World Energy Council

CONSEIL MONDIAL DE L'ENERGIE

KOMITE NASIONAL INDONESIA

Membedah Perencanaan Ketenagalistrikan Nasional

Coffee Morning - Short Discussion
DIREKTORAT JENDERAL KETENAGALISTRIKAN
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Anggota Scientific Board BALITBANG-ESDM

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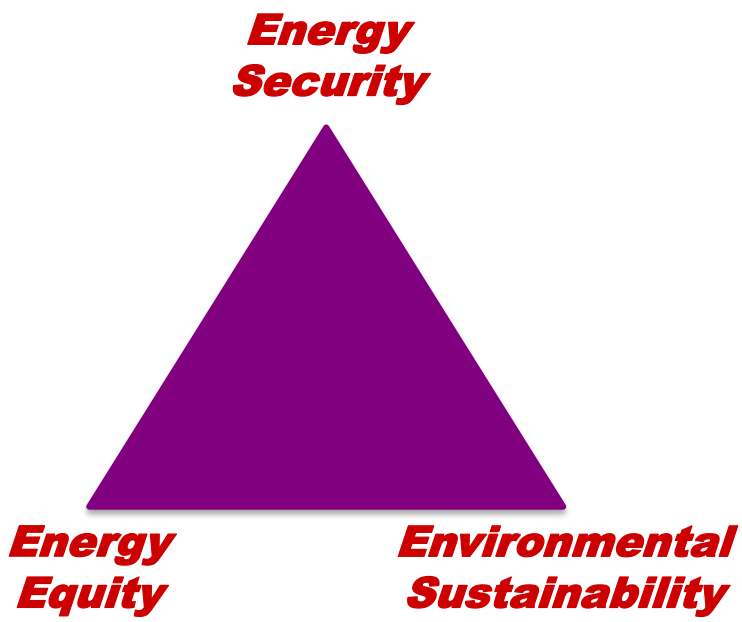
CONSEIL MONDIAL DE L'ENERGIE

3 Core Dimensions of Energy Sustainability

3 Core Dimensions of Sustainable Energy System
Balancing the 'Energy Trilemma'



Energy Security

The effective management of primary energy supply from domestic and external sources, the reliability of energy infrastructure, and the ability of energy providers to meet current and future demand.

Energy Equity

Accessibility and affordability of energy supply across the population.

Environmental Sustainability

Encompasses the achievement of supply and demand side energy efficiencies and the development of energy supply from renewable and other low-carbon sources.

World Energy Council 2013, "World Energy Trilemma", Time to get real – the Agenda for Change.

Towards Sustainable Energy Path

The Energy Trilemma

Balancing the 3 core dimensions of the energy trilemma is a strong basis for prosperity and competitiveness of individual countries. Secure energy is critical to fuelling economic growth. Energy must be accessible and affordable at all levels of society to ensure social stability. The impact of energy production and energy use on the environment needs to be minimized in order to combat climate change as well as local air and water pollution and its implications.

Addressing the energy trilemma presents extraordinary environmental, social, and economic challenges requiring national and international action by not only governments, but also the private sector and civil society. Robust and enabling environments will be required toward these ends, including appropriate technology mechanisms and a global trade and investment regime that encourages and leverages investment, innovation, and technology uptake.

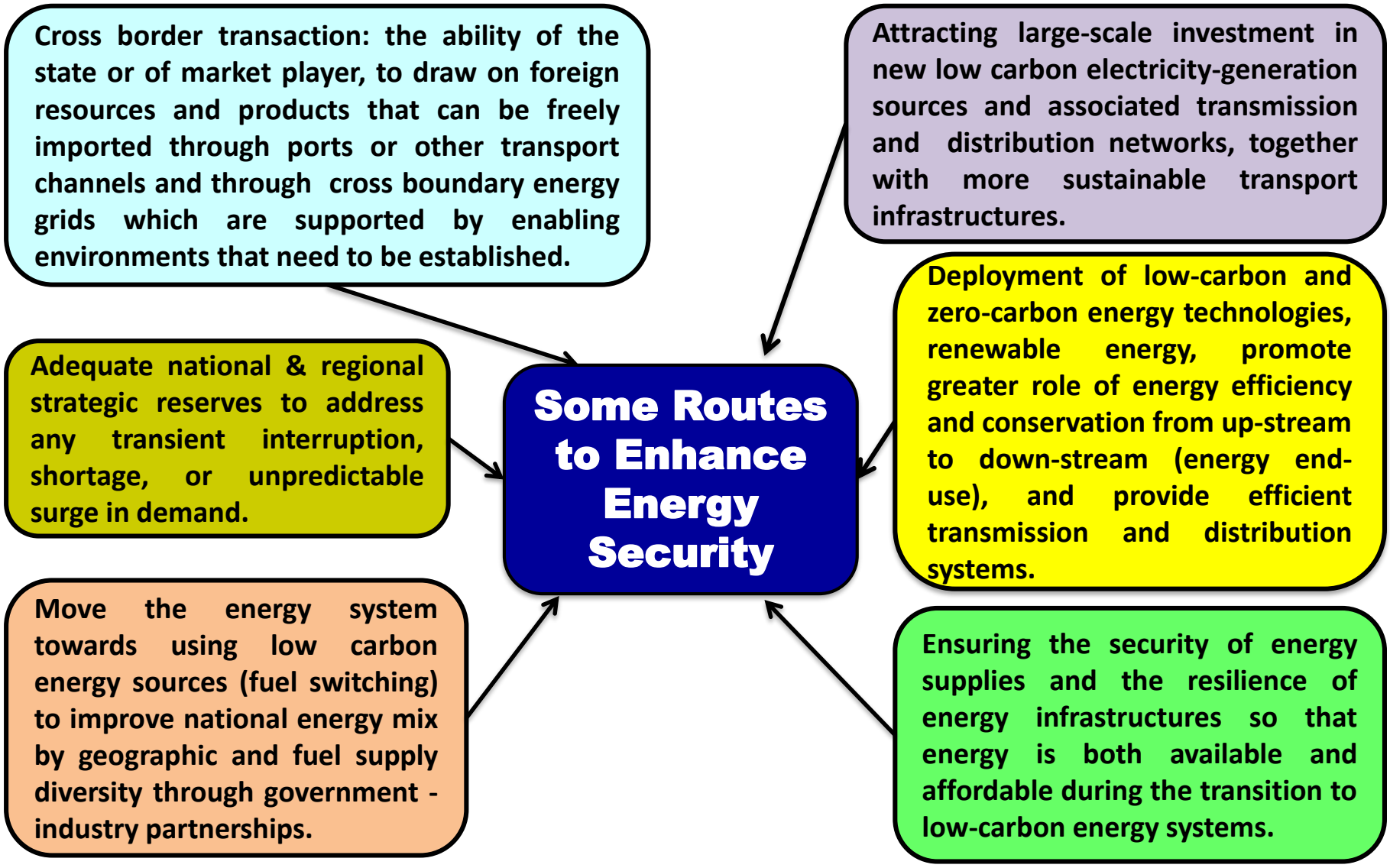
National Energy System

Drive the national energy system towards low-carbon energy sources, low-carbon and zero-carbon energy technologies, renewable energy, greater role of energy efficiency and conservation from up-stream to down stream (energy end-use), and efficient transmission & distribution systems.

- ***Governments & Policy Makers***: Policymakers must focus on reducing political and regulatory risks: 1) Have a clear vision for sustainable energy and a master plan with clearly defined energy sustainability goals, 2) Define coherent, long-term, and predictable energy policies, underpinned by well-implemented regulations, and 3) Recognise that investors are not going to provide capital without an attractive profit.
- ***Financing Community***: The financial infrastructure must exist for capital to flow easily to the energy sector: 1) Help policymakers and energy sector understand the role of different financial investors and instruments, 2) Support efforts for the standardisation of instruments, and 3) Review existing rating models and develop new approaches to bundle smaller-scale projects.
- ***Energy Industry***: The energy sector must bring clearly bankable projects to the market: 1) Be more proactive in the dialogues around energy policies, 2) Establish standard procedures and best practices for data and disclosure, 3) Create new pricing models that meet the reality of changing business models and encourage demand side response.

Some Routes to Enhance Energy Security Towards Sustainable Energy Path

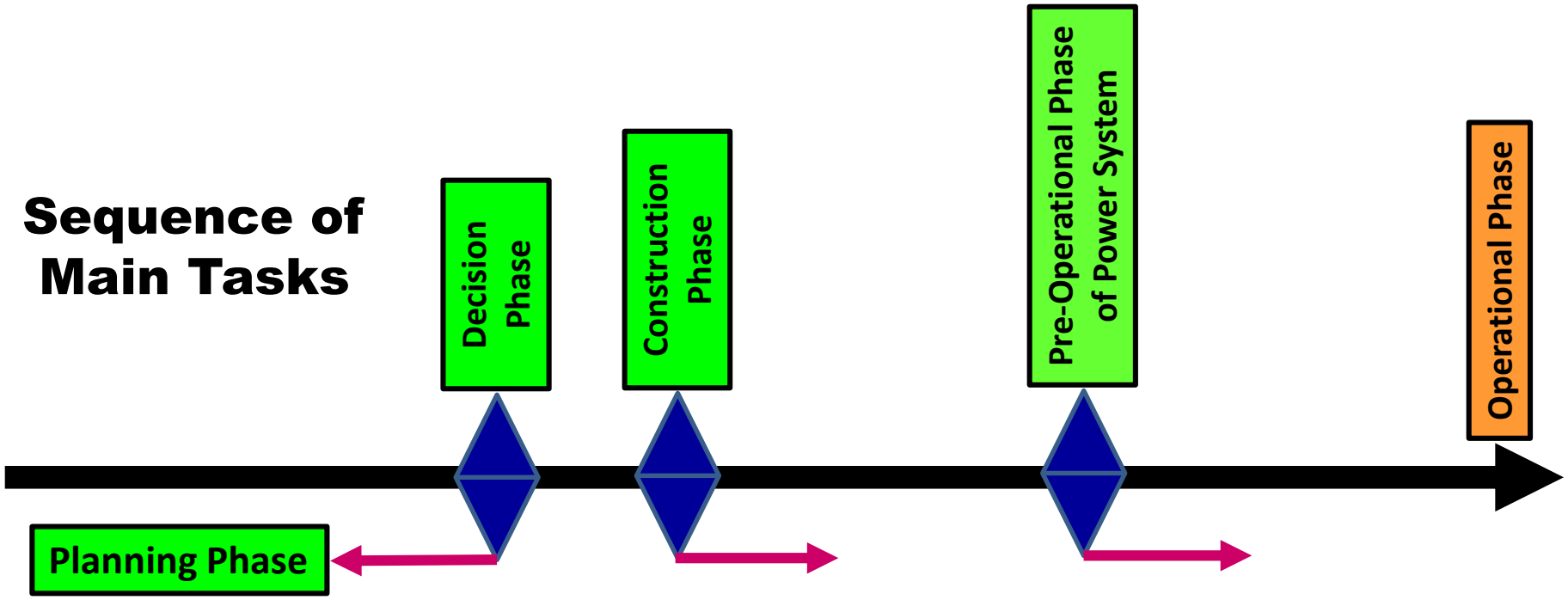
Some Routes to Enhance Energy Security



*) "World Energy Assessment: Energy and the Challenge of Sustainability". UNDP, UN Dept. of Economic & Social Affairs, World Energy Council (WEC).

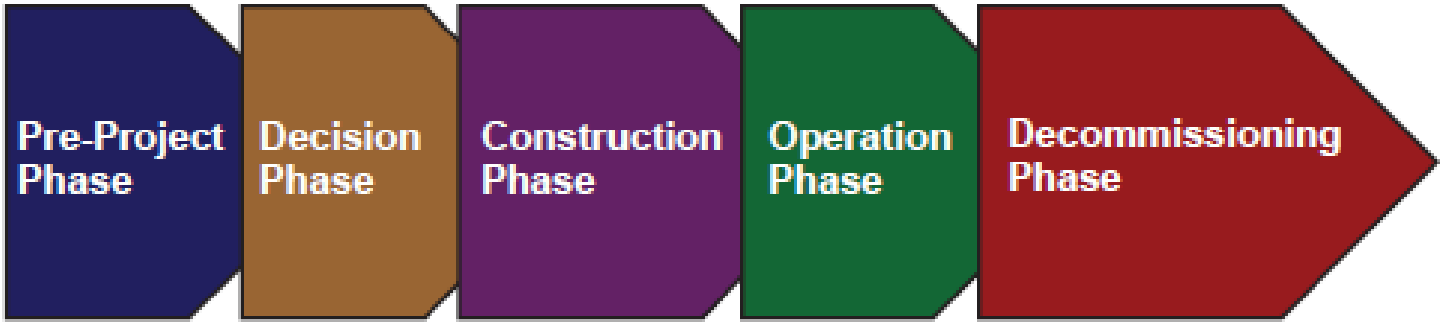
- Sequence of Main Tasks
- System Planning Process
- Pre-Operational & Operational Phase

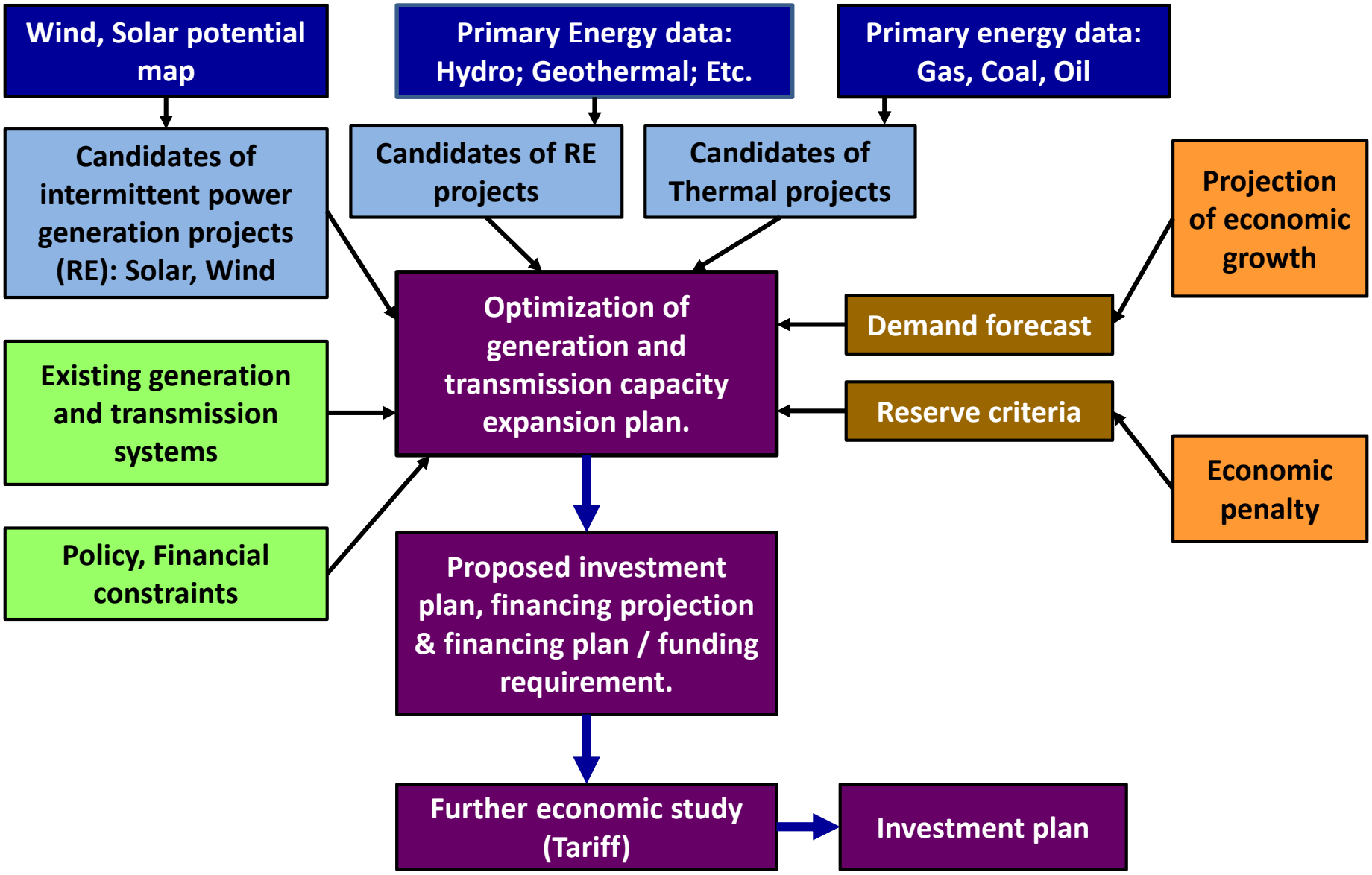
Sequence of Main Tasks



Key Elements of NPP Phase

(Example)

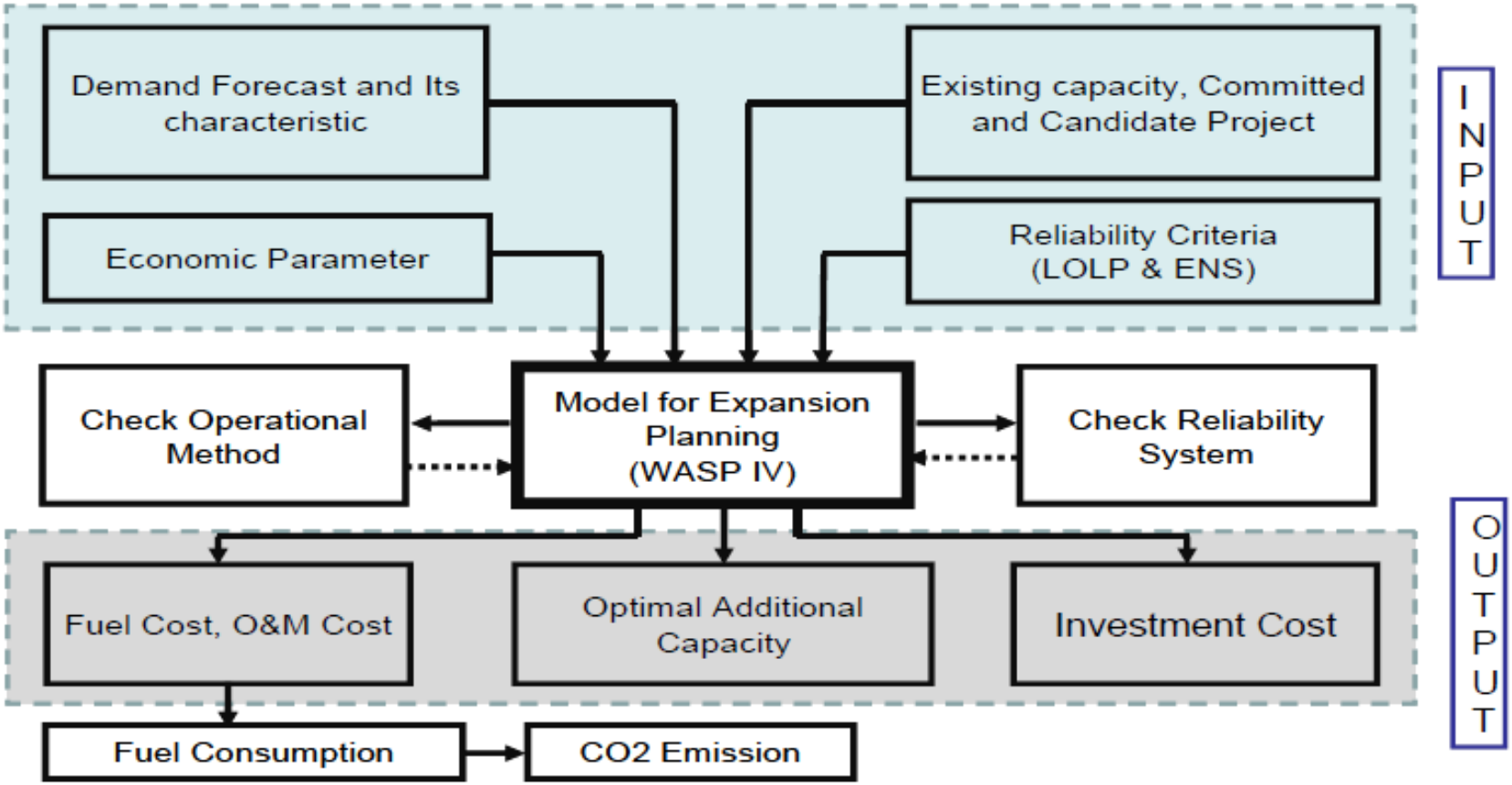


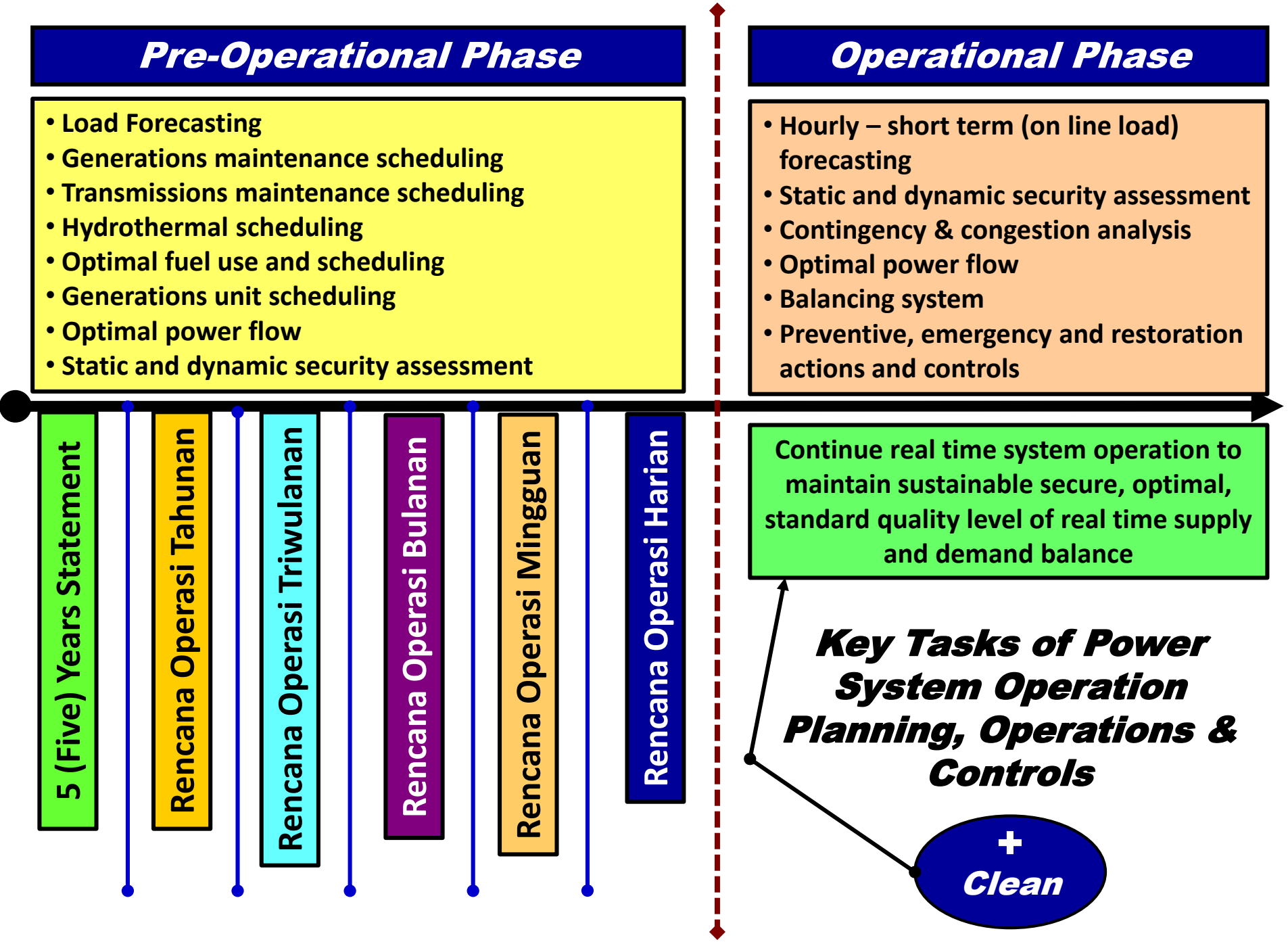


System Planning Process

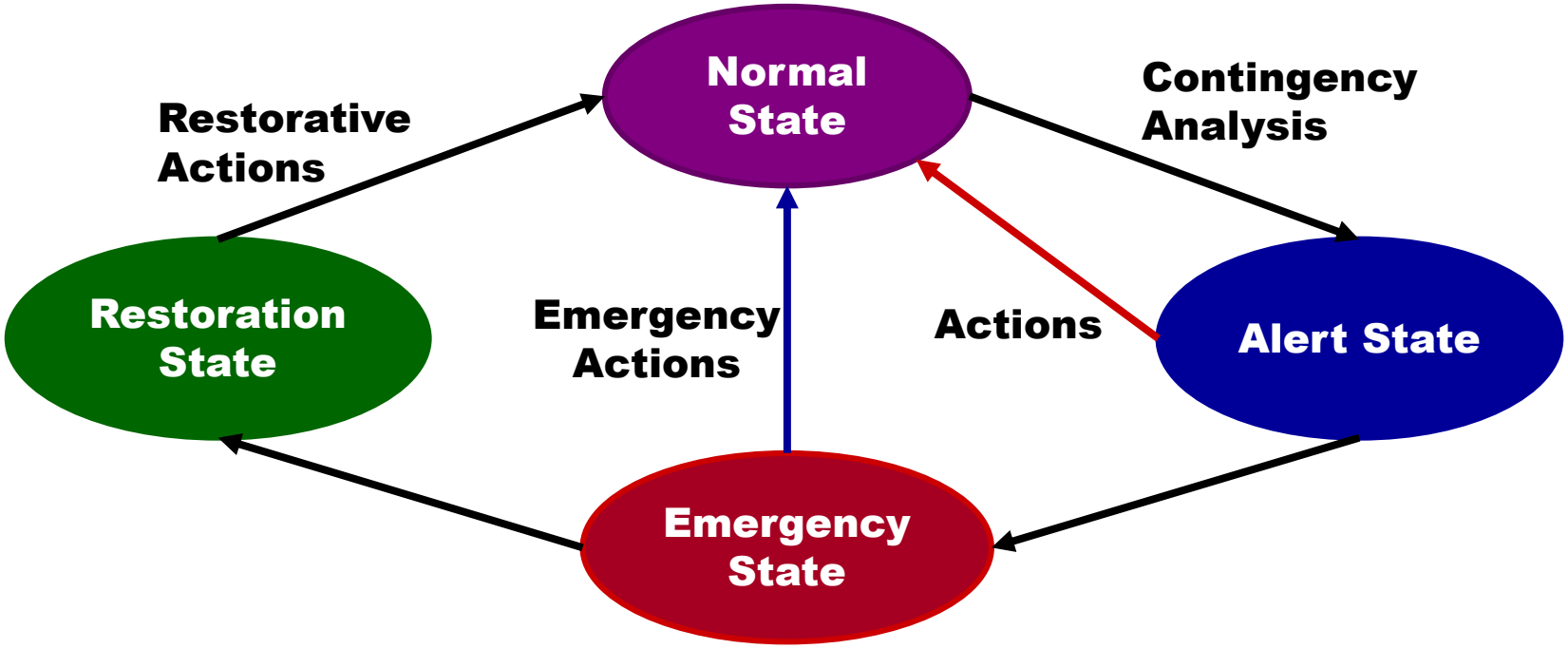
(Example of General Practice)

Input/Output Models for Generation Expansion Planning - WASP




Pre-Operational Phase
• Load Forecasting
• Generations maintenance scheduling
• Transmissions maintenance scheduling
• Hydrothermal scheduling
• Optimal fuel use and scheduling
• Generations unit scheduling
• Optimal power flow
• Static and dynamic security assessment
Operational Phase
• Hourly – short term (on line load) forecasting
• Static and dynamic security assessment
• Contingency & congestion analysis
• Optimal power flow
• Balancing system
• Preventive, emergency and restoration actions and controls
5 (Five) Years Statement
Rencana Operasi Tahunan
Rencana Operasi Triwulanan
Rencana Operasi Bulanan
Rencana Operasi Mingguan
Rencana Operasi Harian
Continue real time system operation to maintain sustainable secure, optimal, standard quality level of real time supply and demand balance
Key Tasks of Power System Operation Planning, Operations & Controls
+
Clean

Principal States of Power System Operation*)



In 1967, DyLiacco*) presented his famous chart which introduced a view of the power system operations in terms of its principal states: (1) Normal, (2) Alert, (3) Emergency, and (4) Restoration, and the transitions spontaneous between theses states. In his framework, the level of the system security is tested with respect to a set of contingencies, and the system state is said to be secure if no contingency would violate the emergency operating constraints.

- **Landasan Hukum RUKN**
- **Kebijakan Energi Nasional**

(Some of Its Key Elements)

Landasan Hukum RUKN

UU No. 30 Tahun 2009 tentang Ketenagalistrikan. Pasal 7

1) RUKN disusun berdasarkan KEN dan ditetapkan oleh Pemerintah setelah berkonsultasi dengan DPR RI.
2) RUKN sebagaimana dimaksud pada ayat (1) disusun dengan mengikut sertakan PEMDA.
3) RUKD disusun berdasarkan pada RUKN dan ditetapkan oleh PEMDA setelah berkonsultasi dengan DPRD.
4) Pedoman penyusunan RUK sebagaimana dimaksud pada ayat (1) dan ayat (3) ditetapkan oleh Menteri.

PP No. 14 Tahun 2012 tentang Kegiatan Usaha Penyediaan Tenaga Listrik, sebagaimana telah diubah dengan PP No. 23 Tahun 2014. Pasal 8

1) Usaha penyediaan tenaga listrik untuk kepentingan umum dilaksanakan sesuai dengan Rencana Umum Ketenagalistrikan dan Rencana Usaha Penyediaan Tenaga Listrik.
2) RUK sebagaimana dimaksud pada ayat (1) meliputi RUKN dan RUKD.
3) RUKN sebagaimana dimaksud pada ayat (2) disusun berdasarkan KEN dan mengikut sertakan PEMDA.
4) Menteri menetapkan RUKN sebagaimana dimaksud pada ayat (3) setelah berkonsultasi dengan DPR RI.

PP No. 62 Tahun 2012 tentang Usaha Jasa Penunjang Tenaga Listrik.

PP No. 79 Tahun 2014 tentang Kebijakan Energi Nasional. Pasal 30.

Kebijakan Energi Nasional
(Some of Its Key Elements)

Pasal 2: Kebijakan energi nasional merupakan kebijakan Pengelolaan Energi yang berdasarkan prinsip berkeadilan, berkelanjutan, dan berwawasan lingkungan guna terciptanya Kemandirian Energi dan Ketahanan Energi nasional.

Pasal 5: Kebijakan energi nasional memberi arah Pengelolaan Kemandirian Energi dan mendukung pembangunan disusun sebagai pedoman untuk Energi nasional guna mewujudkan Ketahanan Energi nasional untuk nasional berkelanjutan.

Pasal 6: Kemandirian Energi dan Ketahanan Energi nasional sebagaimana dimaksud dalam Pasal 5, dicapai dengan mewujudkan: (a) Sumber Daya Energi tidak dijadikan sebagai komoditas ekspor semata tetapi sebagai modal pembangunan nasional; (b) Kemandirian Pengeloiaan Energi; (c) ketersediaan Energi dan terpenuhinya kebutuhan Sumber Energi dalam negeri; (d) pengelolaan Sumber Daya Energi secara optimal, terpadu, dan berkelanjutan; (e) Pemanfaatan Energi secara ehsien di semua sektor; (f) akses untuk masyarakat terhadap Energi secara adil dan merata; (g) pengembangan kemampuan teknologi, lndustri Energi, dan jasa Energi dalam negeri agar mandiri dan meningkatkan kapasitas sumber daya manusia; (h) terciptanya lapangan kerja; dan (i) terjaganya kelestarian fungsi Lingkungan Hidup.

→ Kemandirian Energi adalah terjaminnya ketersediaan Energi dengan memanfaatkan semaksimal mungkin potensi dari sumber dalam negeri. → Ketahanan Energi adalah suatu kondisi terjaminnya ketersediaan Energi dan akses masyarakat terhadap Energi pada harga yang terjangkau dalam jangka panjang dengan tetap memperhatikan perlindungan terhadap Lingkungan Hidup.

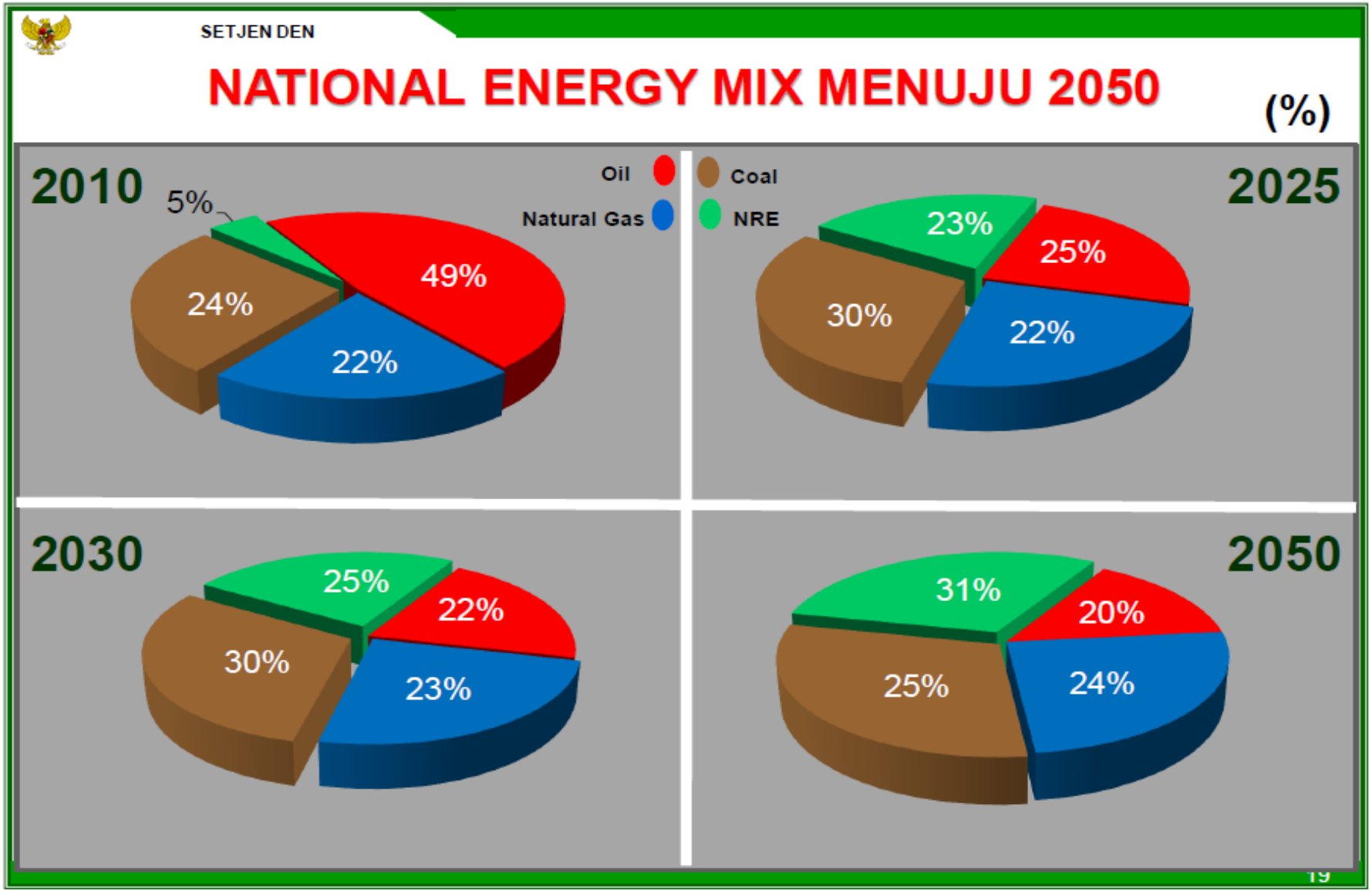
Kebijakan Energi Nasional
(Some of Its Key Elements)

Pasal 11: (1) Prioritas pengembangan Energi dilakukan melalui: (a) pengembangan Energi dengan mempertimbangkan keseimbangan keekonomian Energi, keamanan pasokan Energi, dan pelestarian fungsi Lingkungan Hidup; (b) memprioritaskan Penyediaan Energi bagi Masyarakat yang belum memiliki akses terhadap Energi listrik, gas rumah tangga, dan Energi untuk transporlasi, industri, dan pertanian; (c) pengembangan Energi dengan mengutamakan Sumber Daya Energi setempat; (d) pengembangan Energi dan Sumber Daya Energi diprioritaskan untuk memenuhi kebutuhan energy dalam negeri; dan (e) pengembangan industri dengan kebutuhan Energi yang tinggi diprioritaskan di daerah yang kaya Sumber Daya Energi.

Pasal 11: (2) Untuk mewujudkan keseimbangan keekonomian Energi sebagaimana dimaksud pada ayat (1) hurul a, prioritas pengembangan Energi nasional didasarkan pada prinsip: (a) memaksimalkan penggunaan Energi Terbarukan dengan memperhatikan tingkat keekonomian; (b) meminimalkan penggunaan minyak bumi; (c) mengoptimalkan pemanfaatan gas bumi dan Energi Baru; dan d. menggunakan batubara sebagai andalan pasokan Energi nasional.

Pasal 11: (3) Ketentuan sebagaimana dimaksud pada ayat (2) dikecualikan bagi Energi nuklir yang dimanfaatkan dengan mempertimbangkan keamanan pasokan Energi nasional dalam skala besar, mengurangi emisi karbon dan tetap mendahulukan potensi Energi Baru dan Energi Terbarukan sesuai nilai keekonomiannya, serta mempertimbangkannya sebagai pilihan terakhir dengan memperhatikan factor keselamatan secara ketat.

National Energy Mix up to 2050



Supply of Primary Energy – By Type (%)
(2014 Handbook of Energy & Economic Statistics of Indonesia)

Type of Energy	2000	2001	2002	2003	2004	2005
Oil	41.74	42.42	42.32	40.37	43.52	42.32
Coal	9.42	11.44	11.48	14.58	13.24	14.89
Gas	16.54	16.53	17.65	18.05	16.39	16.39
Hydropower	2.54	2.82	2.34	2.03	2.13	2.32
Geothermal	0.96	0.96	0.96	0.92	0.97	0.94
Biomass	28.80	25.83	25.25	24.05	23.75	23.15
Biofuel	0.00	0.00	0.00	0.00	0.00	0.00

2006	2007	2008	2009	2010[*)]	2011[*)]	2012[*)]	2013
39.24	38.50	38.08	37.28	37.57	38.91	38.08	37.93
17.51	20.97	17.80	18.18	19.84	22.00	24.12	25.44
16.72	14.92	18.70	19.30	19.03	17.23	16.56	15.04
2.06	2.31	2.30	2.20	3.10	2.06	2.06	2.64
0.95	0.93	1.06	1.26	1.08	1.00	0.97	0.94
23.51	22.37	22.03	21.71	19.29	18.64	17.92	17.67
0.01	0.02	0.03	0.06	0.10	0.15	0.29	0.33

Note: **Oil including crude oil, petroleum product and LPG; Coal including coal and briquette; Gas including natural gas and LNG; Biomass including firewood and charcoal; Biofuel : pure bio energy (not blending product).**

Potential of Renewable Energy - Indonesia

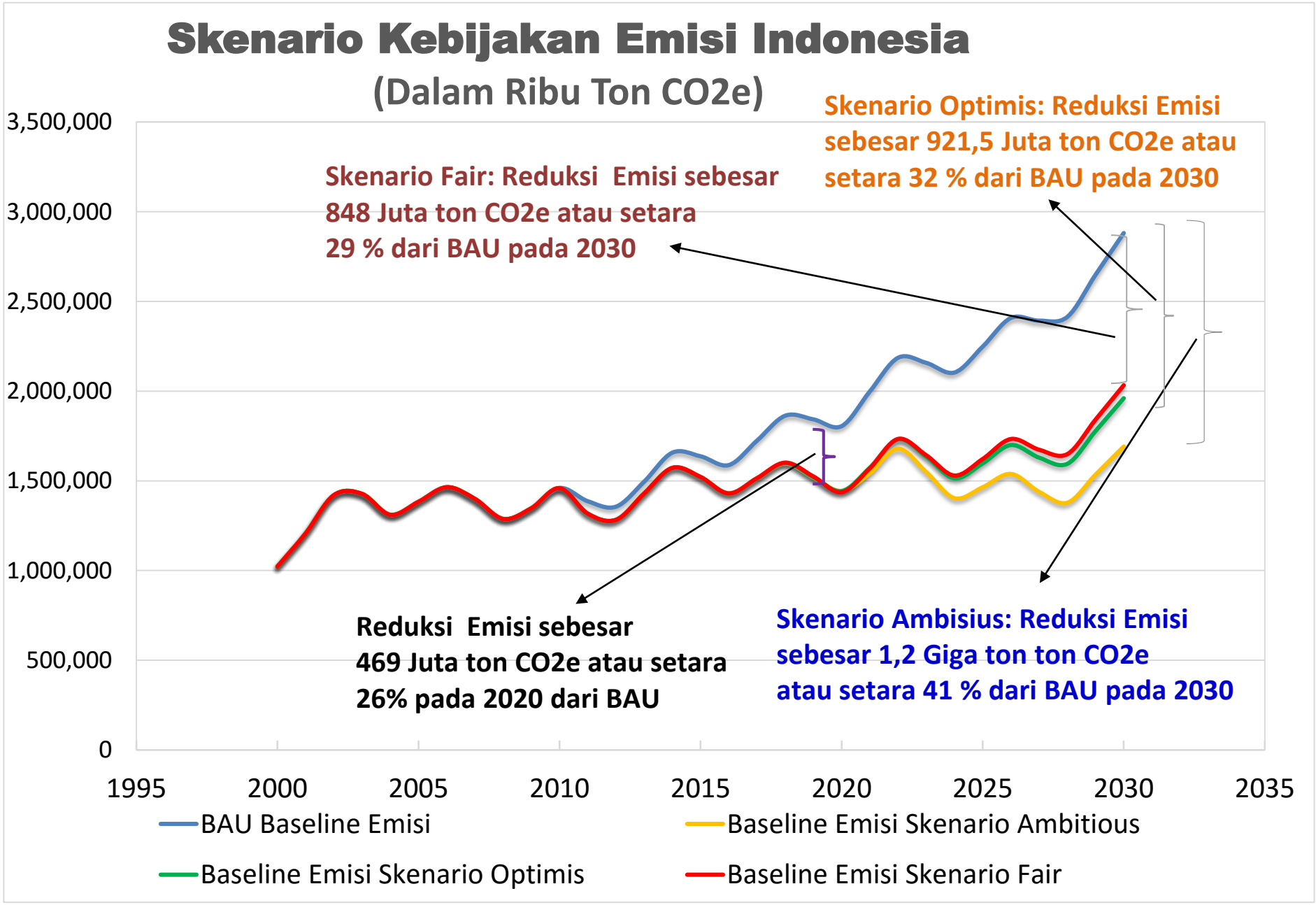
Energy Type	Hydro	Geothermal	Biomass	Solar Energy	Wind	ORE
Potential	75 GW	29 GW	50 GW	4.8 kWh/m^2/day	3-6 m/s	49 GW
Installed Capacity	6.8 GW	1.3 GW	1.6 GW	27 MW	1.4 MW	0.01 MW

Ref.: Deputi Bidang Koordinasi ESDM, "Pencapaian Bauran Energi (Perpres No.5/2006) dan Target Bauran Energy KEN 2050", 21 August 2014. Jakarta.

Emisi GRK Indonesia 2000-2030 berdasarkan Skenario Fair, Optimis dan Ambisius

(Reference: Proses Kaji Ulang RAN-GRK dan Penyusunan INDC, BAPPENAS)

Kementerian PPN/ Bappenas

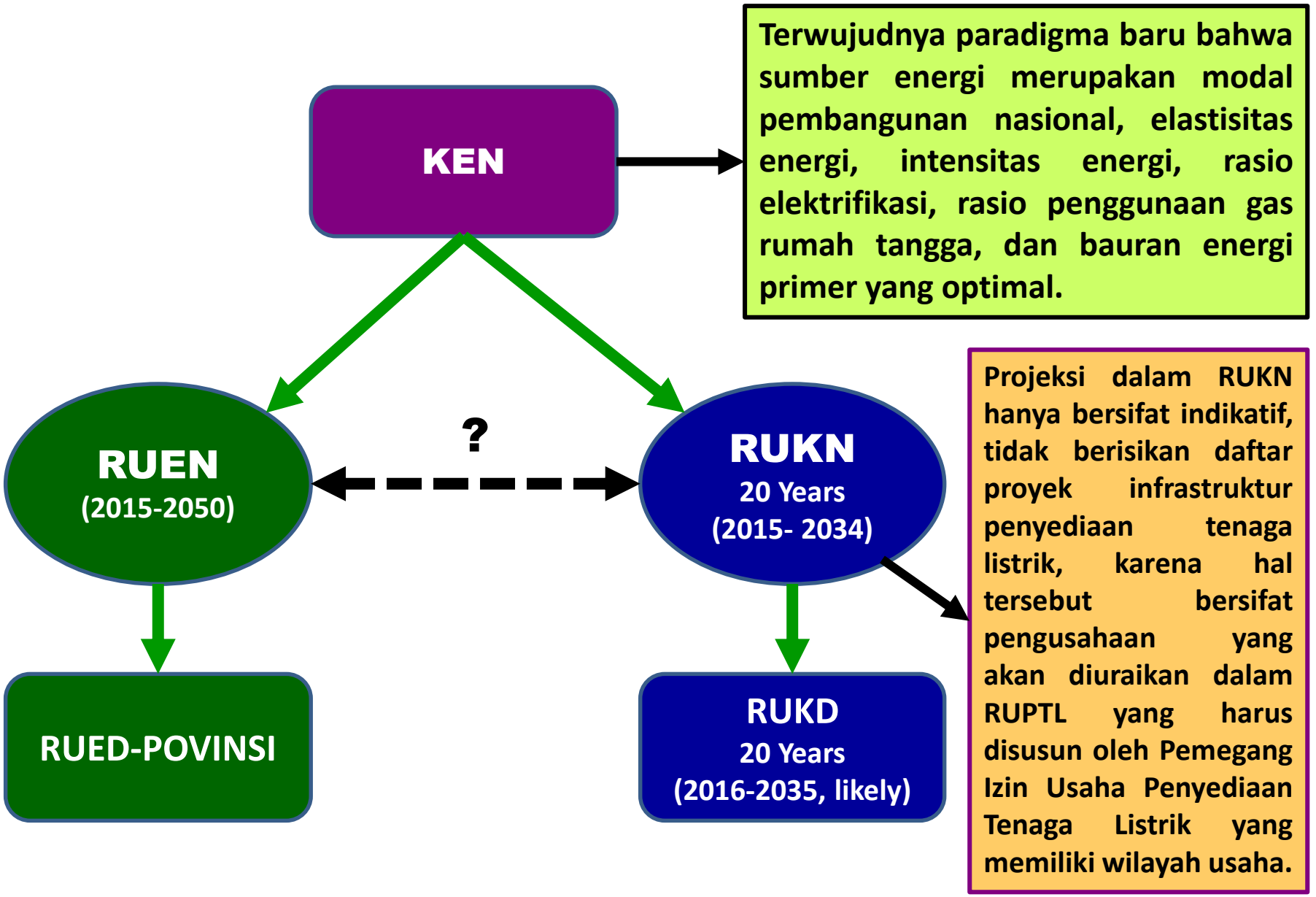

Skenario Kebijakan Emisi Indonesia
(Dalam Ribu Ton CO2e)
Skenario Optimis: Reduksi Emisi sebesar 921,5 Juta ton CO2e atau setara 32 % dari BAU pada 2030
Skenario Fair: Reduksi Emisi sebesar 848 Juta ton CO2e atau setara 29 % dari BAU pada 2030
Reduksi Emisi sebesar 469 Juta ton CO2e atau setara 26% pada 2020 dari BAU
Skenario Ambisius: Reduksi Emisi sebesar 1,2 Giga ton ton CO2e atau setara 41 % dari BAU pada 2030
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1995
2000
2005
2010
2015
2020
2025
2030
2035
BAU Baseline Emisi
Baseline Emisi Skenario Ambitious
Baseline Emisi Skenario Optimis
Baseline Emisi Skenario Fair

Penurunan Emisi di Tahun 2030

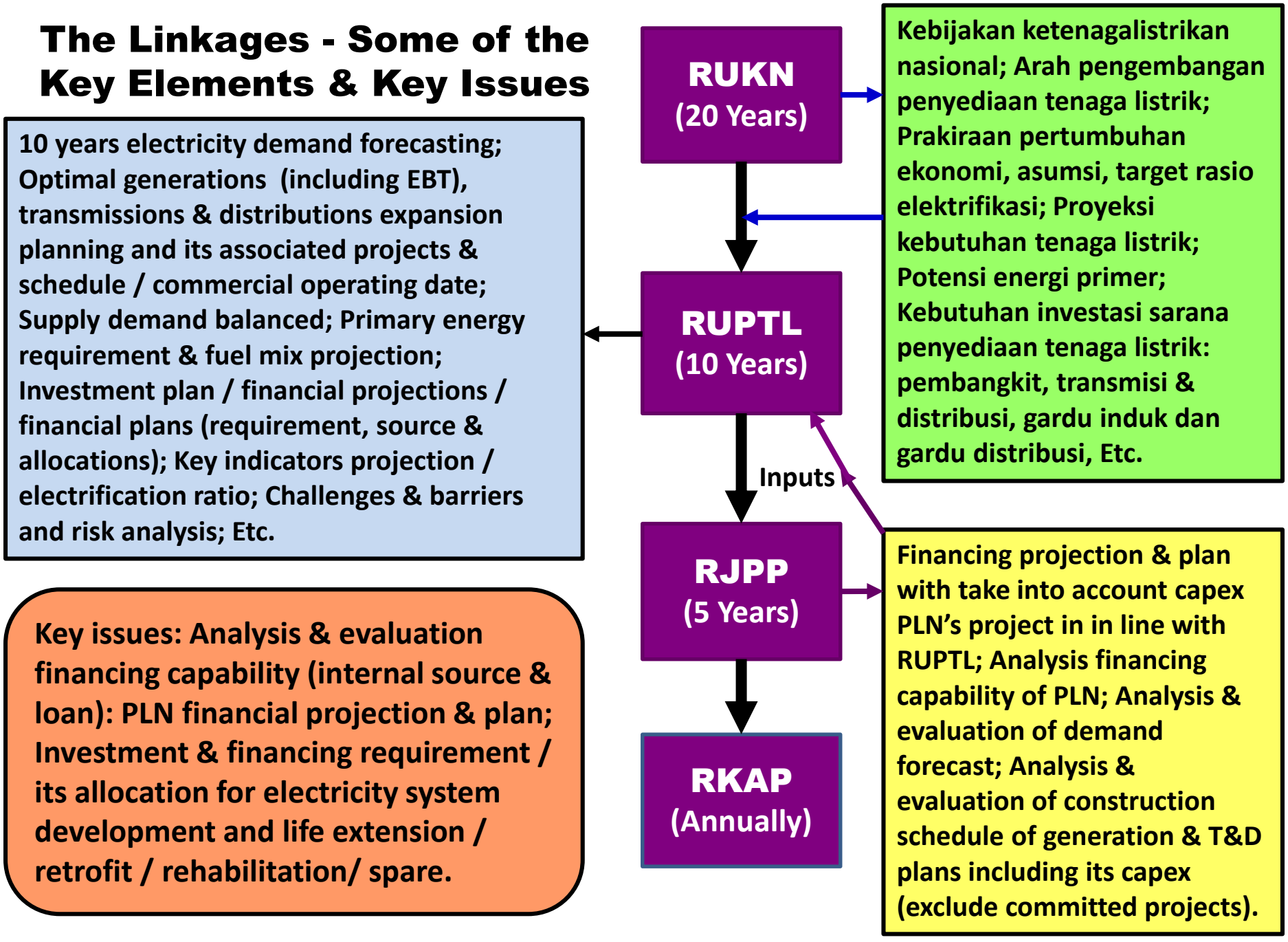
		BAU	Ambisius	Optimist	Fair
Hutan, Lahan dan Gambut	Emisi (ribu ton)	**1.073.835**	**323.553**	**446.818**	**477.811**
	Penurunan Emisi (ribu ton)		**750.282**	**627.017**	**596.023**
	% Penurunan Emisi		**70%**	**58%**	**56%**
Energi	Emisi (ribu ton)	**1.444.679**	**1.051.706**	**1.186.967**	**1.223.050**
	Penurunan Emisi		**392.973**	**257.712**	**221.629**
	% Penurunan Emisi		**27%**	**18%**	**15%**
IPPU	Emisi (ribu ton)	**78.206**	**76.091**	**77.027**	**77.183**
	Penurunan Emisi (ribu ton)		**2.116**	**1.180**	**1.023**
	% Penurunan Emisi		**3%**	**2%**	**1%**
Waste	Emisi (ribu ton)	**284.664**	**239.184**	**249.010**	**254.822**
	Penurunan Emisi (ribu ton)		**45.480**	**35.654**	**29.842**
	% Penurunan Emisi		**16%**	**13%**	**10%**
TOTAL	Emisi (ribu ton)	**2.881.385**	**1.690.534**	**1.959.822**	**2.032.867**
	Penurunan Emisi (ribu ton)		**1.190.850**	**921.562**	**848.517**
	% Penurunan Emisi		**41%**	**32%**	**29%**

The Linkages

The Linkages



The Linkages - Some of the Key Elements & Key Issues



Need Further Elaboration

Need Further Elaboration of Some Important Issues

Issues	Need Further Elaboration
Pemenuhan kebutuhan tenaga listrik di pulau-pulau terluar (daerah terpencil) dalam rangka mendukung program pengembangan listrik perdesaan sehingga seluruh lapisan masyarakat mendapat akses listrik dengan memanfaatkan potensi EBT, misalnya ocean renewable energy (ORE). Smart grid teknologi dapat dipergunakan dalam memanfaatkan potensi EBT, dan to maintain sustainable secure, optimal, standard quality level of real time supply and demand balanced.	Terutama untuk off-grid system perlu ditentukan business model yang akan di-aplikasikan. Terlebih dahulu perlu dibuat assessments to ensure undistorted price signal: its cost effectiveness & its implementability level of its associated technologies including its challenges & barriers, land arrangement, grid access, environmental impact, economic & social development: job creation, poverty reduction, power purchase agreement, etc.
Harga jual dan sewa jaringan tenaga listrik.	Perlu ditentukan lebih lanjut approach & methodology of transmission pricing yang akan digunakan, such as, ▪ Embedded-cost-based approaches: Postage stamp method, Contract path method, Distanced based MW-mile method, Power flow based MW-mile method. ▪ Marginal-cost-based approaches: Short-run marginal cost pricing method, Long-run marginal cost pricing method.

Need Further Elaboration of Some Important Issues

Issues	Need Further Elaboration
Jual beli tenaga listrik lintas negara (ex. Direct interconnection from power plant to other country network).	Who will manage its CO_2 emissions, and who will be responsible.
Kebijakan lingkungan di sektor Ketenagalistrikan diarahkan untuk mendukung mitigasi perubahan iklim, part of global coherent action) guna mencapai dengan national emissions reduction target, dimana Indonesia INDC sudah di-submit pada bulan September 2015.	Particularly for power sector deep decarbonization is strongly required. Some key actions will be needed: ▪ Planning for a low-carbon future: zero-carbon and low-carbon energy technologies pathways, greater role of energy efficiency & conservation from up-stream to down-stream, and move the energy system towards using low carbon energy sources to improve national energy mix. ▪ Establish long-term deep decarbonization roadmap in line with the planning of low-carbon future. ▪ Regulation and standards to secure long-term national low-emissions path and climate-resilient development, for instance to limit emissions from new fossil power plants: in U.S., for a new coal plants 500 Kg CO_2 per MWh.

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KOMITE NASIONAL INDONESIA

To promote the sustainable supply and use of energy for the greatest benefit of all people.

Terima Kasih