MINUTES OF 10th MEETING OF SAFIR JOINT WORKING GROUP (JWG) "TO STUDY, FORMULATE AND RECOMMEND FOR FACILITATING POWER TRADE DEVELOPMENT IN SOUTH ASIA"

DATE: 8TH JANUARY, 2024 (MONDAY)

TIME: 16:00 HRS (IST)

VENUE: ONLINE (THROUGH MS- TEAM)

LIST OF PARTICIPANTS: APPENDIX – I

1. At the onset, the Chairperson of the JWG / CEO of Electricity Regulatory Authority of Bhutan welcomed all the dignitaries to the 10th meeting of the JWG meeting.

2. Thereafter , Deputy Chief (Regulatory Affairs), CERC provided a brief on the agenda of the meeting after which the items were taken up for discussion.

AGENDA ITEM 1: CONFIRMATION OF THE MINUTES OF THE 9 TH MEETING OF THE JOINT WORKING GROUP (JWG)

3. The JWG members were apprised of the action taken on the decision points of the 9th JWG meeting held on 27.07.2023 wherein the draft Common Minimum Grid Code (CMGC) document was circulated amongst the member countries by the SAFIR Secretariat for their comments/ suggestions and that the Code, as updated by SAREP (assisting the JWG for the same) has been shared with the JWG members.

4. The members were further informed that the presentation made by the World Bank Team on "Power market design for facilitating electricity trade among SAFIR member countries" was shared with the member countries for providing comments and suggestions.

5. Upon this update, the members of the JWG confirmed the Minutes.

AGENDA ITEM 2: HARMONIZATION OF RULES AND COMMON MINIMUM GRID CODE

6. The representatives of SAREP/USAID team informed the members that based on the comments/ suggestions of the SAFIR countries on the CMGC, the draft code has been updated along with an Explanatory Memorandum (EM) and that the same has been shared with SAFIR secretariat. The members were also informed that there were still some points on which the SAREP Team would request for further clarity. Thereafter, the SAREP team presented the specific points on which discussion and guidance of the members of SAFIR were solicited for finalisation of the document.

7. Post discussion, the following was decided:

   a) Till the time Indian power exchanges are used for cross border transaction of power, it shall be governed by the regulations of Central Electricity Regulatory Commission of India. As and when the transactions move outside the Indian power exchange, it will be governed by the relevant Regulations.
   b) Till the time Regional Co-ordination bodies are formed at different levels , the concerned Indian entities can work on the coordination, subject to consent of the participating country/entity.
   c) As regards deviation settlement mechanism, it was decided that till the time a mutually agreeable mechanism is evolved for the region, the present practice shall continue.

8. Subsequently, the JWG adopted the CMGC **(Annexure-I)**, based on the changes suggested by the members during the meeting, and suggested the CMGC be placed before SAFIR for its consideration. The members thanked the SAREP team for their dedication and effort in formulating the Code with extensive stakeholder consultation.

AGENDA ITEM 3: POWER MARKET DESIGN FOR FACILITATING ELECTRICITY TRADE AMONG SAFIR MEMBER COUNTRIES

9. Delivering the presentation **(Annexure – II)**, the World Bank team informed the members that subsequent to the presentation made during the 9th JWG meeting, the

suggestions/ comments of the member countries on the presentation have been received and addressed and that they would be sharing a document on market design and governance with the members of the JWG soon.

10. In the presentation, the World Bank provided the framework that is envisaged for the implementation of regional market. It was suggested that the existing bilateral trade within and between the countries can continue to exist, however the net demand can be met or surplus availability can be traded through a regional level day ahead market for which a regional platform may need be created. The details about the operation of this regional market platform (including pricing methodology etc.) could evolve over a period of time. With the stabilisation and maturity of the day ahead market, intra-day market for real time and for imbalance handling may also be developed and implemented.

11. The World Bank Team also informed that under the Recommendations, it is being suggested to undertake a pilot to test the applicability of the proposed approach. Once the proposed framework and the road map is approved, the details of the implementation shall be developed which shall be used for the simulation pilot based on the data collected from the participating countries. They further informed the members that in accordance with the recommendation during the previous meeting, draft of the transmission plan has also been developed and shall be submitted to each member country for their suggestions/ recommendations. It was also informed that as sufficient deliverables have been achieved, it is being envisaged to present the achievement by the World Bank to the Power Secretaries Round Table (PSRT) – 18 for their deliberations. Subsequently, detailed Market Design Document for the pilot shall be developed.

12. Some of the members of the JWG suggested that the time line provided in the presentation for implementation of simulation-based pilot and for the development of the Market Design Document by 2030 is too long a time and effort should be made to develop the document as soon as possible.

13. After discussion, the JWG noted as under:

- Market development in South Asian should follow an incremental approach, honouring the existing practices and the policies of the respective member countries;

- Net pool approach should be followed for designing a market for the region. In other words, the 'balance' of demand and supply after exhausting the existing contractual obligations should be met through trades in the market platform created in the region.

- The demand and supply within a specific country should ideally be met based on the contracts agreed between the parties, and the common platform available in another country or a common market platform evolved for the region could be used to optimise power procurement and sale on day ahead basis. Subsequently, intra-day and real time market platform can be conceived for use by the participating countries for further optimisation of power procurement and sale.

- For multi-lateral trade though a common platform in the South Asian region to become a reality, it is essential to evolve political consensus alongside creation of the regulatory framework (involving regulations inter alia on transmission planning, transmission pricing, Grid Code, market operation rules etc) and formation of regional level coordination forum of electricity regulators and various fora for transmission planning, scheduling and deviation settlement etc.

- There would be a need for a blueprint of market design; details of policy and regulatory interventions required; structure of various regional level fora to be created; and a pilot on market to ensure the design evolved, rules and regulations framed meet the objective behind market creation.

- There would be a need for capacity building of the concerned stakeholders in all the participating countries.

Subject to the above, JWG accorded in-principle consent to the framework for Market Design. However, it was suggested by JWG that the presentation and the document developed by the World Bank shall be shared with the JWG members and the member countries will make available their suggestions, if any, in a month's time.

The meeting ended with a vote of thanks to the Chair.

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Appendix – I

LIST OF PARTICIPANTS OF THE 10TH JWG MEETING OF SAFIR ON 8TH JANUARY 2024

Sl. No.	Name & Designation	Organization
MEMBERS		
1	Ms Deki Choden, Chairperson of JWG and CEO	Electricity Regulatory Authority of Bhutan
2	Mr. I. S. Jha, Member	CERC, India
3	Mr. Abul Khayer Md. Aminur Rahman, Member	BERC, Bangladesh
4	Dr S.K. Chatterjee, Chief (Regulatory Affairs)	CERC & Convenor
SPECIAL INVITEES		
5	Mr. Dilli Bahadur Singh, Chairman	ERC, Nepal
6	Mr. Harpreet Singh Pruthi, Secretary	CERC
7	Mr. R. V. Shahi, Senior Energy Advisor	World Bank
8	Mr. Jigme Dorji, Chief	ERA, Bhutan
9	Mr Gokarna Raj Pantha, Secretary	ERC , Nepal
10	Mr. Chamath Goonewardena, Director, Regulatory Affairs	PUCSL, Sri Lanka
11	Mr. Waleed Saleh I. Alsuraih	World Bank
12	Mr. Pankaj Batra, Adviser	SAREP
SAFIR SECRETARIAT & OTHERS		
13	Mrs. Rashmi Somasekharan Nair, DC(RA)	CERC
14	Mrs. Sukanya Mandal, AC (RA)	CERC
15	Mr. Gagan Diwan, AC(Eco)	CERC
16	Mr. Ashutosh Sharma, AC (Eco)	CERC
17	Mr. Ravindra Kadam, Sr. Advisor (RE)	CERC
18	Mr Kanchana Siriwardana	PUCSL, Sri Lanka
19	Mr. Dileepa Karunaratne, Assistant Director, Regulatory Affairs	PUCSL, Sri Lanka
20	Ms. Graeme Chown	World Bank
21	Mr. Jonathan Hedgecock	World Bank
22	Mr. Naoki Fujioka	World Bank
23	Mr. Serrano Daniel	World Bank
24	Mrs. Namrata Mukherjee	SAREP
25	Mr. Rajiv Ratna Panda	SAREP
26	Mr. Ajit Kumar	SAREP
27	Mr. Sumedh Agrawal	SAREP
28	Mr. Saurabh, PRO	CERC
29	Mrs. Jijnasa Behera, RO	FOR

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Common Minimum Grid Code for South Asia

PREAMBLE

The Common Minimum Grid Code for South Asia lays down the common minimum rules, guidelines and standards to be followed by various South Asia country participants in the system for cross border trading in electricity, while operating the power system, in the most secure, reliable, economic and efficient manner.

1. Short title, extent and commencement

(1) These Regulations may be called Common Minimum Grid Code for South Asia Regulations, ~~2022~~2024.

(2) These Regulations shall come into force from 1.6.~~2023~~2024, except for the Planning Code, which ~~would~~ shall come into effect from a future date, as decided by the South Asia Forum of Electricity Regulators.

2. Definitions

a) **Deviation Settlement mechanism (DSM)**: ~~DSM~~ means~~is~~ the commercial mechanism for dealing with violations of scheduled generation and scheduled power flows, w.r.t. cross border electricity trade.

b) **Grid** means the high voltage backbone system of inter-connected transmission lines, sub-stations and generating plants

c) **National Load Despatch Centre (NLDC)**: NLDC is the national system operator of India, which has jurisdiction over operationalizing the power

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exchange trades discovered in the power exchanges in India, including for cross border electricity trade.

d) **South Asia Forum of Electricity Regulators (SAFER)** : SAFER is an association of Electricity Sector Regulators of South Asia, for coordination w.r.t. cross border electricity trade among the South Asian countries. This can start as an informal body, which ~~would~~ shall provide a platform for building consensus between the South Asian Electricity Sector Regulators, till it gets legal recognition from the south Asian Governments.

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~~b~~e) **South Asia Forum of Operational Planners (SAFOP)** : SAFOP is an association of operational planners of the South Asian countries, for coordination w.r.t. cross border electricity trade among the South Asian countries. This can start as an informal body, which ~~would~~ shall provide a platform for building consensus between the South Asian operational planners, till it gets legal recognition from the south Asian Governments.

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~~c~~f) **South Asia Forum of Transmission Utilities (SAFTU)** : SAFTU is an association of transmission utilities of the South Asian countries, for coordination w.r.t. cross border electricity trade among the South Asian countries. This can start as an informal body, which ~~would~~ shall provide a platform for building consensus between the South Asian transmission utilities, till it gets legal recognition from the south Asian Governments.

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~~d~~g) **South Asia Forum of System Operators (SAFSO)**: SAFSO is an association of system operators of the South Asian countries, for coordination w.r.t. cross border electricity trade among the South Asian countries. This can start as an informal body, which ~~would~~ shall provide a platform for building consensus between the South Asian system operators, till it gets legal recognition from the south Asian Governments.

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~~e~~h) **South Asia Forum of Billing and Accounts Settlement Agency (SAFAS)**: SAFAS is an association of Accounts settlement agencies of

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the South Asian countries, for coordination w.r.t. cross border electricity trade among the South Asian countries. This can start as an informal body, which ~~would~~ shall provide a platform for building consensus between the South Asian system accounts settlement agencies, till it gets legal recognition from the south Asian Governments.

~~e~~i) **South Asia grid** is the interconnected grids of the South Asian countries.

j) **Special Energy Meter** is a meter with accuracy of 0.2 or better, capable of time-differentiated measurements for time block wise (presently every 15 minutes) active energy and voltage differentiated measurement of reactive energy.

~~National Load Despatch Centre (NLDC): NLDC is the national system operator of India, which has jurisdiction over operationalizing the power exchange trades discovered in the power exchanges in India, including for cross border electricity trade.~~

f) ~~Deviation Settlement mechanism (DSM): DSM is the commercial mechanism for dealing with violations of scheduled generation and scheduled power flows, w.r.t. cross border electricity trade.~~

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3. General

a) This Common Minimum Grid Code for South Asia is applicable to all countries of South Asia, whose grid gets connected to the South Asia grid through a ***synchronous*** or ***a-synchronous*** (i.e. HVDC) connection.

b) Each country ~~will~~ shall initially be represented by a single point of contact for the initiation of implementation of the Common Minimum Grid Code.

c) The single point of contact ~~will~~ shall be supported by the relevant Ministry dealing with power, the Regulator of the respective country, the transmission agency of the respective country, the system operator of the respective country and the accounts settlement/market operator of the respective country.

d) Later, to formalize the process of implementation, Regional coordination bodies need to be formed for South Asia, i.e. South Asia Forum at the Government level, at the Regulator level, at the operational planning body level, transmission utility level, at the system operator level and at the billing and accounts settlement/market operator level.

e) Till these are formed, the concerned Indian entity (such as Central Transmission Utility (CTU) for Transmission, National Load Despatch Centre (NLDC) for System Operation, etc.) can do the coordination in lieu of the respective forums, subject to the consent of the participating country(ies)/entity(ies).

f) A South Asia Power Portal ~~would~~ shall be made for information of all South Asian countries. This ~~would~~ shall be maintained by the South Asia Forum at the operational planning level.

4. Objective and Structure of the Common Minimum Grid Code for South Asia

The objectives of the South Asia Common Minimum Grid Code are as given below :

(a) Facilitation of cross border trading of power, in a fair and non-discriminatory manner for all South Asian nations, while ensuring secure, reliable, economic and efficient planning and operation of the grid.

(b) Facilitation of the coordinated optimal operation of the South Asian Grid.

(c) Facilitation of coordinated and optimal maintenance planning of generation and transmission facilities in the South Asian grid.

The structure of the Common Minimum Grid Code for South Asia consists of the Planning Code, Connection Code, Operating Code, Scheduling and Despatch Code and Administration of the Grid Code.

5. PLANNING CODE

5.1 Objective

~~The objectives of Planning Code are as follows:~~

a) To specify the principles, procedures and criteria which shall be used in the planning and development of the cross border transmission system.

b) To promote co-ordination amongst the transmission ~~utilities~~ planning entities of the South Asian countries.

5.2 Planning Criterion General Philosophy

(a) The planning criterion general policy for the cross border transmission system shall be as detailed below:

i) As a general rule, the cross border transmission system shall be capable of withstanding and be secured against the following contingency outages

a. without necessitating load shedding or rescheduling of generation during Steady State Operation:

- Outage of a 132 kV D/C (Double Circuit) line or,

- Outage of a 220 kV D/C line or,

- Outage of a 400 kV S/C (Single Circuit) line or,

- Outage of single Interconnecting Transformer, or

- Outage of one pole of HVDC (High Voltage Direct Current) Bipole line, or one pole of HVDC back to back Station or

- Outage of 765 kV S/C line

b. without necessitating load shedding but could be with rescheduling of generation during steady state operation-

- Outage of a 400 kV S/C line with TCSC (Thyristor Controlted Series Compensation), or

- Outage of a 400kV D/C line, or

- Outage of both pole of HVDC Bipole line or both poles of HVDC back to back Station or

- Outage of a 765kV S/C line with series compensation.

ii) The above contingencies shall be considered assuming a pre-contingency system depletion (Planned outage) of another 220 kV D/C line or 400 kV S/C line in another corridor and not emanating from the same substation. The planning study ~~would~~ shall assume that all the Generating Units operate within their reactive capability curves and the network voltage profile at interface points of cross border are also maintained within voltage limits specified.

(b) The cross border transmission system shall be capable of withstanding the loss of most severe single system infeed without loss of stability.

(c) Any one of these events defined above shall not cause:

i. Loss of supply

ii. Prolonged operation (i.e. more than 10 minutes) of the system frequency below and above specified limits.

iii. Unacceptable high or low voltage iv. System instability v. Unacceptable overloading of ISTS elements.

(d) In all substations (132 kV and above), at least two transformers shall be provided.

(e) SAFOP shall carry out planning studies for Reactive Power compensation of ~~ISTS~~ the cross border transmission network, including reactive power compensation requirement at the interconnection substations on both sides of the border .

(f) Suitable System Protection Schemes may be planned by SAFOP, either for enhancing transfer capability or to take care of contingencies beyond that indicated in a)(i) above.

~~5~~6. CONNECTION CODE

~~5~~6.1 Objective

~~The objective of the connection code is as given below:~~

a) To ensure the safe operation, integrity and reliability of the connected South Asia grid.

~~c~~b) Any country in South Asia intending to ~~new country~~ getting connected to the South Asia grid shall neither suffer unacceptable effects due to its connectivity nor impose unacceptable effects on the South Asian grid.

~~d~~c) Any country in South Asia ~~new country~~ seeking connection to the South Asia grid is required to be aware, in advance, of the requirements for connectivity to

the South Asian grid and also the standards and conditions its system has to meet for being integrated into the grid.

~~5~~6.2 Procedure for Inter Country connection

Any country in South Asia ~~A new country~~ seeking to establish a synchronous connection to the South Asian grid, shall submit an application, on a predetermined format, to the South Asia Forum of transmission utilities (SAFTU). After the study, the SAFTU shall lay down the minimum requirements of additional transmission infrastructure/modifications in the transmission infrastructure necessary to integrate the ~~any~~ country in South Asia ~~new country~~ into the South Asian grid.

~~5~~6.3 Important Technical Requirements for Connectivity to the Grid

a) The minimum technical requirements for connectivity to the South Asian grid are as given below..

A. For a synchronous connection, the following technical requirements hold :

b) This may require the necessity of installing fault current limiters to limit the short circuit current flowing into the country due to connection with a large grid. It may also require reactive power controller in the form of Static Var Compensator/STATCOM, etc. to prevent burdening of the South Asia grid with reactive power drawl/injection beyond limits, as specified by the South Asia Forum of Operational planners.

c) Any country in South Asia intending to get its grid connected to the existing interconnected grid of South Asia ~~The new country would~~ shall have to implement generation and/or load control mechanisms to be able to control cross border power flows, in case of contingencies.

d) ~~The~~ Any country in South Asia intending to get its grid connected to the existing interconnected grid of South Asia ~~new country would~~ shall also have to abide by the Regional under frequency load shedding schemes to ensure commensurate load shedding in case of grid disturbances, to prevent falling frequency, and also abide by the Regional islanding schemes and system protection schemes, which ~~would~~ shall be decided by the South Asian Forum of Operational Planning bodies, which are involved in operation planning.

e) It ~~would~~ shall also have to ensure installation of Data Acquisition System, disturbance recorders and sequence-of-events recorder at the interconnection points and other significant points, as specified by SAFTU, to analyse faults through post mortem, so that such instances do not recur.

f) ~~The~~ Any country in South Asia intending to get its grid connected to the existing interconnected grid of South Asia ~~new country would~~ shall have to ensure robust and reliable communication between countries, ~~through two different modes of communication, so that voice and data communication takes place instantly and seamlessly across countries. This would be~~which shall be mutually decided by the points of contacts of the South Asian countries. The associated communication system to facilitate data flow up to appropriate data collection point at the interface sub-station, shall also be established by the concerned country system operators as specified by the SAFTU in the Connection Agreement.

g) The relevant international standards on cyber security of power systems may be followed by all the countries. The presently existing Standards for cyber security in power systems is attached in Annexure I.

B. For an asynchronous (HVDC) connection, the following technical requirements hold :

The provisions all the above provisions except 5,3 (b), (c) & (d) ~~will~~ shall ~~not~~ apply.

~~5~~6.4 Connection Agreement

Every connection of a country's system to the South Asian grid shall be covered by a Connection Agreement between the SAFTU and the national transmission utility of the country seeking connection. The connection agreement shall contain general and specific technical conditions, applicable to that connection, including, but not limited to, the necessary equipment to be installed, the condition of coordination between the System Operators of the South Asian countries, protection coordination, system protection schemes, communication requirements, etc.

~~6~~7. OPERATING CODE:

A. For a synchronous connection, the following requirements of Operating Code hold :

~~6~~7.1 Frequency band

All country system operators shall take all possible measures to ensure that the grid frequency always remains within the 49.9 –50.05 Hz band and as revised by the South Asia Forum of Electricity Regulators.

~~6~~7.2 Grid Voltage

All country system operators shall take all possible measures to ensure that the grid voltage always remains within the following operating range at the interconnection point.

Voltage – (kV rms)		
Nominal	**Maximum**	**Minimum**
765	800	728
400	420	380
220	245	198
132	145	122
110	121	99
66	72	60
33	36	30

~~6~~7.3 System Security Aspects

Protection coordination ~~would~~ shall have to be done on a South Asian Regional basis, as per the procedures laid down by the SAFSO, to ensure that the protection schemes are sensitive and selective. Testing of protection devices ~~would~~ shall have to be done periodically. Protection coordination ~~would~~ shall have to be done whenever a new major power system element is introduced in the synchronously connected South Asian Grid.

~~6~~7.4 Operation liaison

Any tripping, whether manual or automatic, of any of the significant elements of country grid shall be precisely intimated by the concerned country system

operator to the concerned System Operators, whose grid/s is/are likely to be affected, as soon as possible, say within ten minutes of the event. The reason (to the extent determined) and the likely time of restoration shall also be intimated. The concerned System Operators shall share a report of incidence in a prescribed form/ format as specified by the South Asia Forum of Electricity Regulators.

~~6~~7.5 Restoration plan to be done in coordination in case of tripping

All connected countries ~~would~~ shall have to furnish the required data to the concerned country System Operators whose grid is likely to be affected, and South Asia Forum of operational planning bodies from disturbance recorders and sequence-of-events recorder within 48 hours of restoration. Restoration procedures, including black start ~~would~~ shall have to be laid out by the South Asia Forum of operational planning bodies for the South Asian Grid as a whole, to facilitate quick restoration of the system after tripping.

~~6~~7.6 Periodic reports

a) A daily report covering the performance of the regional grid shall be prepared by each country's system operator, based on the format decided by the South Asia Forum of operational planning bodies, and shall be put on its website. This report shall also cover generation by renewable energy sources, including the quantum of energy injected into grid.

b) A Monthly report covering performance of the national/integrated grid in previous week shall be prepared by the South Asia Forum of operational planning bodies. Such weekly report shall be available on the website of the South Asia Power Portal for at least 12 months.

The monthly reports shall contain the following:-

(a) Frequency profile

(b) Voltage profile of interconnecting -sub-stations.

(c) Major Generation and Transmission Outages, which affect the cross border flow of power

(d) Transmission Constraints affecting the cross border transmission capacity

B. For an asynchronous (HVDC) connection, the following technical requirements hold :

For HVDC connection, the provisions 6.1, 6.2, 6.3 ~~will~~ shall not apply. However, the reliability of the control and protection of the HVDC link has to be ensured, and testing ~~would~~ shall have to be done periodically.

~~6~~7.7 Outage Planning

Regional outage planning shall be done by the South Asia Forum of operational planning bodies to ensure that all countries can reap the benefit of optimal utilization of generation and transmission sources, and thus reduce the requirement of each country's reserves.

~~7~~8. SCHEDULING AND DISPATCH CODE

~~7~~8.1 Objective

This code deals with the procedures to be adopted for scheduling of the net injection / drawals of concerned country entities on a day ahead basis with the modality of the flow of information between the SAFSO / country system operators / Power Exchange.

Responsibility

~~7~~8.2The system of each country shall be treated and operated as a notional control area. The algebraic summation of scheduled drawal by the country from all generation procurement contracts through long – term access, medium -term and short –term open access arrangements shall provide the drawal schedule of each country, and this shall be determined in advance on day-ahead basis.

~~7~~8.3 The system operator of each country shall regulate their generation and/or consumers' load so as to maintain their actual drawal from the South Asia grid close to the above schedule. If regional entities deviate from the drawal schedule, such deviations from net drawal schedule shall be priced through a pre-decided Deviation Settlement mechanism. Till the time a Deviation Settlement mechanism is mutually decided at the level of single point of contact of the South Asian countries, the present practice of Deviation Settlement mechanism, as ~~given in the **Annexure I** shall prevail~~ amended from time to time shall continue .

~~7~~8.4 The respective country transmission system operator shall install special energy meters, as specified by the South Asia Forum of Electricity Regulators, on all inter connections between the country grids and other identified points for recording of actual net MWh interchanges and MVArh drawals. All countries shall take weekly meter readings from Monday to Sunday and transmit them to the South Asia forum of accounts settlement operator/market operator by Tuesday noon. The South Asia forum of accounts settlement operator/market operator shall be responsible for computation of actual net injection / drawal of concerned regional entities, 15 minute-wise, based on the above meter readings on a weekly basis by each Thursday noon for the seven-day period ending on the previous Sunday mid-night, in order to prepare and issue the Deviation Settlement account in accordance with the South Asia Deviation Settlement Mechanism, as amended from time to time. All computations carried out by South Asia forum of accounts settlement operator/market operator shall be open

to all South Asia country entities for checking/verifications for a period of 15 days. In case any mistake/omission is detected, the South Asia forum of accounts settlement operator/market operator shall forthwith make a complete check and rectify the same.

~~7~~8.5 Scheduling and Despatch procedure for long-term access, Medium – term and short-term open access (All timelines given in this para are India time):

a) The ~~country~~ system ~~operators~~ operator of each country shall advise the South Asia Forum of System Operators by 3 PM their drawal/injection schedule for the country as a whole, which ~~would~~ shall include long-term, medium-term and short-term contracts.

b) **Scheduling of collective transaction**:

National Load Despatch Centre (NLDC) shall indicate to Power Exchange(s), the list of interfaces/control areas/regional transmission systems on which unconstrained flows are required to be advised by the Power Exchange(s) to the NLDC, based on the System operator of respective country which is transacting power on Indian Power Exchange.

Power Exchange(s) shall furnish the interchange on the boundaries of various countries, as intimated by NLDC. Power Exchange(s) shall also furnish the information of total drawal and injection in each of the countries. Based on the information furnished by the Power Exchanges, NLDC (National Load Despatch Centre), the National System Operator of India, dealing with the subject, shall check for congestion. In case of international transactions, the NLDC shall ask the system operator of the respective country for internal congestion within the grid of that country relating to the transmission corridor on which power would flow across the border, and along with congestion on the Indian side of the transmission corridor, shall assess the congestion on the complete transmission

corridor to the respective country. In case of congestion, NLDC shall inform the Exchanges about the period of congestion and the available limit for scheduling of collective transaction on respective country interfaces for Scheduling of Collective Transaction through the respective Power Exchange. The limit for scheduling of collective transaction for respective Power Exchange shall be worked out in accordance with CERC (Central Electricity Regulatory Commission, the Central Electricity Regulator of India) directives. Based on the application for scheduling of Collective Transaction submitted by the Power Exchange(s), NLDC shall send the details (Scheduling Request of Collective Transaction) to different country system operators for final checking and incorporating them in their schedules.

After getting confirmation from the country system operators, NLDC shall convey the acceptance of scheduling of collective transaction to Power Exchange(s). The country system operators shall schedule the Collective Transaction at the respective periphery of the respective countries.

The individual transactions for the country's intra-country Entities shall be scheduled by the respective country system operators. Power Exchange(s) shall send the detailed break up of each point of injection and each point of drawal within the country to the respective country system operator, after receipt of acceptance from NLDC. Power Exchange(s) shall ensure necessary coordination with country system operators for scheduling of the transactions.

Timeline for above activities ~~will~~ shall be as per detailed procedure for Scheduling of Collective Transaction issued in accordance with CERC (Open access in inter-state transmission) Regulations,2008 and as amended from time to time.

b)c) By 6 PM each day, the South Asia System Forum of System Operators shall convey the despatch schedule to each of the country system operators, in MW for different time block, for the next day, consisting of both bilateral and collective transactions.

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c)d) The country system operators shall inform any modifications/changes to be made in drawal/injection schedule, if any, to South Asia Forum of System Operators by 10 PM.

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d)e) While finalizing the drawal and despatch schedules as above, the South Asia Forum of System Operators (SAFSO) shall also check that the resulting power flows do not give rise to any transmission constraints. In case any impermissible constraints are foreseen, SAFSO shall moderate the schedules to the required extent, under intimation to the concerned country operators. Any changes in the scheduled quantum of power which are too fast or involve unacceptably large steps, may be converted into suitable ramps by the SAFSO.

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79. COMPLIANCE OVERSIGHT

The respective country system operators shall report to the SAFER instances of serious or repeated violation of any of the provisions of the South Asia Grid Code. The SAFER will shall investigate the matter. In case of non-compliance, appropriate action will shall be taken by SAFER.

810. ADMINISTRATION OF THE GRID CODE

a) Initially, the Committee of the single points of contact for each country would shall be responsible for administration and modification of the Common Minimum Grid Code for South Asia. Later this would shall be replaced by the South Asia Forum of Electricity Regulators.

b) The Committee may meet at regular intervals or as needed for the purpose of administration and modification of the Common Minimum Grid Code for South Asia.

~~Annexure – I : Deviation Settlement Mechanism~~

~~Charges for Deviations: (1) The charges for the Deviations for all the time-blocks shall be payable for over-drawal by the buyer and under-injection by the seller and receivable for under-drawal by the buyer and over-injection by the seller and shall be worked out on the average frequency of a time-block at the rates specified in the table below~~

~~https://cercind.gov.in/2018/regulation/dsm_fourth_amendment11-22-2018.pdf~~

~~(Pages 2 to 4)~~

Annexure-I

List of existing Cyber Security Standards for the power sector

1. **ISO/IEC 27019 - Information security controls for the energy utility industry –** Guidance to process control systems used by the energy utility industry for controlling and monitoring the production or generation, transmission, storage and distribution of electric power, gas, oil and heat, and for the control of associated supporting processes.

2. **IEC 62351 series - Cyber Security Series for the Smart Grid - Power systems management and associated information exchange – Data and communications security**

   IEC 62351-1 - Communication network and system security – Introduction to security issues
   IEC 62351-2 – Glossary of terms
   IEC 62351-3 – Communication network and system security - Profiles including TCP/IP
   IEC 62351-4 – Profiles including MMS and derivatives
   IEC 62351-5 – Security for IEC 60870-5 and derivatives
   IEC 62351-6 – Security for IEC 61850
   IEC 62351-7 – Network and System Management (NSM) data object models
   IEC 62351-8 – Role-based access control
   IEC 62351-9 – Cyber security key management for power system equipment
   IEC 62351-10 – Security architecture guidelines
   IEC 62351-11 – Security for XML documents
   IEC 62351-12 – Resilience and security recommendations for power systems with distributed energy resources (DER) cyber-physical systems
   IEC 62351-13 – Guidelines on security topics to be covered in standards and specifications

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Annexure II : Note on the Jurisdiction over Grid Code by the Regulators of South Asian Countries

Bhutan

Regulator- Bhutan Electricity Authority

Main Act- ELECTRICITY ACT OF BHUTAN YEAR 2001[1]
(http://www.bea.gov.bt/wp-content/uploads/2013/12/eact01.pdf)

Relevant Section/Clause:

Preamble

The Electricity Act enables the restructuring of the power supply industry and the possible participation of the private sector, by providing mechanisms for licensing and regulating the operations of power companies. The establishment of the Bhutan Electricity Authority as an autonomous body will ensure a transparent regulatory regime; the Authority also has the role of laying down the standards, codes, and specifications of the Electricity Supply Industry. By this means the Electricity Act will define the roles and responsibilities of suppliers and protect the interests of the general public.

(" 11 Functions of the Authority

11.1 Functions of the Authority are:

i) to develop regulations, standards, codes, principles and procedures, which include, but are not limited to the following :
a. performance standards, including minimum technical and safety requirements for construction, operation and maintenance of generation, transmission and distribution facilities;
……
……")
(" 89 The Authority shall, by statutory instrument, make regulations to establish a Grid Code. ")

[1] http://www.bea.gov.bt/wp-content/uploads/2013/12/eact01.pdf

Bangladesh

Regulator-Bangladesh Energy Regulatory Commission

Main Act: - Bangladesh Energy Regulatory Commission Act, 2003[2]
(http://www.clcbd.org/document/download/277.html)

Relevant Section/Clause:

(" CHAPTER – 4, Functions, Powers and Proceedings of the Commission

22. Functions of the Commission—

Subject to the provisions of this Act, functions of Commission shall be as follows:-

.....

.....

(f) to frame codes and standards and make enforcement of those compulsory with a view to ensuring quality of service;

.....

..... ")

("59. Power to make regulations—

(1) Commission may, for the fulfillment of the objectives of this Act, make regulation by publishing it in the official gazette.

(2) Without affecting the totality of the said power, regulations may be made, on any or all of the following heads:

.....

(e) making of different codes and standards ;

.....

")

[2] http://www.clcbd.org/document/download/277.html

In exercise of the powers conferred by section 59 of the Bangladesh Energy Regulatory Commission Act 2003 (Act 13 of 2003), read with sub-sections 2(e) and 2(f) thereof and for the fulfillent of the objectives of the Act, the Bangladesh Energy Regulatory Commission has made the grid code regulations:

India

Regulator-Central Regulatory Commission (CERC) and State Regulatory Commission (SERC)

Main Act- THE ELECTRICITY ACT, 2003

Relevant Section/Clause:

(" Section 79. (Functions of Central Commission): --- (1) The Central Commission shall discharge the following functions, namely:-

……..

(h) to specify Grid Code having regard to Grid Standards; ")

……..

(" Section 86. (Functions of State Commission): --- (1) The State Commission shall discharge the following functions, namely: -

…….

(h) specify State Grid Code consistent with the Grid Code specified under clause (h) of sub-section (1) of section 79; ")

……..

(" Section 178. (Powers of Central Commission to make regulations): --- (1) The Central Commission may, by notification make regulations consistent with this Act and the rules generally to carry out the provisions of this Act.

(2) In particular and without prejudice to the generality of the power contained in sub-section (1), such regulations may provide for all or any of following matters, namely:-

……..

(g) Grid Code under sub-section (2) of section 28; ")

The Indian Electricity Grid Code (IEGC) is a regulation made by the Central Commission in exercise of powers

under clause (h) of subsection (1) of Section 79 read with clause (g) of sub-section (2) of Section 178 of the Act.

Nepal

Regulator-Electricity Regulation Commission

ELECTRICITY REGULATORY COMMISSION
(Electricity sector regulator of the Government of Nepal)

Main Act- Electricity Regulation Commission Act, 2017
https://erc.gov.np/storage/listies/April2020/erc-act-2017-english.pdf

Relevant Section/Clause:

(" Chapter 6, Function, duties and authority of the commission
12 To manage the technician : For the regulation with regard to generation, transmission, distribution and business of electricity the commission shall carry up the following works :
A. To form, execute and monitor the grid code and distribution code for electricity service.
…….
……. ")

Pakistan

Regulator- National Power Regulatory Authority

Main Act-Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997

https://nepra.org.pk/Legislation/1-Act/NEPRA%20Act%201997%20as%20amended%20vide%202018%20Act.pdf

Relevant Section/Clause:

(" 23G. **System Operator licence**.–(1) No person shall, unless licensed by the Authority under this Act, undertake functions as a system operator as may be specified by the Authority, including but not limited to.-
.....
.....
(4) An application for licence under sub-section (3) shall be accompanied by a draft grid code governing the form and manner in which the system operator shall undertake its licensed activities. ")

(" 23H. Duties and responsibilities of a system operator.–

(1) A system operator shall, from time to time and subject to approval by the Authority, make such grid management code as may be required to enable it to carry out its functions as a system operator.

(2) A system operator shall regulate its operations, standards of practice and business conduct in accordance policies and procedures as approved by the Authority.

(3) The Authority may, if required in the public interest, direct the system operator to make such grid code or amend its existing grid code as it may specify in writing: Provided that if the system operator does not comply with the direction of the Authority within a period of thirty days without providing just cause for such non-compliance to the Authority, the grid code of the system operator shall be deemed to have been made or amended, as the case may be, and shall take effect accordingly.
.....
....")

Grid code is prepared in "Pursuant to Section 35 of NEPRA Act and Article 16 of the NTDC licence, the National Transmission and Dispatch Company is required to ensure that there is in force at all times a Grid Code. Consequently, NTDC is required to submit a comprehensive Grid Code for approval of the Authority in accordance with the requirement of Article 16 of its licence. The Grid Code provides for the smooth and effective functioning of NTDC and other NEPRA licensees that are or will be connected to the NTDC's Bulk Transmission System[3] ".

Sri Lanka

[3] https://nepra.org.pk/Legislation/6-Codes/6.2%20NTDC%20The%20Grid%20Code%20June%202005%20with%20Grid%20Code%20Addendum%20No.%20I%20&%20II/Grid%20Code%202005.pdf

Regulator-Public Utilities Commission of Sri Lanka

Public Utilities Commission of Sri Lanka

Main Act- Sri Lanka Electricity Act, No 20 of 2009 (SLEA 2009)
https://www.pucsl.gov.lk/wp-content/uploads/2017/12/electricity_act_2009.pdf

Relevant Section/Clause:

(" CHAPTER II FUNCTIONS OF THE COMMISSION
3. (1) The functions of the Commission shall be to act as the economic, technical and safety regulator for the electricity industry in Sri Lanka, and—

,,
(c) to approve such technical and operational codes and standards as are required from time to time to be developed by licensees; ")
……

(" 17. Without prejudice to the generality of section 15, a transmission licence issued to a licensee shall include conditions—
…….
……
(f) requiring the licensee to implement and maintain such technical or operational codes in relation to the transmission system (including a grid code) as the Commission considers necessary or expedient; ")
……..
…….
The Grid Code of Sri Lanka has been formulated in terms of the provisions of Clause 17(f) and 3.1 (c) of the Sri Lanka Electricity Act, No 20 of 2009 (SLEA 2009)[4], which require the licensees to implement and maintain technical or operational codes; the Public Utilities Commission of Sri Lanka (PUCSL) to approve and regulate the implementation of such codes[5].

[4] https://www.pucsl.gov.lk/wp-content/uploads/2017/12/electricity_act_2009.pdf
[5] https://www.pucsl.gov.lk/wp-content/uploads/2018/09/Grid-Code-March-2014-Final1.pdf

Annexure - II

The Electricity Market of South Asia

Market Design Recommendations

WORLD BANK GROUP

Starting point in South Asia : Currently all trade is bilateral with or via India, no regional market governance or institutions exist

Soft Infra

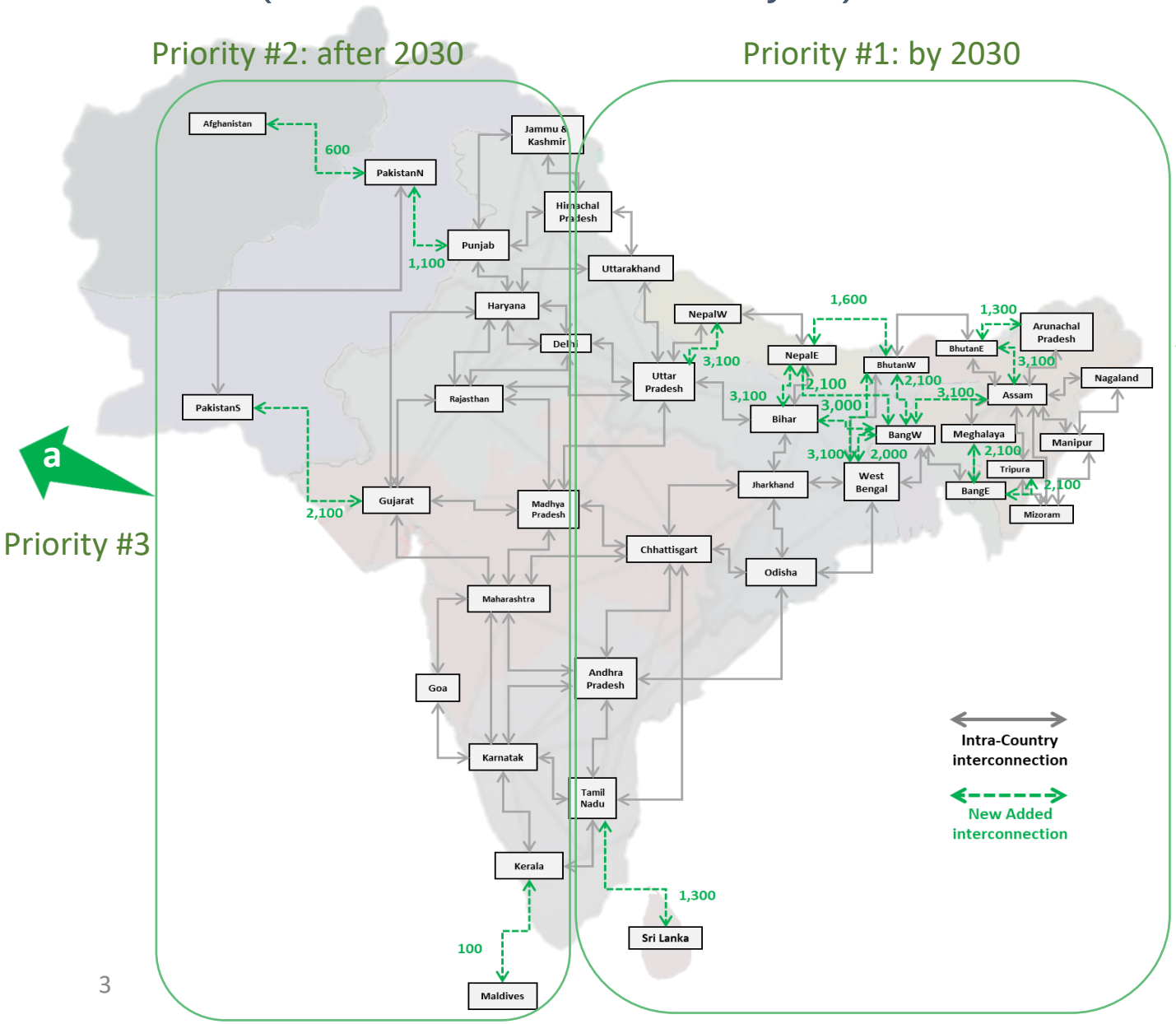
- **Regional Governance**: no regional market design nor defined regional legal framework- only SAARC Agreement (signed in 2014) is geared towards regional market (not operational)
- **Regional institutions**: none
- **Regional Regulatory framework & market rules**: no regulatory frameworks, commercial or technical rules
- **National enabling measures:** almost all countries silent on cross border trade but it is happening based on cross-border transmission bilateral agreements & facilitated by India's evolving cross-border electricity trade guidelines

political commitment focused on bilateral transmission development

Hard Infra (cross-border transmission)

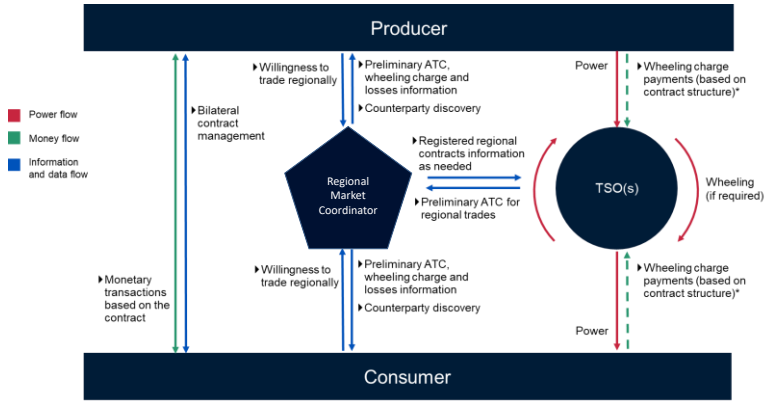
- **G2G connectivity** level is still constrained by only connecting/operating via India's grid
- **Cross-border transmission planning**: bilateral opportunistic approach with a focus on short distance transmission network and utilizing hydro in BT & NP (in the future)
- **Coordination & execution**: incubated bilaterally by Governments & executed ministries/utilities
- **Business model**: Asset-in-country model; JV, PPP (BOT) with gradual increase in private sector role
- **Financing**: mostly public (inc. IFIs, ECAs), with commercial financing mainly on India's side
  Trading strategies & contractual: designed for bilateral trade & dominated by long-term PPAs

Identified trade backbones to develop the Grid-to-Grid transmission among South Asia countries (an initial World Bank analysis)



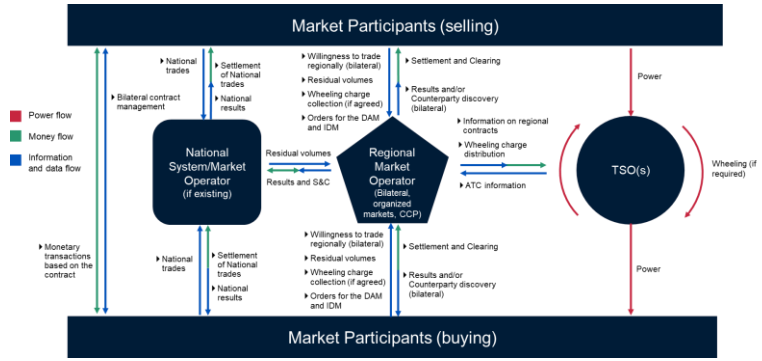
1. **Backbone 1 (priority #1a)**: Constellation project by 2030 for direction connections as Nepal-Bhutan, Bhutan-Bangladesh, Nepal-Bangladesh, India (Assam) - Bangladesh-India (West Bengal) capacity transfer is up to 2000MW with exception of the latter and Nepal-Bhutan at 1000MW
2. **Backbone 2 (priority #1b)**: India-Sri Lanka by 2030, transfer capacity 1000MW
3. **Backbone 3 (priority #2a)**: : India-Pakistan (N) in 2030-2035, transfer capacity 1000MW
4. **Backbone 4 (priority #2b)**: : India-Maldives in 2030-2035, transfer capacity 500MW
5. **Backbone 5a and 5b (priority #3)**: India-PAEM in 2035-2040 | South Asia - ASEAN in 2035-2040, transfer capacity of 2000-5000MW.

Potential models for a regional market development in South Asia



Model 1: **Standardized Regional Bilateral Trading**

- **Standard Physical contracts**
- **Announcement platform ("OTC" platform)**
- Coordination of **preliminary ATC calculation**
- **Information sharing**
- Central registry of regional bilateral contracts
- **Facilitating approval** of proposed deals among involved TSOs



Model 2: a **Secondary Regional Market**

- **New regional market is created** that can accommodate the current non-market SA countries as well as those with established markets
- Agreed methodology to calculate and use **interconnector capacity**
- **Harmonized Market Book of Rules**
- **Allows a full market coupling optimization**

Model 3: a **Primary Regional Market**

- **One common market for South Asia**
- **Common rules, timelines and using the same Market Trading Platform**
- **One organisation that operates the market on behalf of all connected countries**
- **Fully harmonized platforms, rules and procedures**

Pros and cons of different models

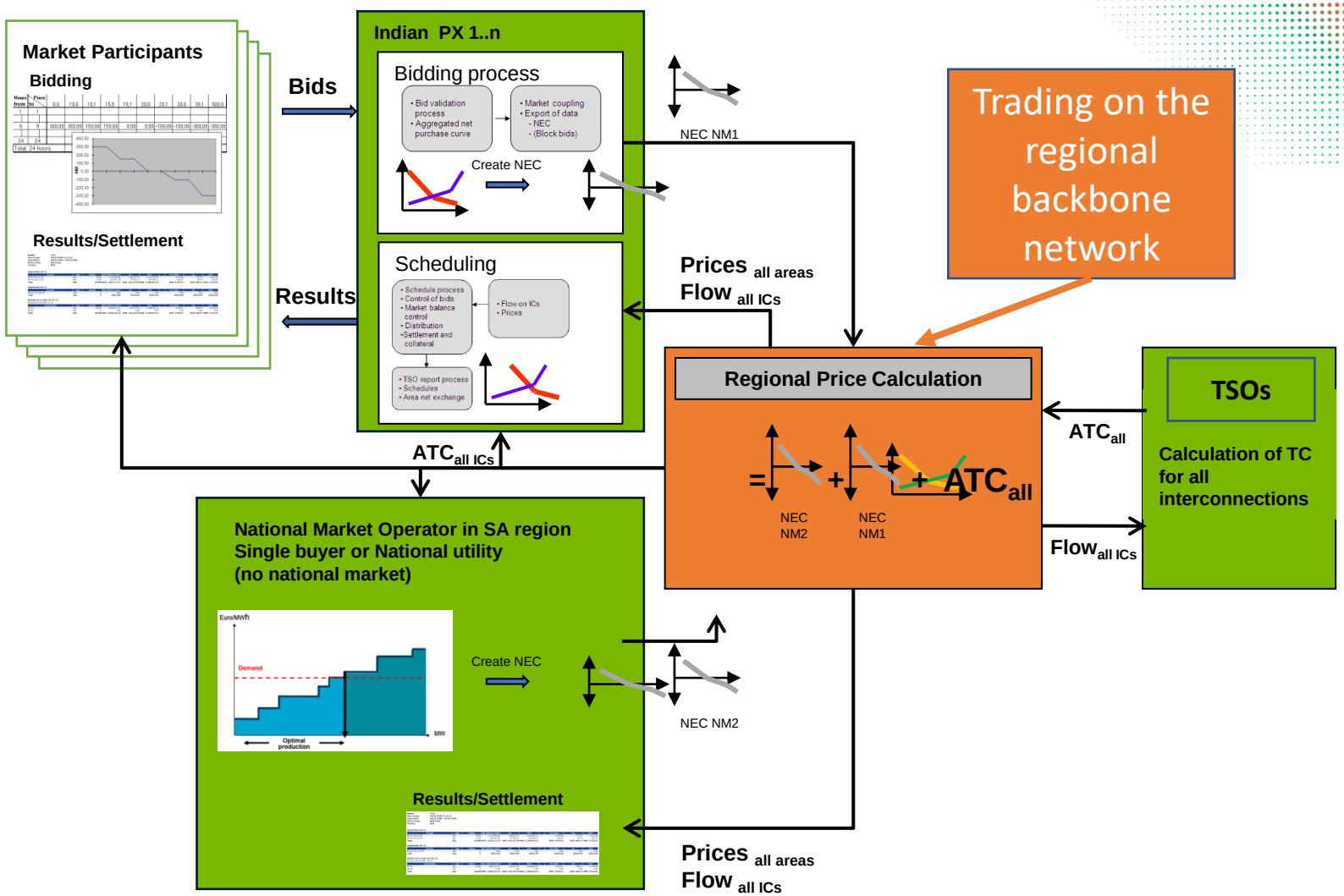
	Multinational Standardized Regional Bilateral Trading	Secondary Regional Market		Multinational Regional Market
	Model 1	**Model 2a** Loose Coupling	**Model 2b** Tight Coupling	**Model 3** Implicit coupling
Pro	• Today´s solution put into a more common framework • Will be easy to implement and a quick start • Could be part of a stepwise implementation	• Will ensure allow for independent market operators • Requires less harmonization	• Will allow for independency • Will deliver optimal cross-border flow • Could be based on one trading system (based on legal model) • Could be “end-game”	• Will deliver optimal cross-border flow • Will be based on one trading system • Will be optimal operational setup • Could be “end-game”
Con	• Will not deliver optimal flow or really a common market	• Complex solutions (require at least three trading systems) • Even with little harmonization, the legal setup will be complex • Will not ensure optimal flow and full benefit	• Will require tight operational coupling between the countries – will take time to implement and agree • Difference between India and the rest • Big step?	• Will require a fully common setup (too tight?) • Could mean full merging – not wanted? • Very hard politically • Too big a step?

Target model

Ultimate market design: transition to full Regional Trading through a regional market beyond 2030: Tight coupling model facilitated by continued backbones development

A new regional market organically evolves to combine coupling and national markets

- The Indian PXs will still base their operation on their current market trading platforms;
- A new regional market is created to cater for all the current non-market SA countries;
- This new regional market will be the national market for the non-market SA countries as well as the regional coupling platform
- All parties to agree on a methodology to calculate and use of the interconnector capacity between the countries;
- Harmonized Market Book of Rules and a tight harmonization on operational procedures;
- It will allow India to still operate their respective markets with its market participant management;
- The Indian PXs will be counterparts to their own trades, but the regional market is the legal counterparts towards the other SA countries;
- Common database for coupling ;
- Allows a full market coupling optimization but still no issues for the Indian PXs;
- Similar to SAPP current model and early European model.



Recommended pathway for a regional market development in South Asia: piloting regional trading based on a transitional market design with dedicated trading platform by 2030

Build on current cross-border trades by introducing and testing **standard forms of bilateral contracts** to simplify bilateral trading

Identify and develop multi-country regional backbone transmission infrastructure to increase capacity for regional trading **(the "hard infra" approach) e.g. Sri Lanka – India connection, new lines between Bhutan, Nepal, India and Bangladesh**

Set up a Pilot Regional **Day Ahead Market** Trading platform creating opportunities for trade across regional interconnectors by interested parties

Develop market governance and organisational structures **– a Market Governance Framework Agreement is in draft**

Develop a Regional **Balancing Market** and evaluate application of SCED alongside the decentralised market model

Key features of the transitional pilot market design on selected grid-to-grid trading backbones: The bottom-up a "hard infra" focus is recommended for regional market development in South Asia

Institutional

- Work with existing utilities/organisations (existing 5 to 7 bilateral mechanisms)
- No requirement for a physical market operator at this stage – use a virtual MO model to operate the market

Legal/ Regulatory

- Basic market access/participation rules to be defined
- Confirm third party access available for market participants
- Develop and apply straightforward transmission pricing methodology

Commercial

- Develop pilot market rules
- Develop a pricing algorithm and platform
- Define market settlement procedures

Technical/ operational

- Identify backbone transmission network hosting trades
- Build on draft Common Minimum Grid Code
- Develop agreed rules for congestion management and transmission capacity allocation
- Define interfaces between national and regional markets

Key transitional tasks between steps of market development for countries that are ready for a rapid start in regional trading using existing and new cross-border lines

Step 1: Status quo to regional bilateral trading (2023 – 2025)

Step 2: Pilot market trading on regional backbone infra (2025 – 2030)

Step 3: Transition from pilot market operation to long-term market development (2030 –)

The transitional Market platform

Develop a pilot market trading platform

- Facilitating trading across existing backbone network with standardised bilateral contracts
- Begin with the Day Ahead Market
- Focus on continuous capacity building
- "Light touch" institutional development
- Develop market rules and settlement processes
- Third party access regulations
- Transmission pricing rules
- SCED and other short-term mechanisms will be evaluated

Pilot trading and institutional development

- Countries that are ready commence pilot market trading
- Development of market governance structure
- Regional Market Operator established
- Full market rules developed, including potential intraday and balancing markets
- Trading over new interconnectors as they are built
- Continuous capacity building
- Testing/learning

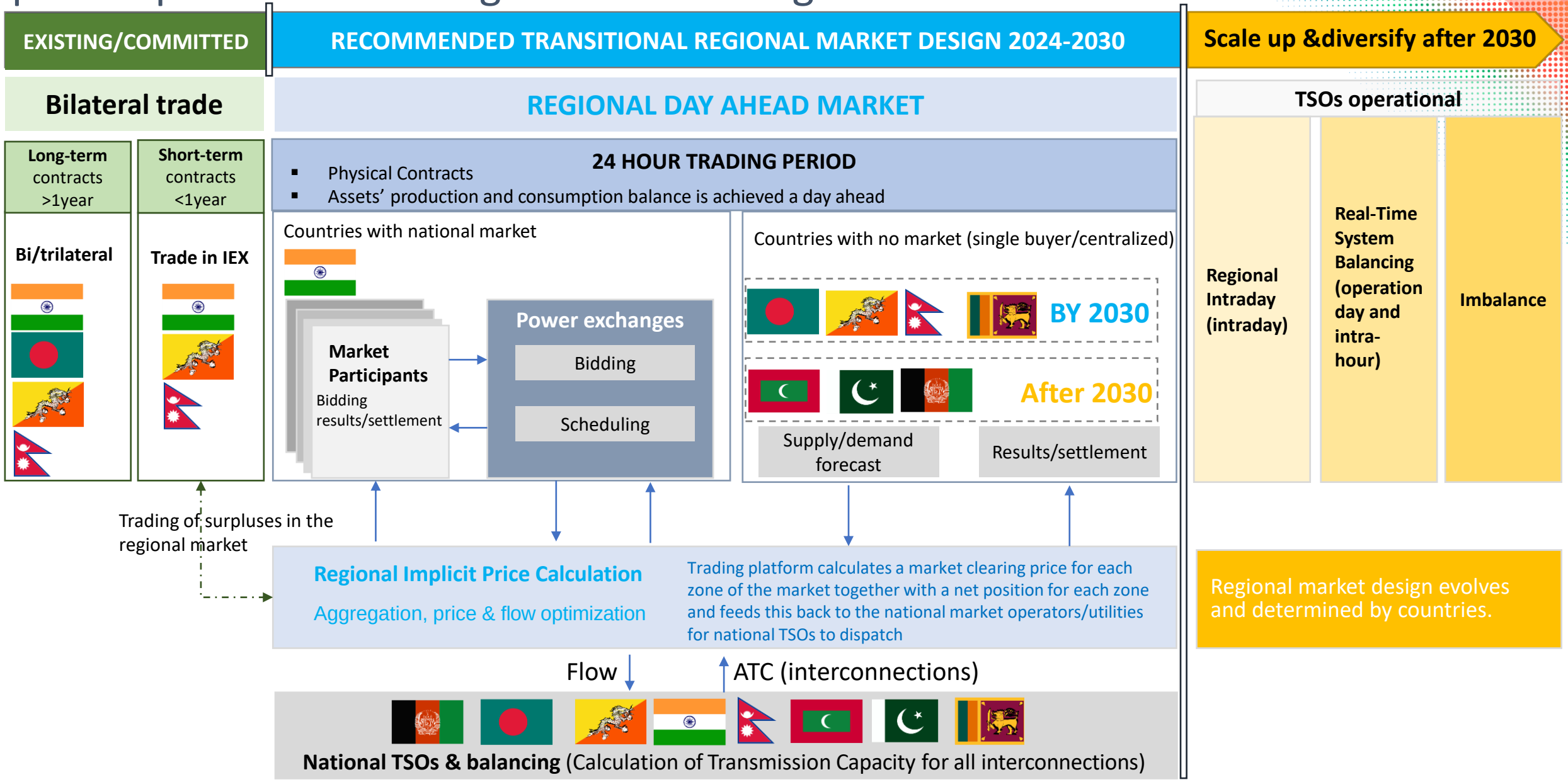
Market fully operational

- Management and operation of processes
- Market monitoring/surveillance
- Routine reporting to regional regulators
- Continued integration of new hard infra as it is commissioned
- Expansion of market participation, possible integration with other regional markets

Benefits of Regional Market for South Asia – complementing existing trades and national markets

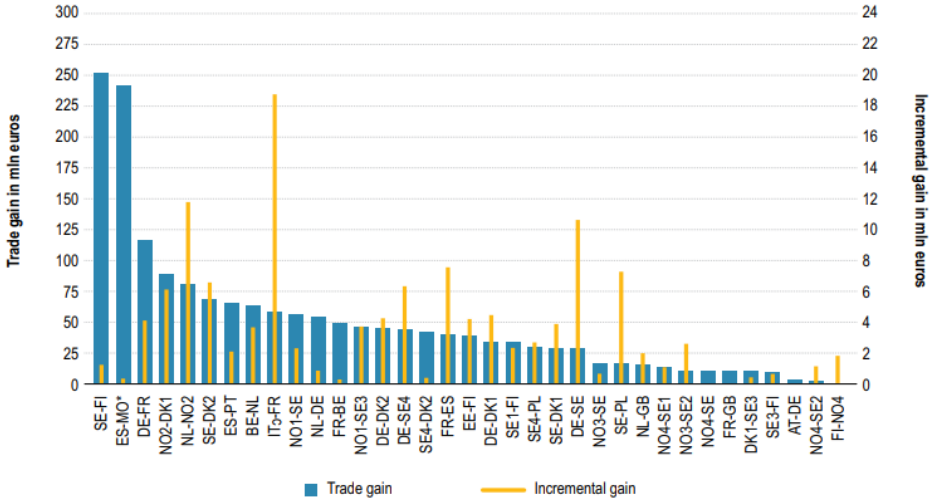
- **Increased liquidity:** Each country will gain access to the wider region's resources through the regional market and by default this increases liquidity in the existing national markets (e.g. Indian PXs).
- **Single interface:** The national market doesn't have to sign up new members, create multiple bank accounts etc. for other countries. National approval is required for participants to trade in the regional market.
- **Welfare gains:** Increasing the size of a market, by bringing together more supply and demand into it, shows welfare gains and an optimized used of assets and resources
- International experience (USA, EU, SAPP, MER, among others) shows that regional electricity markets are the right tools to do so because:
  - The design of regional markets has proven to be flexible enough to cope with any pre-existing requisite without destroying value to already existing institutions (see EU example)
  - They remove legal / technical / regulatory barriers since all players follow the same set of rules, regardless of their location, including open access and transparent transmission arrangements/tariffs
  - Players have appropriate representation on the governance structures and can influence market rules and proposed changes
  - They provide simple and transparent means for trading by centralising bids and offers is accessible and easy-to-use platforms that acts as a central counter party
  - There is no financial risk to sellers as buyers have to provide sufficient credit and/or bank guarantees, and financial settlements are performed after market clears
- **Technical benefits:** regional markets allow for increased reliability and security, and can help the integration of variable resources by correctly pricing the value of flexibility, capacity, storage and ancillary services

The Electricity market of South Asia – a transitional trading platform pilot in parallel to existing bilateral trading



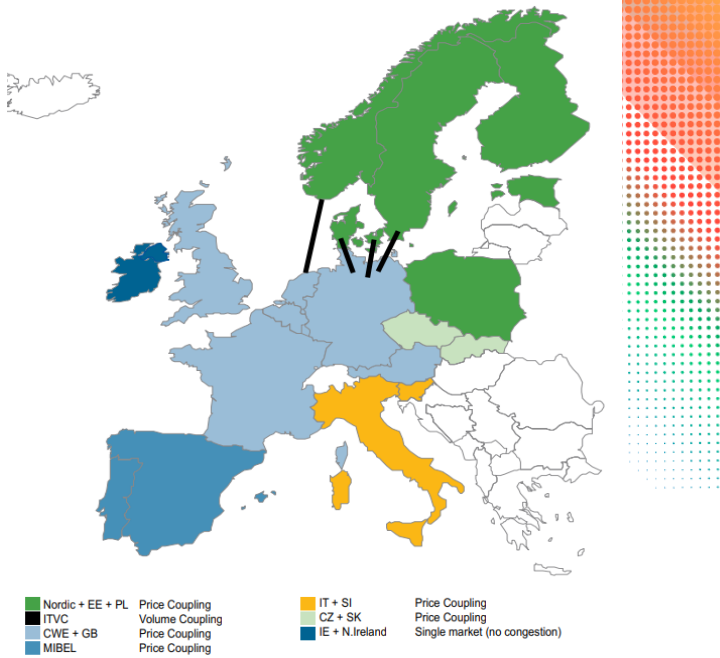
An example of regional integration across countries with already existing PXs: The EU case

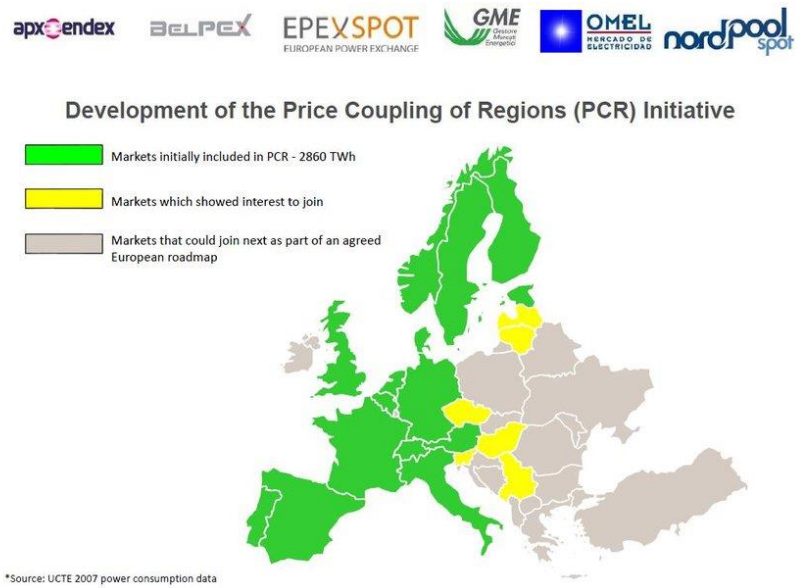
- EU single electricity market is an example of successful integration of separate PXs into a single net regional market
- All pre-existing PXs remain in operation
- In 2012, ACER estimated the benefits of market integration in €1 bn/yr only for the DA market



Source: PCR project, including APX-Endex, Epex Spot, Nordpool, GME, OMIE (2012)

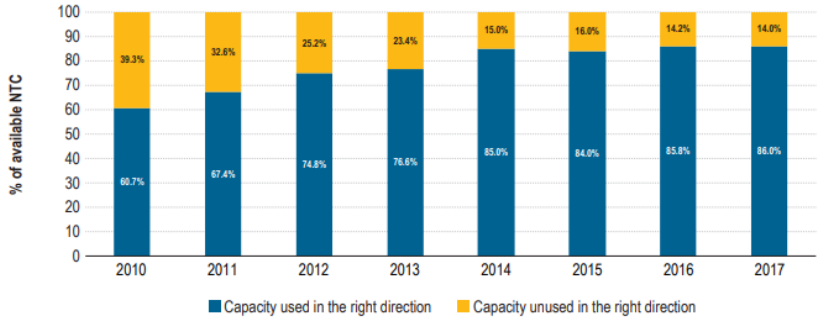
- Since then, all market monitoring reports show how market integration has successfully increased liquidity, and improved the efficient use of cross-border capacities





Liquidity in the EU market

Figure 33: Progress made in the efficient use of electricity interconnectors in the DA market timeframe over the last 8 years – percentage of available capacity (NTC) used in the 'right direction' in the presence of a significant price differential (>1 euro/MWh) on 37 European electricity borders – 2010 (Q4)–2017 (%)



Source: ENTSO-E, Vulcanus, Nord Pool and ACER calculations (2018).

Figure 16: Yearly churn factors in major European intraday markets by type of trade – 2020–2022

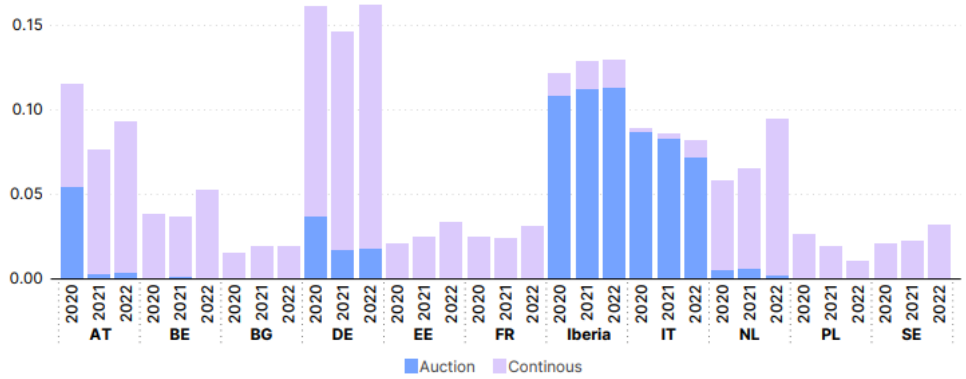
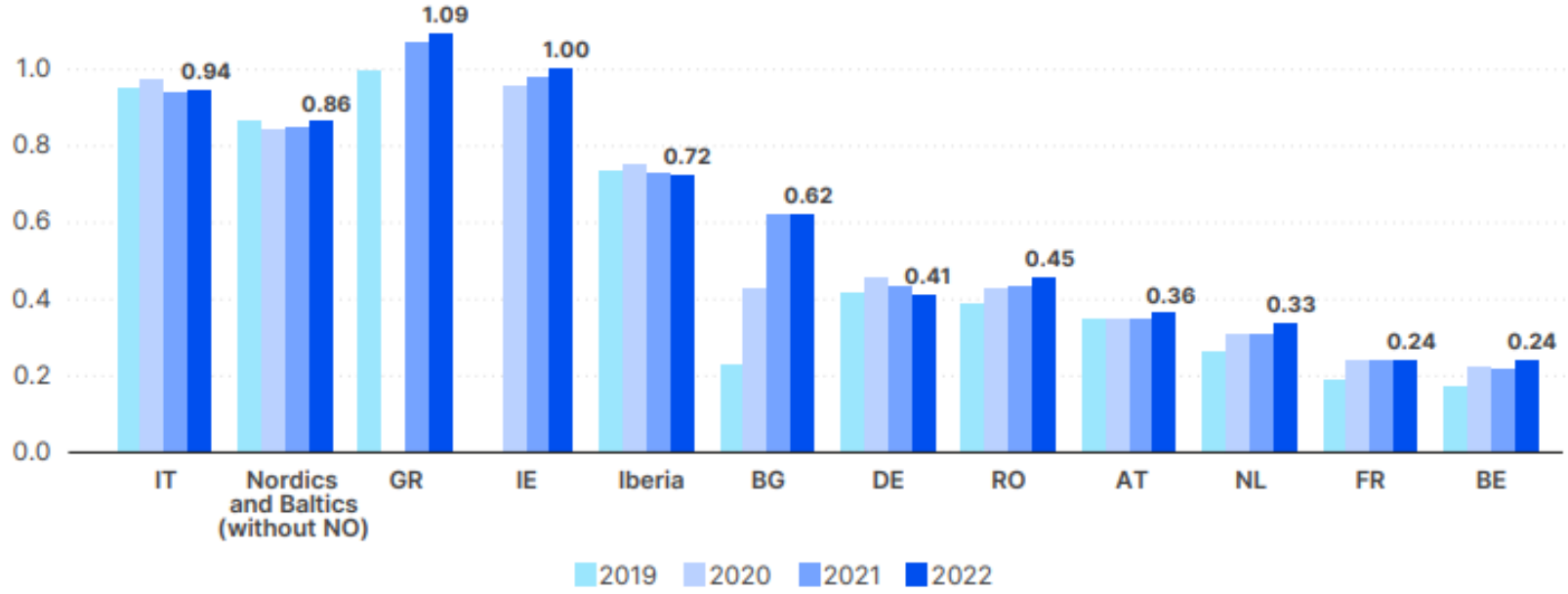
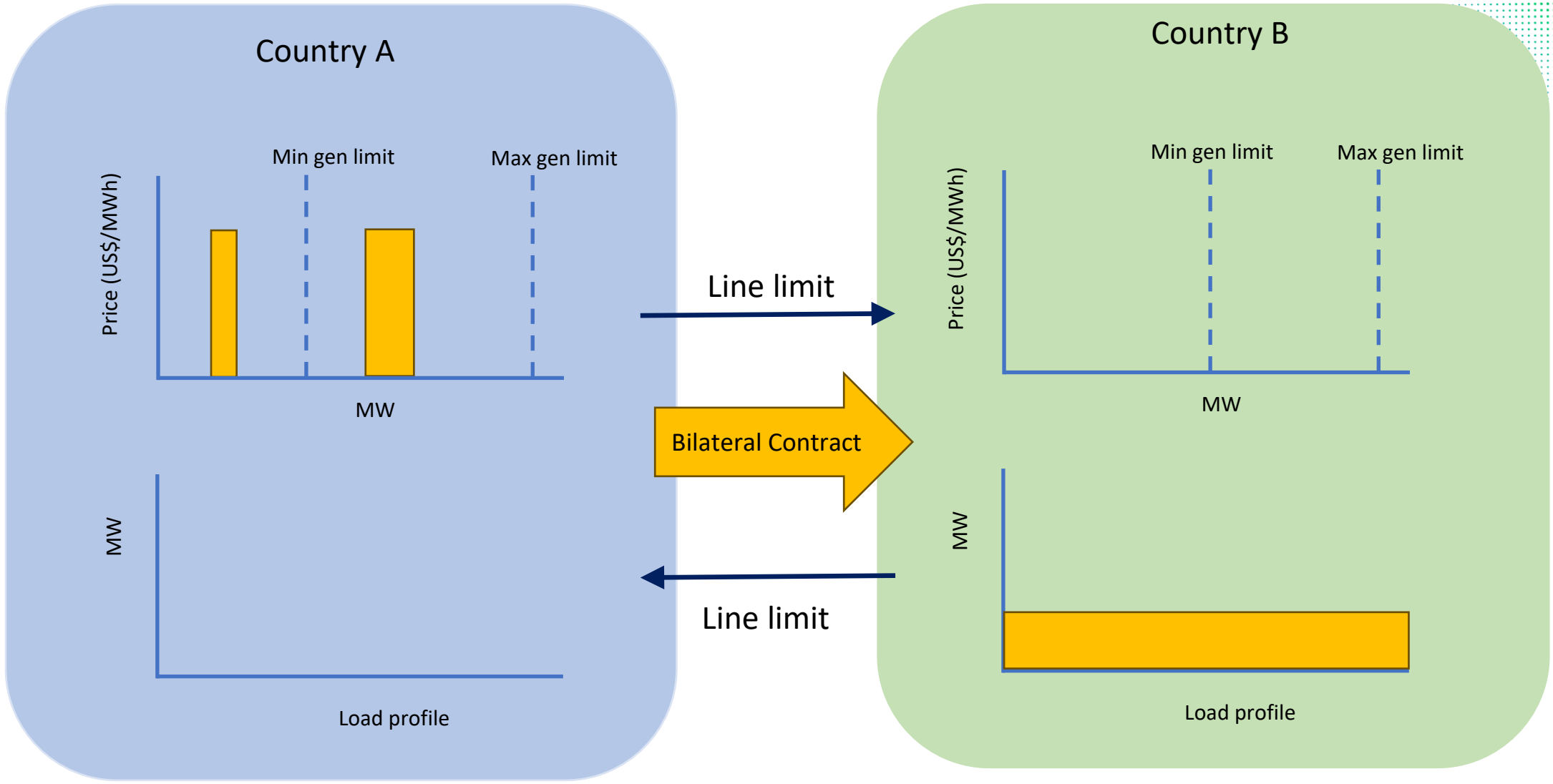


Figure 13: Churn factors in major European day-ahead markets - 2019-2022

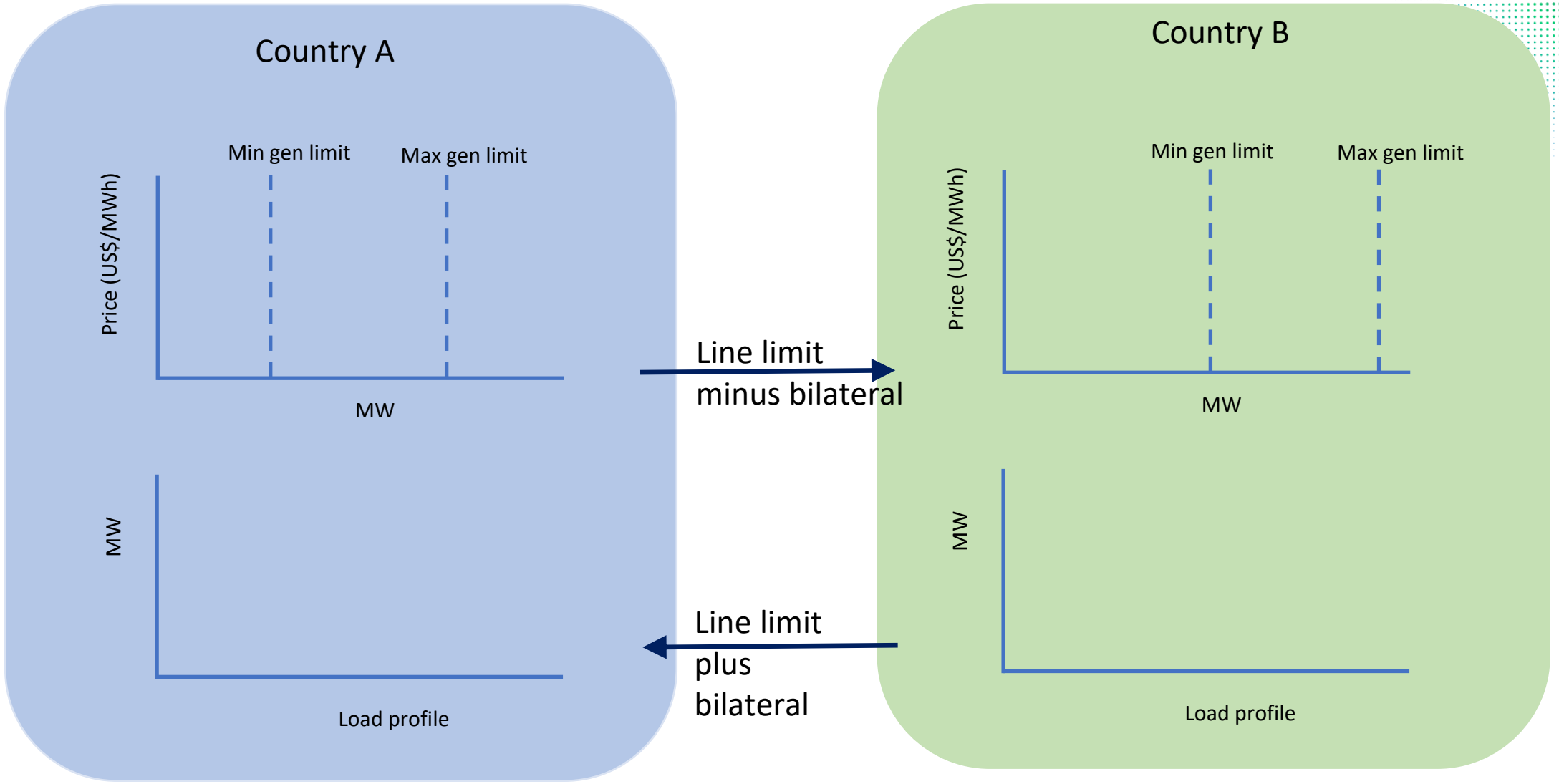


Source: Acer calculations based on REMIT and ENTSO-E data.

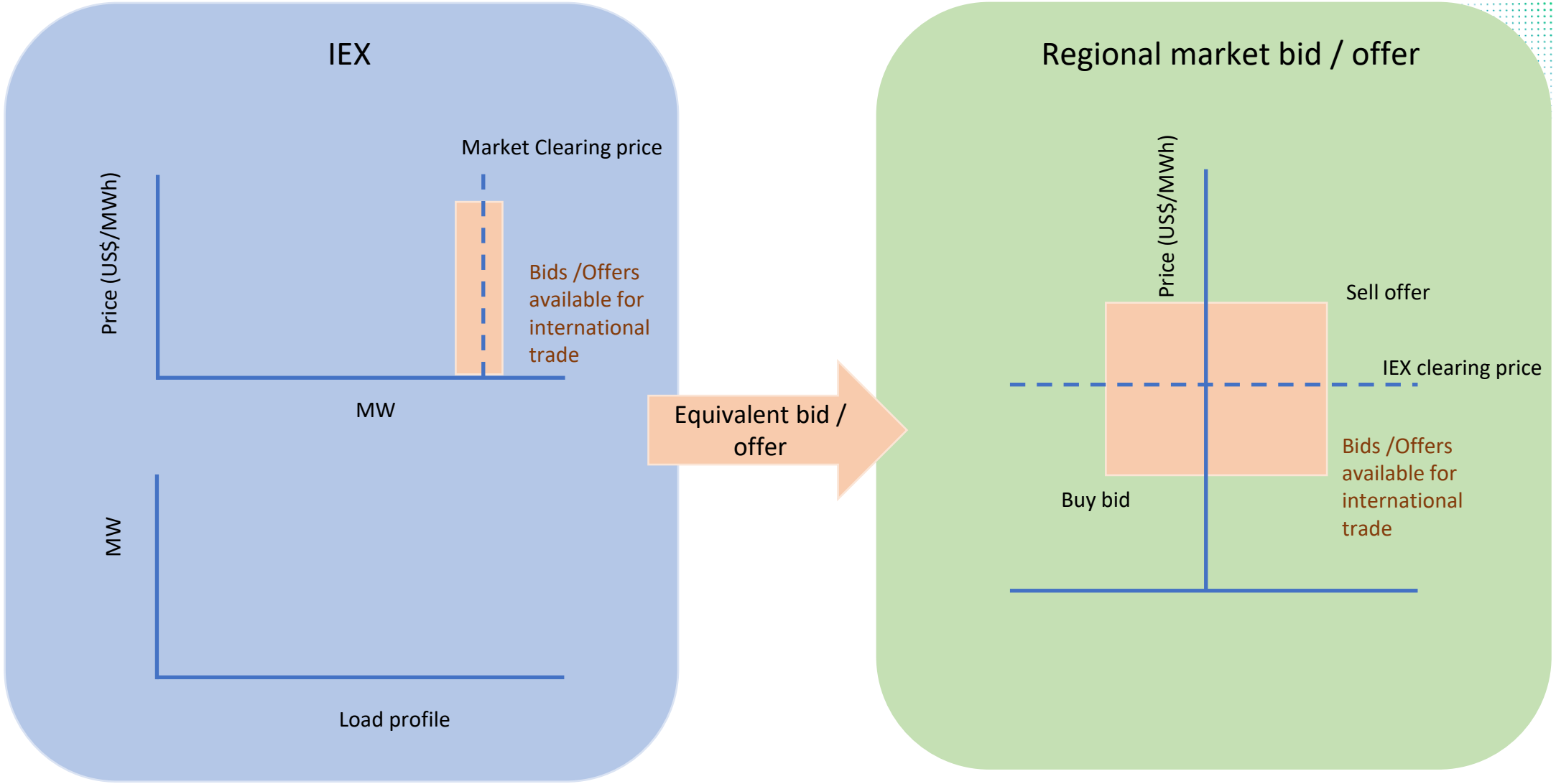
Evaluating market benefits: Original case with bilateral contract



Original case without bilateral contract



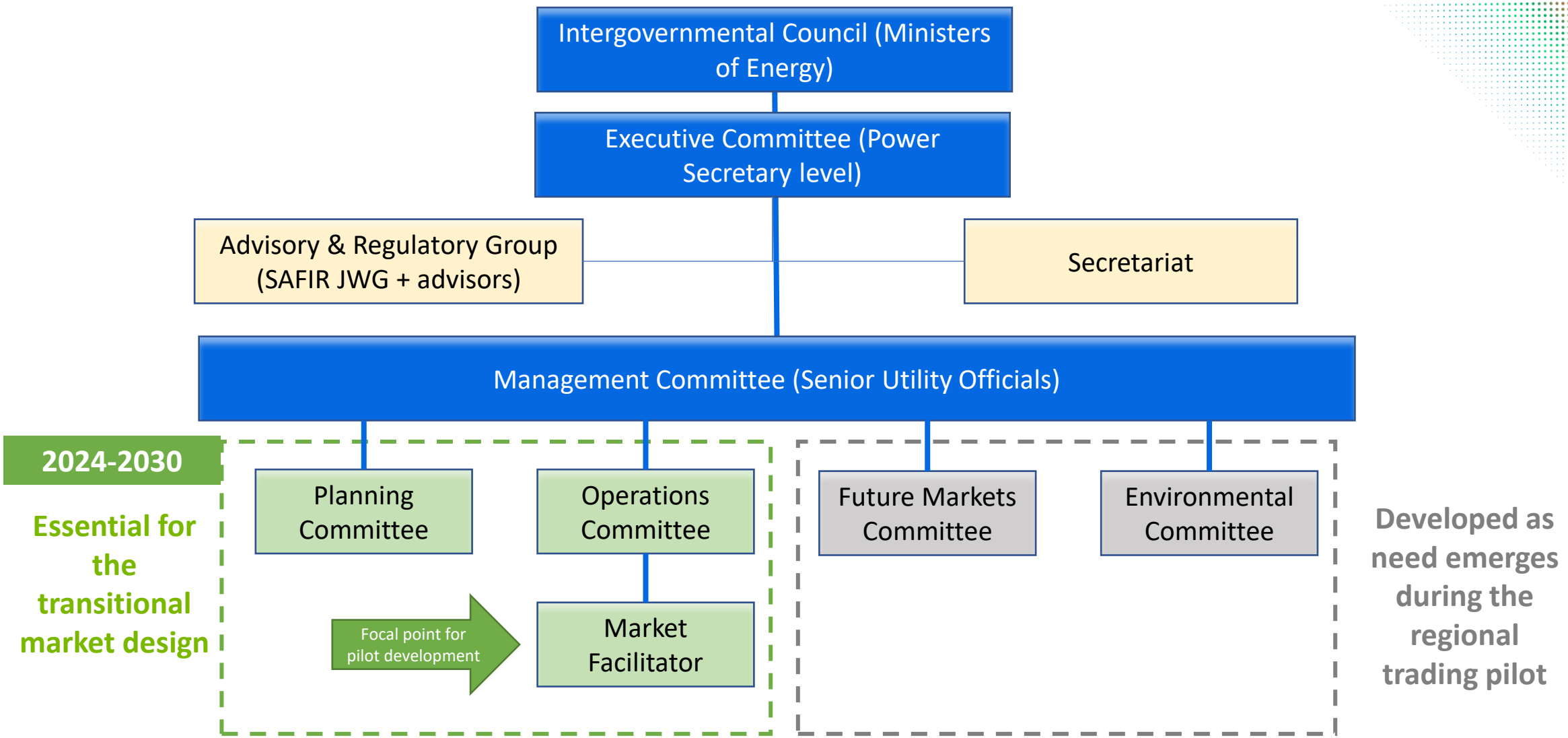
The case of the IEX bidding into the Regional Market



Summary

- This approach could be used to evaluate the impact on liquidity
- Due to the small trade volumes in IEX currently the impact initially will be small
- Does the JWG see a need to carry out simulations to evaluate liquidity?
  - This would require data provision by JWG members
- The proposed market design brings substantial additionality to the existing trading arrangements
- Each country has the right to approve access to the regional market

Recommended Governance/institutional Structure for the transitional market design



The Role of the Market Facilitator

- While in developed regional markets it would be expected to have a regional market operator, or a common platform to trade (or common algorithm), in incipient market structures, the role of a market facilitator could suffice.

- The market facilitator would:
  - Act as a facilitator rather than a market operator.
  - Parties would trade on the basis of bilateral contracts and make their own arrangements for settlement.
  - But parties must inform the facilitator of the details of the origin, destination, start time, etc.
  - Parties must ensure that they have the appropriate level of interconnector rights for operations.
  - The facilitator in turn subsequently confirms to the parties that the trade took place or if the actual trade differed from that notified in advance, it notifies them of the actual exchange.
  - The facilitator could have the right to refuse trade if it judges the trade to be infeasible.

- Such entity could be virtual or could be set up as the seed for a future regional market operator.

Learning from international emphasizes the need for Hard Infra and gradual evolution of the soft infra development with adaptive institutional and governance frameworks

Regional Power Pool/Market	# of countries/ states	Main governance framework
European Electricity Market	8 (1951, UCPTE); 24 (1999, UCTE) 35(2009 onwards, ENTSO-e)	Regional bodies empowered by European Union Directives to coordinate regional operations with decentralized dispatch: European Union Directive 96 / 92 towards common rules for the internal market in electricity; Security Package to enforce multilateral agreement; 3rd Energy Package
South African Power Pool (SAPP)	16	A regional body with clear functions formulated under Inter-Governmental Memorandum of Understanding (IGMOU) that grants its mandate to facilitate power trade among countries via Inter-Utility MOU
Eastern African Power Pool (EAPP)	14	A regional body with clear functions formulated under Inter-Governmental Memorandum of Understanding (IGMOU) that grants its mandate to facilitate power trade among countries via Inter-Utility MOU
Pan-Arab Electricity Market (PAEM)	18 of which 16 signed the MOU in 2017	An Electricity Ministerial Council empowered to approve the regional governance documents (MOU, Legal Agreement, Commercial Agreement, Technical rules)
SIEPAC	6	A Framework Treaty established the Regional Electricity Market (REM), the creation of the SIEPAC line, and the regional organisations part of REM, which include Regional Operations Entity (EPR), the Regional Operating Entity (EOR), the Regional Commission for Electrical Interconnections (CRIE) and the Board of Directors of the Regional Electricity Market (CDMER)
Western Energy Imbalance Market (WEIM)	11 US states	The Western Energy Imbalance Market (WEIM) is governed by a five member body with shared authority from the ISO Board of Governors on rules specific to participation to the WEIM. Designed by regional stakeholders, members of the governing body are nominated by a committee of western stakeholders.
PJM	13 US states plus the District of Columbia	PJM is a membership organization, providing services on a non-profit basis to customers that are members of PJM. The corporate structure works through the interaction of the PJM Board of Managers, member organizations and stakeholders. The PJM Board of Managers works in conjunction with the Members Committee.

Recommended Governance Framework

- The following documents would govern the Electricity Market of South Asia .
- In case of inconsistencies, the first document shall have precedence over the second document, and the second document over the third document.

1. An Inter-governmental Agreement on a Governance Framework for the Electricity Market of South Asia
2. The Electricity Market of South Asia Commercial Code (Market Rules)
3. The Electricity Market of South Asia Technical Code (Common Minimum Grid Code)

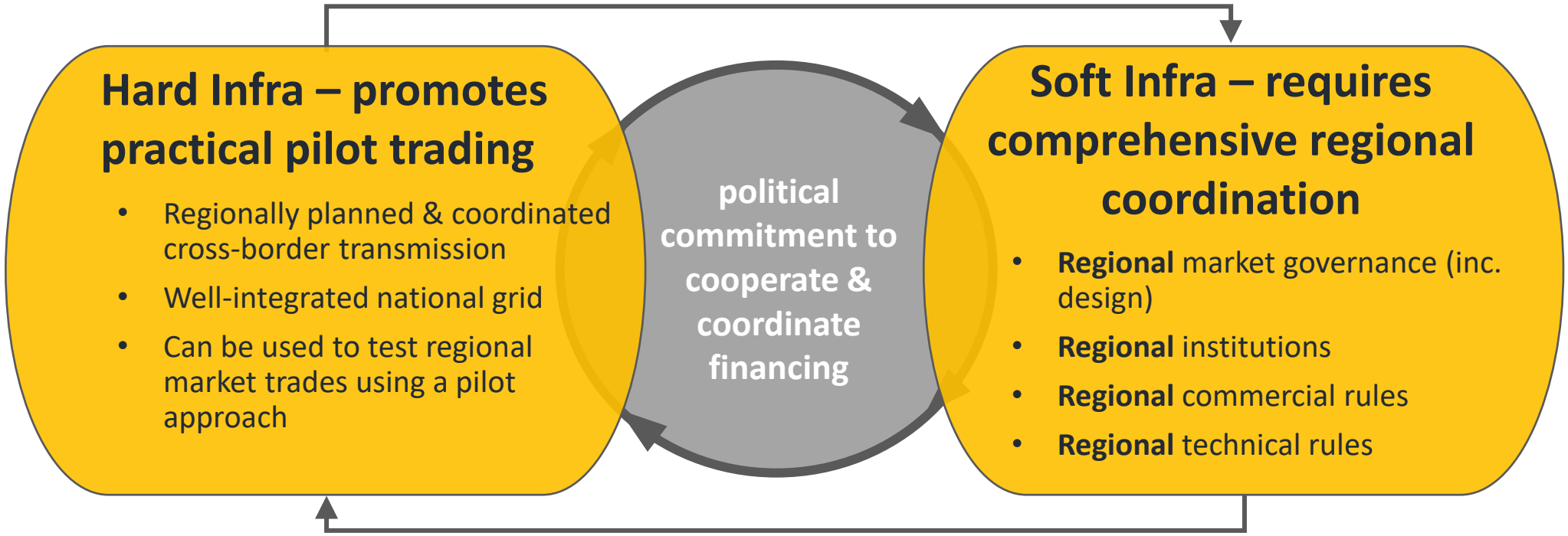
Next Steps

- JWG presents final recommendations on the Market Design and Governance Framework to PSRT-17 on February 23/24 2024
  - This will seek endorsement to start country level deliberations on the two documents
- JWG to decide on any additional WB support to complete deliberations and prepare for PSRT-18
- WB to kick-off full capacity building support and finalise the regional transmission planning task before PSRT-18
- WB supports development of a detailed market design document, based on outcome of deliberations

THANK YOU

WORLD BANK GROUP

Transition to a full regional market requires **continuous interaction** between hard infra development (increased interconnection) and soft infra (increased regional cooperation)



mutually reinforce each other towards a regional market development if political commitment to cooperate on shared goal/vision is in place upfront

The main stages of the evolutionary process from the transitional pilot of the regional market towards establishing the ultimate market design

2023-2025

Step 1: Status quo to regional bilateral trading

(Status Quo to “Bottom-up”)

- Harmonize bilateral trading agreements
- Agree on basic common transmission charging methodology
- Work with existing institutions to develop pilot market proposals
- Establish regional market data website
- Capacity building on future market development

2025-2028

Step 2: Preparation for pilot market trading on “hard infra” transmission backbone(s)

- Prepare national regulatory changes
- Harmonize national regulations to regional market
- Develop pilot market trading rules
- Develop pilot market trading platform & working groups
- Capacity building on future market development

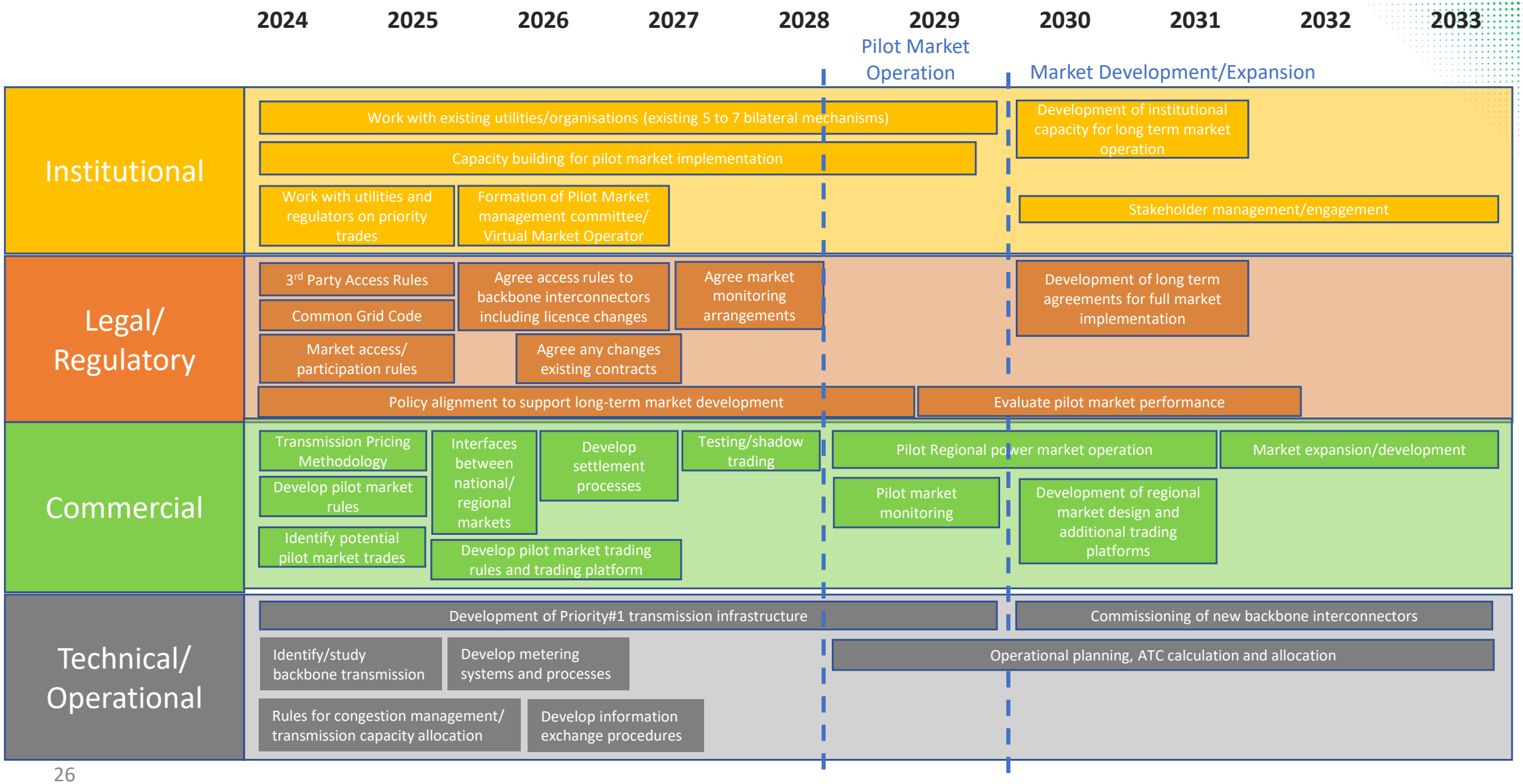
2028- onward

Step 3: Pilot market operation and long-term market development

- Pilot market trading
- Establishment of the regional market as an entity
- Common operational procedures for all
- Implement a more market-supportive transmission pricing
- Product and market evolution will continue
- Continuous capacity building

Evolution towards regional competitive market in South Asia

Timeline - the Bottom-up Hard Infra pathway as a transitional approach towards the ultimate market design model for South Asia, initially using existing infrastructure and trading over new interconnectors as they are commissioned



Main feedback areas raised by SAFIR-JWG and relevance to proposed transitional market design pathway

Issue	Response
Support intra-country system/cost optimization measures to help each member country appreciate efficacy of market	We recommend having a dedicated session/workshop under the SAFIR-JWG umbrella on the experience of India in SCED to ensure knowledge exchange on how such optimization would support the transition to a regional electricity market in South Asia. SCED is not a pre-requisite for a regional market since there are many other forms of increasing the social welfare that are not as complex in terms of computation, governance, pricing, settlements, etc.
Draw lessons from India's experience of regional integration to form a common national grid/market	Market design: the submitted recommendation on market development pathways (this presentation) builds on the significant progress made by India in both national market development and policy/regulations to enable electricity trade. Capacity building program: contributions to different modules of the capacity building will be sought from India's counterparts to share experience in respective areas.

Generation Scheduling: Security Constrained Economic Dispatch (SCED)

- The Security Constrained Economic Dispatch (SCED) can be defined as: *"SCED is a mathematical model to generate the most economic generation dispatch while considering key system operation constraints, such as power balance constraint, reserve requirement constraints, transmission security constraints, as well as generation limitations, such as ramp rates, minimum and maximum output levels ."**

- It can be seen an advance merit order dispatch, since in an ideal world (no technical constraints, infinite capacity in the transmission network, no contractual constraints, etc.) results would be the same.

- It is widely used in the sector, specifically in centralised environments (where no self-generation takes place) and cost-based markets. It is run by the system operator, which requires of an important amount of technical information to run it. It is generally a quite complex algorithm solved through mathematical optimization.

- All System Operators at some point (even if very basically) perform this exercise, since they need to decide which plants to run in real-time after the nominations from self-dispatchers.

- The most important aspect for the SAR is that SCED is not a pre-requisite for a regional market (it is not used in the European markets for example, although it is the standard form of scheduling in the US) since there are other forms of increasing the social welfare that are not as complex in terms of computation, governance, pricing, settlements, etc. (e.g PXs). It's implemtation shall be evaluated during the transitional stages of the market towards its final implementation.

** Source: https://www.aeso.ca/assets/Uploads/3.3-SCED-Overview-by-PJM.pdf*

Examples of key transmission regulations supporting power trade - India

- The Central Electricity Regulatory Commission (Connectivity and General Network Access to the Inter-State Transmission System) Regulations 2022
  - Provides for a regulatory framework to facilitate non-discriminatory open access to licensees or generating companies or consumers for use of the Inter-State Transmission System
  - Covers the process for applying for a grant of Connectivity (for generation or storage >50MW) or a grant of General Network Access (which applies to state transmission utilities, distribution licensees, transmission-connected demand or trading licensees engaged in cross-border electricity trade and using the Inter-State Transmission System)
  - Refers to the CBTE and Sharing Regulations as below – transmission charges are published in Rs/MW/time block for each State each month
- The Central Electricity Regulatory Commission (Cross-Border Trade of Electricity) Regulations 2019
- The Central Electricity Regulatory Commission (Sharing of Interstate Charges and Losses) 2010
  - Defines the methodology for calculating point of connection charges for Designated ISTS Customers (i.e. generation and demand) and loss allocation factors

Main feedback areas raised by SAFIR-JWG and relevance to proposed transitional market design pathway

Issue	Response
Study Western EIM Model (California) and other similar models as a precursor to regional market in South Asia	The WEIM is an initiative launched by CAISO to access cheaper balancing resources from neighbouring states. It succeeds in increasing efficiency in close to real time markets, but, due to institutional and political factors, it is far from what a regional coupled market would look like, since, all other activities, from planning to operations, remain in the hands of independent SO or similar State entities that won't give away their control, nor share resources outside their jurisdictions. We will however keep it under review for developing the balancing mechanism stage of the regional market.
Support capacity building in member countries for effective regional integration	Three nominees from each country are recommended (one in each of the three focus areas). Additional nominations are accepted as backups in case of absence of the primary nominee. Participants who will receive the training should be equipped to be part of the technical teams under regional market committees once a regional governance framework is approved.

Short-term balancing market – e.g. WEIM – Western Energy Imbalance Market

What it is

- It is a real-time wholesale energy trading market that enables participants anywhere in the west (of the USA) to buy and sell energy
- It is a small market (tip of the iceberg, compared to CAISO) that renders some benefits through operating a 15 - minute ahead, 5 - minute ahead markets and real time dispatch (RTD)
- It serves as a balancing tool for CAISO, while allowing the ISO to remain independent and not “regionally” coupled with other states

Similarities with SAR

- The size and relevance of India in SAR could be compared to that of CAISO in WEIM (actually CAISO initiated WEIM)

Is WEIM a regional market?

- It is in the sense that different States agree to trade on a common platform, but only for close to real time products, which volumes are very small compared to the DAM
- In terms of welfare maximization, it cannot be compared to other, tighter, regional approaches (PJM, EU, SIEPAC, etc.) since if this were to be the case, all participating states would share (regardless of the market design) all(part of the) available resources in the most efficient manner possible, only limited by transmission constraints –and other technical limitations-.

A regional cooperation and institutional capacity building will pave the way to support the transitional committees of the recommended governance/institutional framework

Focus		Description
Regional transmission planning coordination group		Officials representing each country from Ministry/utility power system planning to jointly review and finalize the South Asia Regional Electricity Transmission Plan 2035 (PLAN2035).
9-12 months institutional capacity building program	**Group-1**: System planning	Regional generation and transmission system planning: This will include least-cost power system planning under different scenarios of trade and system configurations (e.g., uptake of renewables, carbon tax, addition of new interconnectors, fuel availability and price, etc.)
	Group-2: System operations and trade (commercial)	Focused on market-based electricity trades on the regional level to include identification of trade, trade pricing and transmission pricing in the context of the South Asia region. SCED and other emerging needs will be incorporated.
	Group-3: Trade-related regulations	Focused on regulations pertaining to transmission access, fair pricing, and data transparency in light of the varying structure of the power sector in the South Asia region

Standardized Regional Bilateral Trading for the transitional market design

National Market Operator(s), Utilities and potentially IPPs

- Preliminary ATC information wheeling charge and losses
- Counterparty discovery
- Announcement of willingness to trade regionally

Three-party coordination

- Verify ATC availability on proposed contacted route
- Standardized Bilateral contract management among the three parties
- Settlement of contracted volumes directly between the involved parties. Inc. wheeling charges and compensation for losses.

National Dispatch/TSOs and Balancing

- Preliminary ATC calculation result, wheeling charge and losses agreement
- Full regional overview of regional trades to update the ATC calculation with new trades.

South Asian Regional Coordinator
Harmonized Bilateral Trading

- **Standard Physical contracts** for power trading including wheeling charges
- **Announcement platform ("OTC" platform)** for counterparty discovery
- Coordination of **preliminary ATC calculation** for the involved interconnectors (TSOs are responsible for the calculations)
- **Information sharing** to market participants (preliminary ATC, wheeling charges, losses)
- Registration of existing and new regional bilateral contracts to a **central registry** to keep an updated regional overview
- **Facilitating approval** of proposed deals among involved TSOs

- Standardized bilateral contract templates
- ATC calculation methodology
- Wheeling methodologies, potentially including losses
- Third party access (TPA) agreement
- Technical and operational harmonization through regional grid code

Inspiration: IEA feasibility study for ASEAN energy exchange

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Standardized Regional Bilateral Trading: key requirements and relevant tasks

Some more details on the requirements:

- Standardized bilateral contract templates*
  - Develop a standardized contract for striking the regional bilateral deals in the centralized platform
  - The template shall allow for some flexibility on terms
- Transmission Capacity management
  - National dispatchers (TSOs) will have to avail ATC information to the bilateral OTC platform to enable the regional contracting
- Wheeling methodologies, potentially including losses
  - Either a harmonized methodology is created or ensure that the regional wheeling can be calculated, collected and distributed
- ”OTC” (trading) platform for bilateral contracts
  - An IT platform needs to be developed where the willingness to purchase or sell power regionally can be expressed, based on the criteria defined in the standardized contract
  - The platform should include a registry for the concluded contracts (under confidentiality agreements), the regional market operator may share the information either anonymized or under NDAs to the national system operators for grid operation and ATC calculation purposes.

Additional related tasks:

- Legislative and regulatory gaps to be tied up
  - Legislative gap analysis to allow multinational bilateral trading
  - Import/Export license requirements
- Enabling agreements
  - Intergovernmental agreement on market-based power trade
  - Operational agreements among the TSOs for regional power trade
  - Required NDAs
- (Future) Power Market establishment and building
  - Required organizational establishment to allow centralized multinational power trading
  - Wheeling methodologies management, development and harmonization

* As an example, EFET (European Federation of Electricity Traders) has developed a set of templates that are widely used in Europe as serve as a best practice. Several OTC markets in Europe are using these as their basis, ref https://www.efet.org/ where these are available.

Inspiration: IEA feasibility study for ASEAN energy exchange

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