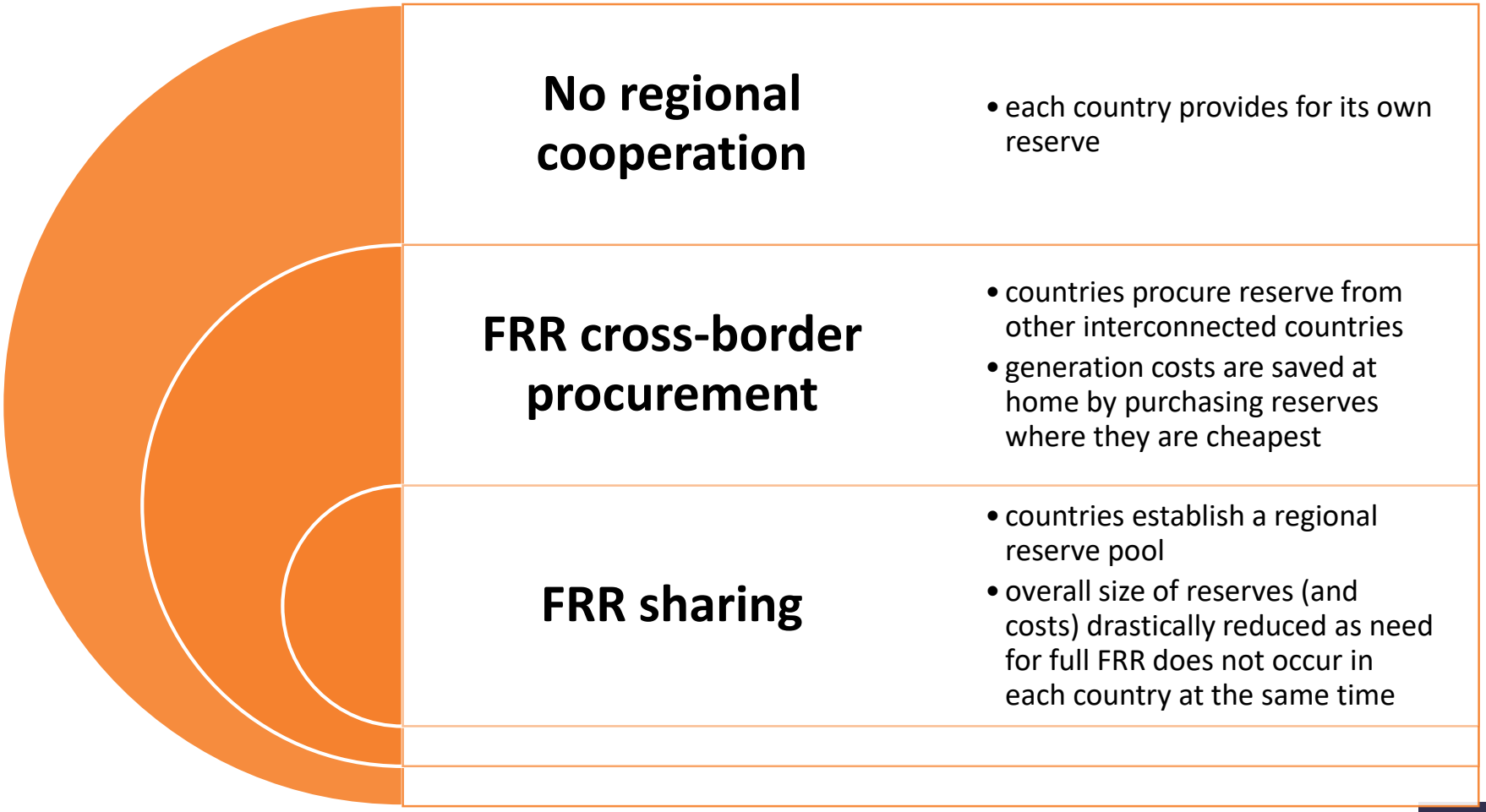
Integration of renewable energy increases the need for balancing capacity reserves

- Frequency Containment Reserve - FCR (primary reserve)
  - Activated within 30 seconds following tripping of generation or load rejection
  - Russia provides FCR to all countries operating in synchronous mode - Kazakhstan, Kyrgyzstan, Uzbekistan, (Tajikistan), Afghanistan

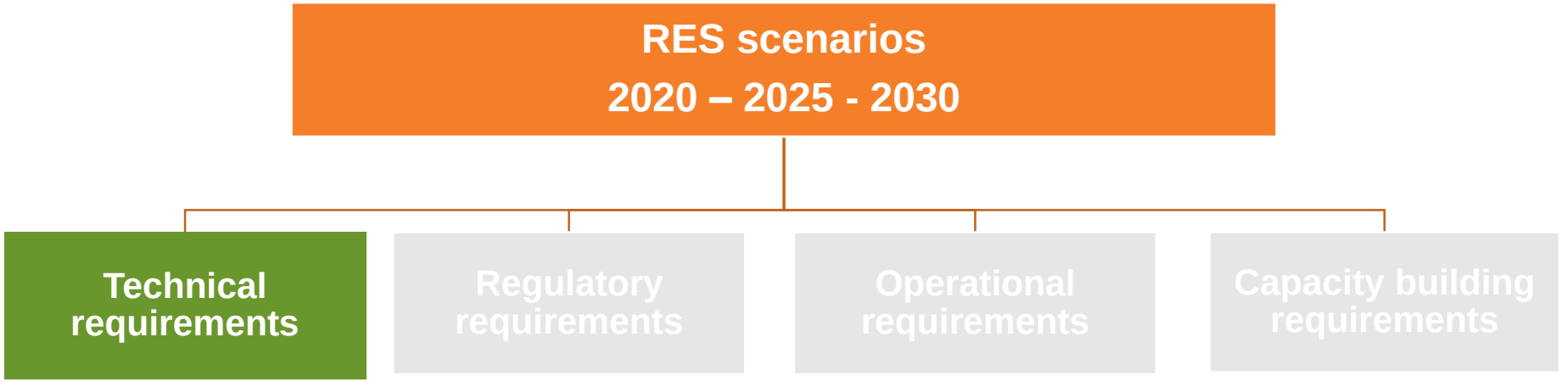
- Frequency Restoration Reserve – FRR (secondary reserve)
  - Activated within 15 minutes, restores frequency to 50Hz after stabilization by primary reserve
  - Primary focus of TA "Regional Cooperation on Renewable Energy Integration to the Grid"

- Replacement Reserve - RR
  - Activation time longer than 15 minutes; no mandatory reserve requirement

Examined reserve sharing scenarios



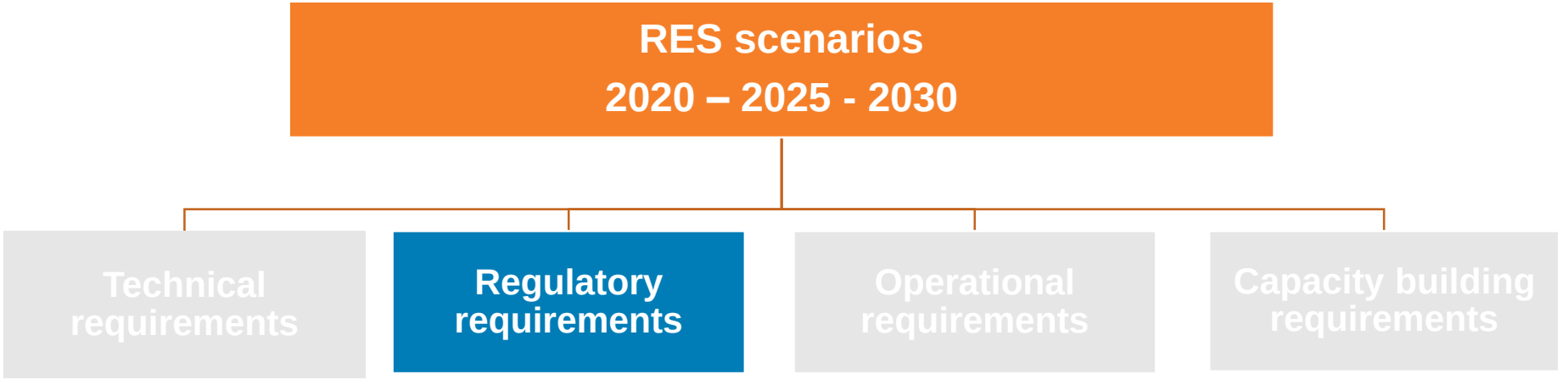
Technical Analysis



- Assessment of balancing capacity reserve size (with and without regional cooperation)
- Development of sharing mechanisms for entire region or sub regions
- Identification of necessary generation investments
- Identification of necessary grid investments
- Assessment of current dispatch practices and gaps for RES integration

-> REGIONAL GRID REINFORCEMENT PLAN

Policy Review

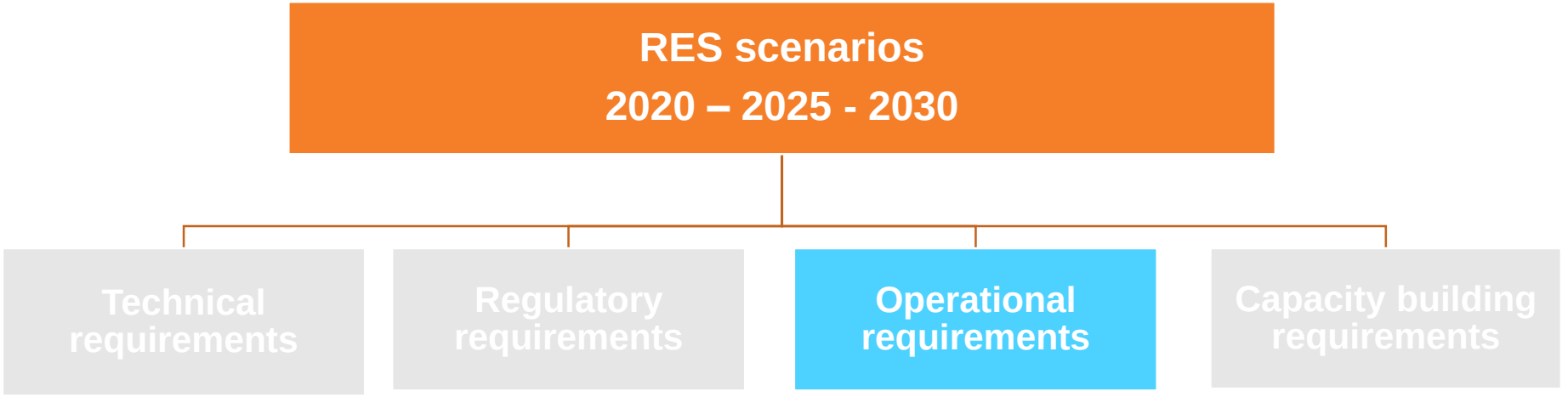


- Development of harmonized regional technical rules for reserve sharing
- Identification of necessary grid code changes on national level
- Development of a model grid connection code for small RES
- Recommendations on institutional/governance arrangements for cooperation
- Other necessary regional agreements

-> REGIONAL RES COOPERATION FRAMEWORK

Operational Tools and Knowledge Building

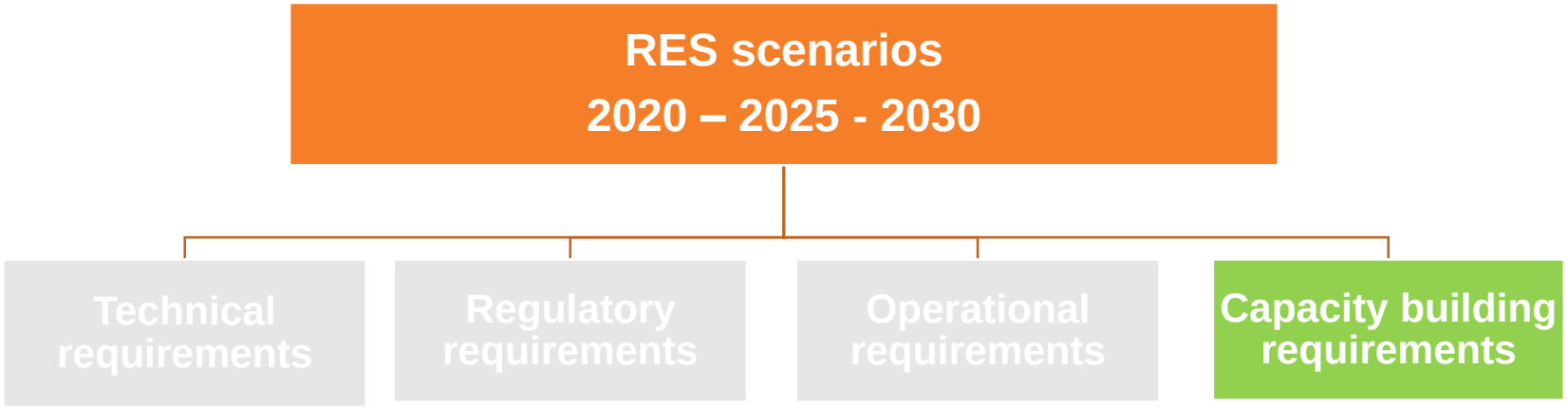
Application of Operational Tools



- Renewable energy is intermittent but not unpredictable
- TA comprises **pilot testing of a forecasting tool in Kazakhstan**
- Predictions are compared with real generation outputs and historical data
- Impacts on dispatching are analyzed

-> LESSONS LEARNED IN KAZAKHSTAN TO BE SHARED WITH REST OF THE COUNTRIES

Knowledge Building



- A permanent Working Committee composed of regional transmission operators was created
- Working committee forms integral part of results development process
- Regular capacity building workshops on best practices of RES integration and cooperation are held

-> WORKING COMMITTEE TO POTENTIALLY FORM REGIONAL COORDINATION ORGANIZATION

Overall Implications

There is a regional solution to mitigate RES intermittency in Central Asia

The fear of large intermittent RES volumes can be overcome by:

- Quantifying the benefit of regional cooperation
- Providing concrete solutions for system bottlenecks
- Developing a supra-national regulatory framework

Benefits are shared on a win-win basis

Increased power system security

- larger systems are more robust and can accommodate energy mix with RES

Lower costs

- power can be sourced from where it is cheapest to produce

Better supply security

- primary energy sources are more diversified

ADB

Thank you.