

WEF Experiences and Best Practices from ASEAN and East Asia

Venkatachalam Anbumozhi

E: v.anbumozhi@eria.org

T: +62.811.910.6874

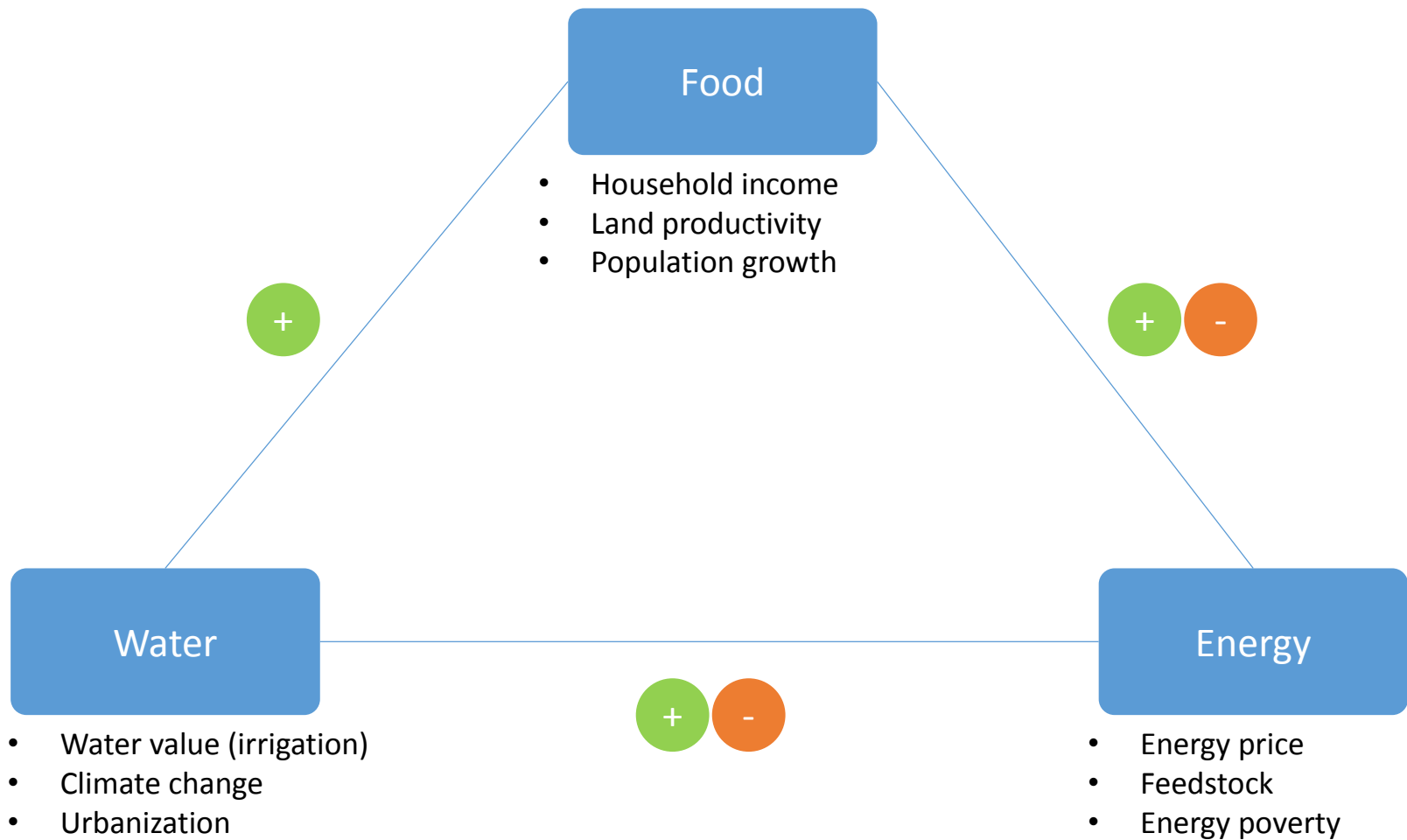
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Key Questions

- What do we know about the complex pervasive inter-connectedness of Water-Food- Energy nexus?
- Where do we see the most promising pathways and actionable items in the near future for policy considerations?
- What are the critical issues for dealing the WEF challenges through SDGs?

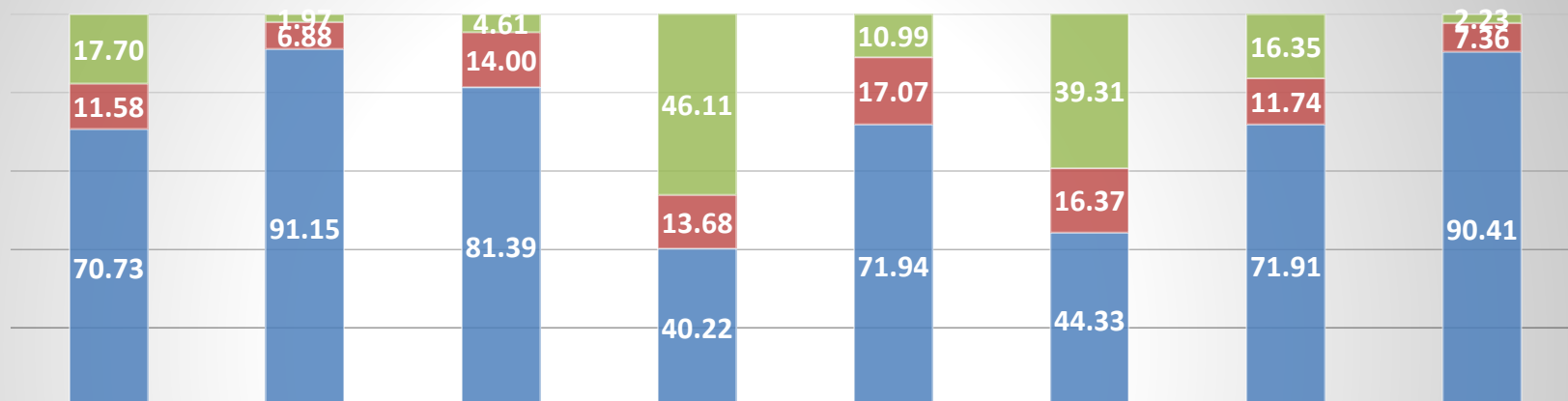


| | Energy – water | Water – food | Food – energy |
|-------------|----------------|--------------|---------------|
| Economic | - | + | + |
| Environment | + | + | + - |
| Social | + | + | + |

Interdependency between Water, Energy and Food Security

| Use/Production | Energy Production | Water Production | Food Production |
|----------------------|---|---|--|
| Energy Use | <ul style="list-style-type: none"> • Losses • Internal Use • Etc. | <ul style="list-style-type: none"> • Pumping • Treatment • Transportation • Heating • Etc. | <ul style="list-style-type: none"> • Tillage • Fertilizer • Processing • Transport • Storage Etc. |
| Water Use | <ul style="list-style-type: none"> • Thermoelectric cooling • Hydropower • Bio-energy • Extraction and mining • Fuel Production (H2, ethanol, biofuels) • Emission controls • Etc. | <ul style="list-style-type: none"> • Losses • Internal Use • Etc. | <ul style="list-style-type: none"> • Irrigation • Food Processing • Preservation • Etc. |
| Food and By-products | <ul style="list-style-type: none"> • Biofuel | <ul style="list-style-type: none"> • Ground Recharge • Water quality etc. | <ul style="list-style-type: none"> • Self-consumption • Seed • Fertilizer etc. |

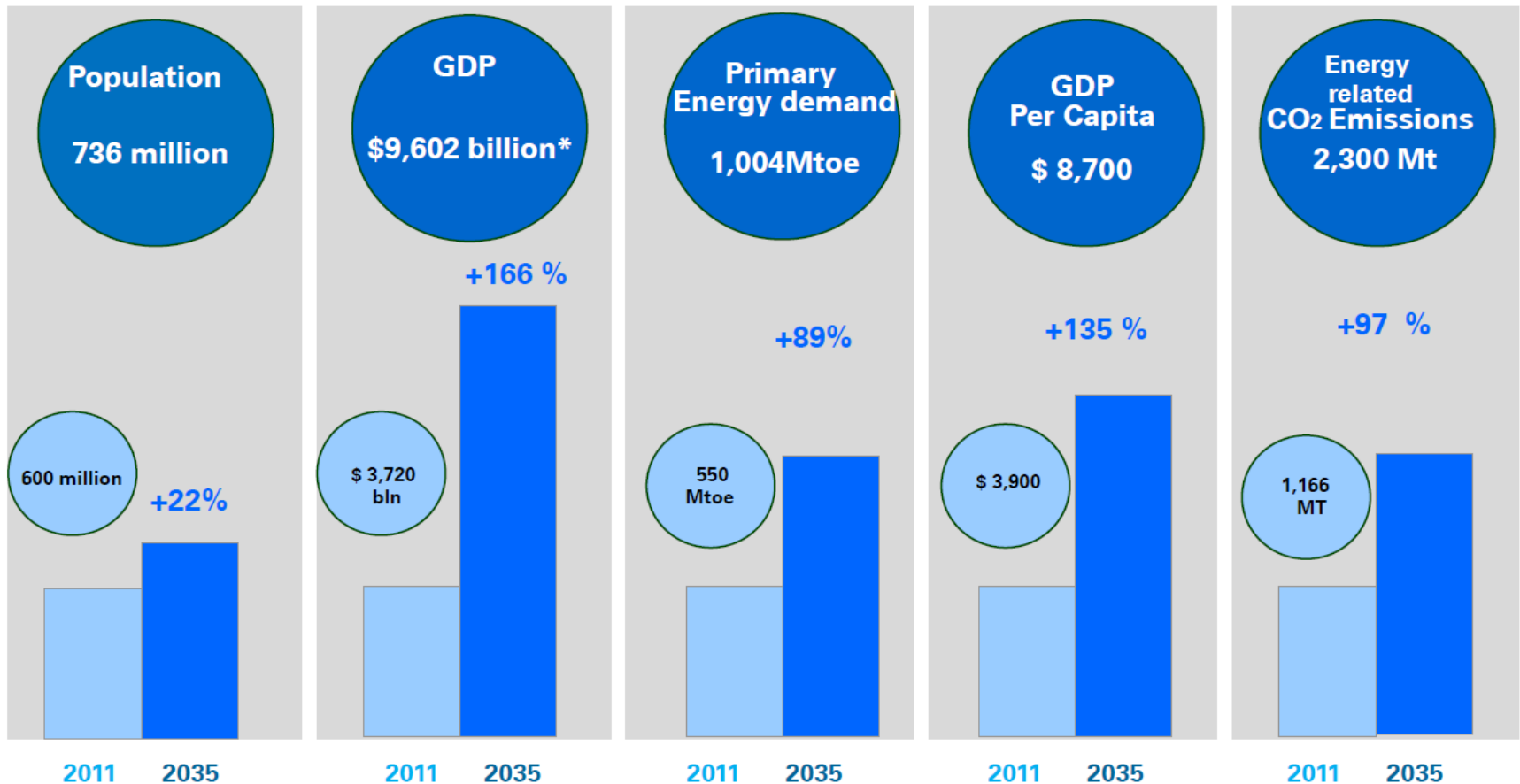
Distribution of Fresh water withdrawal across the sectors



| | World | South Asia | Sub-Saharan Africa (all income levels) | North America | Latin America & Caribbean (all income levels) | Europe & Central Asia (all income levels) | East Asia & Pacific (all income levels) | India |
|-------------|-------|------------|--|---------------|---|---|---|-------|
| Industry | 17.70 | 1.97 | 4.61 | 46.11 | 10.99 | 39.31 | 16.35 | 2.23 |
| Domestic | 11.58 | 6.88 | 14.00 | 13.68 | 17.07 | 16.37 | 11.74 | 7.36 |
| Agriculture | 70.73 | 91.15 | 81.39 | 40.22 | 71.94 | 44.33 | 71.91 | 90.41 |

■ Agriculture ■ Domestic ■ Industry

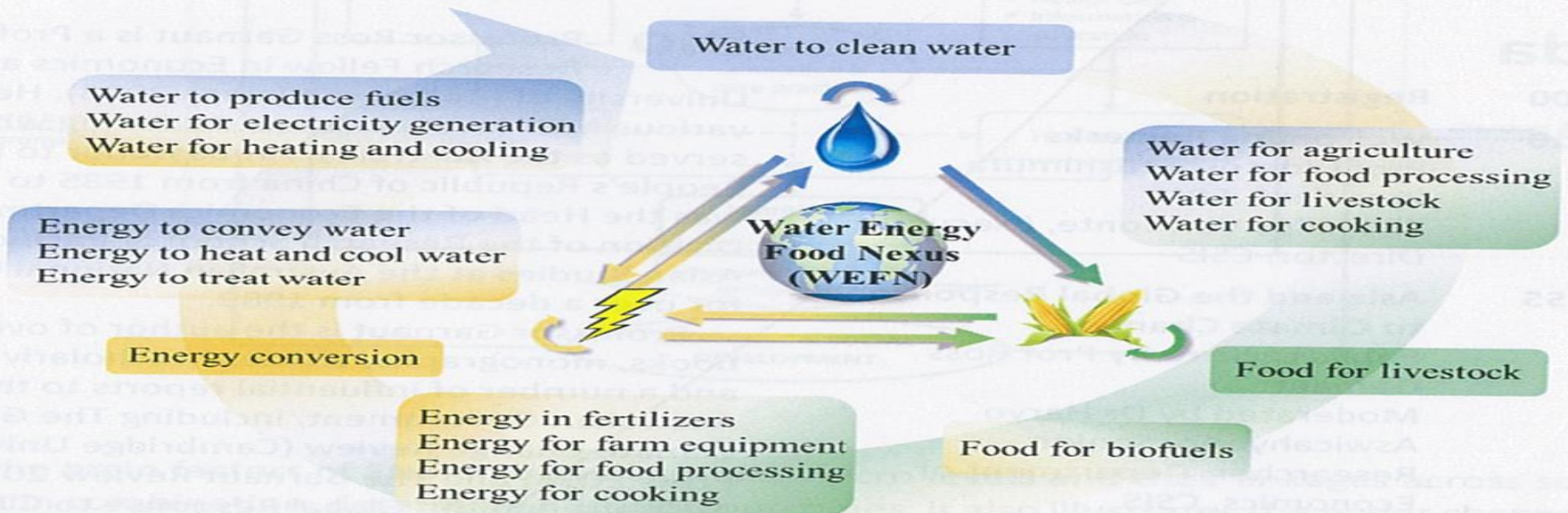
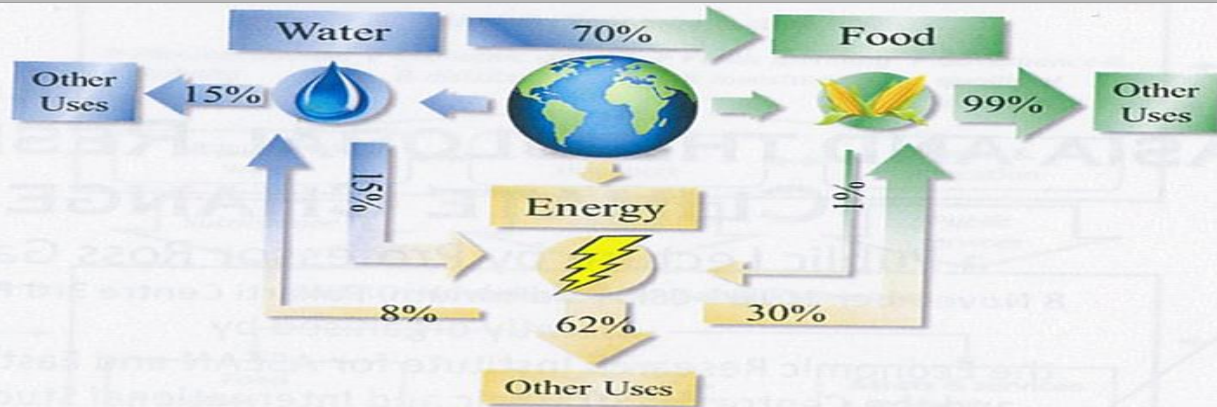
Present and Future Energy Use in ASEAN



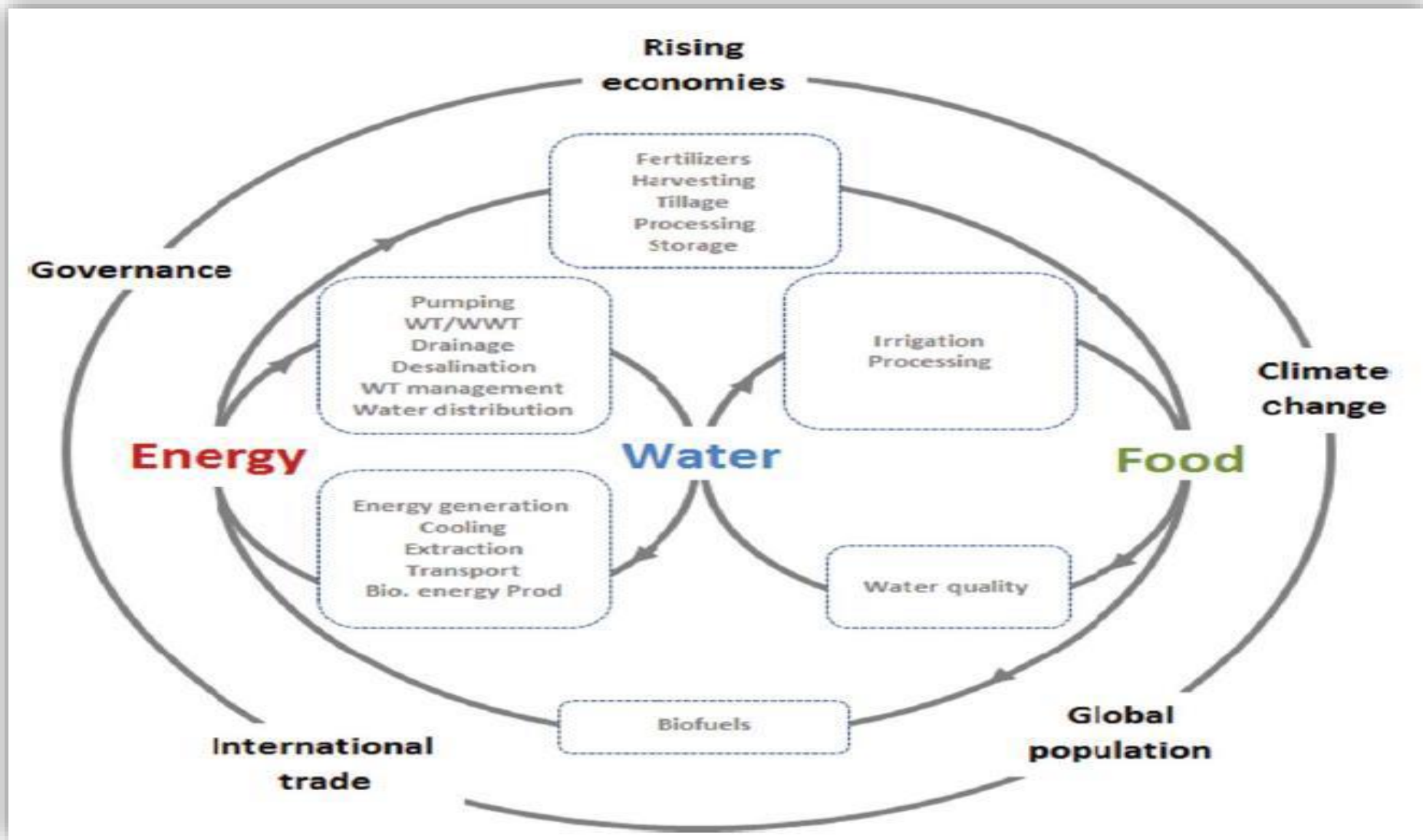
ASEAN Rice Balance Sheet in 2010 (tons)

| Country | Initial stocks | Production | Domestic utilization | Imports | Exports |
|--------------------------|----------------|-------------|----------------------|-----------|------------|
| Brunei Darussalam | 15,505 | 869 | 33,797 | 32,294 | 0 |
| Cambodia | 128,000 | 4,590,000 | 2,927,000 | 0 | 1,471,000 |
| Indonesia | 1,172,435 | 40,346,922 | 38,433,251 | 186,438 | 2,897 |
| Lao PDR | 30,169 | 1,820,750 | 1,764,642 | n.a. | n.a. |
| Malaysia | 275,899 | 1,585,708 | 2,531,159 | 1,094,419 | n.a. |
| Myanmar | 4,345,208 | 20,196,456 | 19,157,000 | 0 | 667,000 |
| Philippines | 2,638,287 | 10,737,201 | 13,163,706 | 1,638,314 | 159 |
| Singapore | 55,000 | n.a. | 262,000 | 280,000 | 33,000 |
| Thailand | 6,251,800 | 20,899,417 | 11,267,000 | 0 | 8,500,000 |
| Viet Nam | 5,680,101 | 25,282,075 | 18,327,996 | 0 | 5,950,000 |
| ASEAN | 20,592,404 | 125,449,397 | 107,867,551 | 3,231,465 | 16,624,056 |

A summary of the WEF Nexus in ASEAN Context

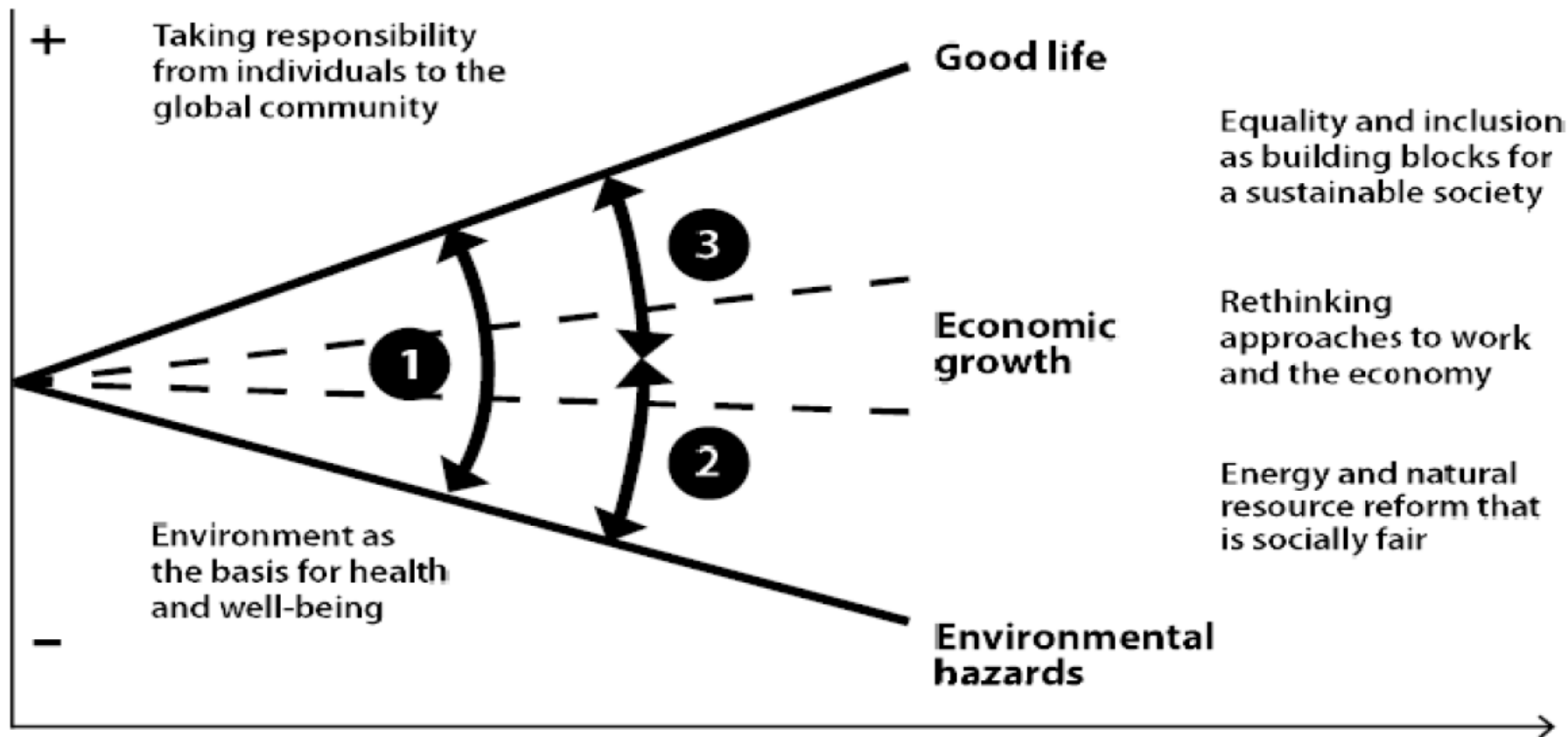


WATER-ENERGY-FOOD NEXUS WITH EFFECTING INTERNAL AND EXTERNAL PARAMETERS

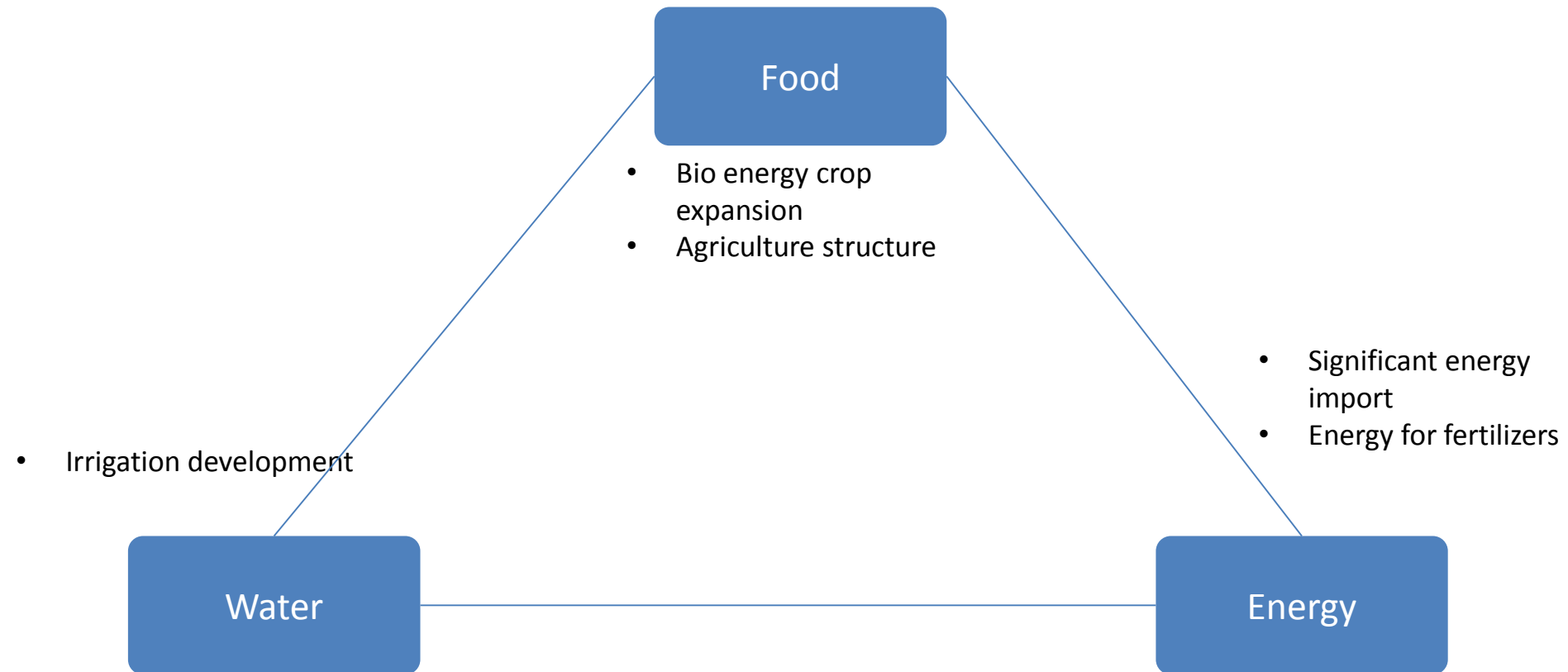


Sustainable Development through WEF Nexus from ASEAN perspective

Key focus areas of sustainable development



Case 1: Key WEF nexus issues for Thailand



Opportunities to improve water, energy and food security

- Thailand's economy is growing but energy production is not sufficient to meet the domestic demand.
- In Lao PDR, the domestic need for energy is relatively low and large scale hydroelectric dams are built to generate revenue by exporting electricity to Thailand. Energy from hydropower in Lao PDR is cheap.
- It provides opportunities for Thailand to maintain a good performance in food production.

Cross-Border Power Grid Interconnection and Energy Trade



| Route | Interconnection line construction cost | | Net benefit (gross benefit - line cost) | | Benefit/Cost ratio |
|-----------------|--|---------|---|---------|--------------------|
| | Mil. USD | US¢/kWh | Mil. USD | US¢/kWh | |
| THA-LAO | 1,400 | 0.25 | 19,881 | 3.51 | 14.2 |
| VNM-LAO-THA | 1,950 | 0.29 | 22,610 | 3.36 | 11.6 |
| LAO-THA-MYS-SGP | 1,860 | 0.26 | 25,490 | 3.60 | 13.7 |

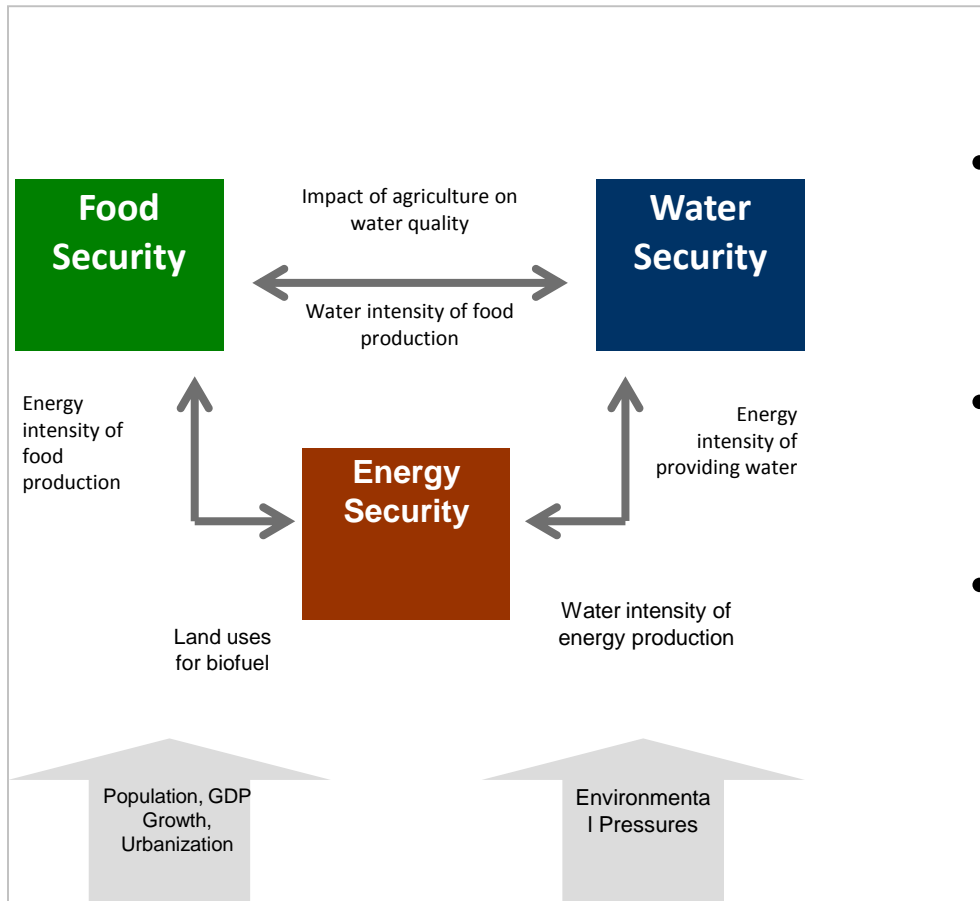
Why Regional Power-grid Connectivity a game Changer for meeting the WEF nexus?

- Social and environmental benefits coming from economies of scale
- Locational factors that favor cross-border connectivity
- Better management of water-energy-food
- Lower electricity and food price for consumers

Regional Power Grid Interconnection; Close to Reality?

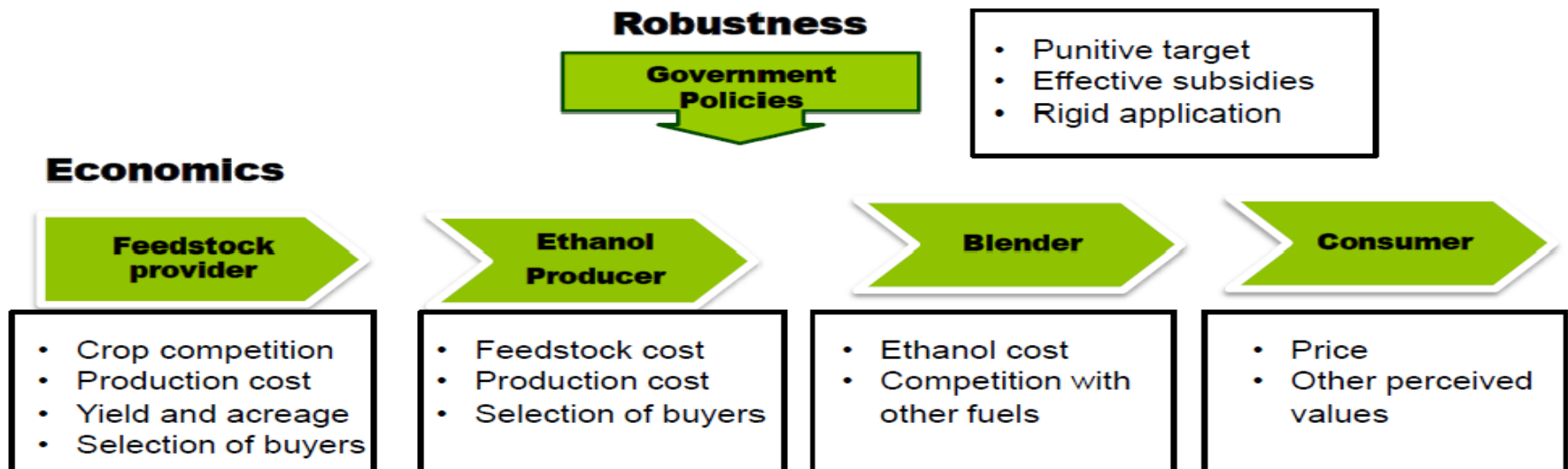
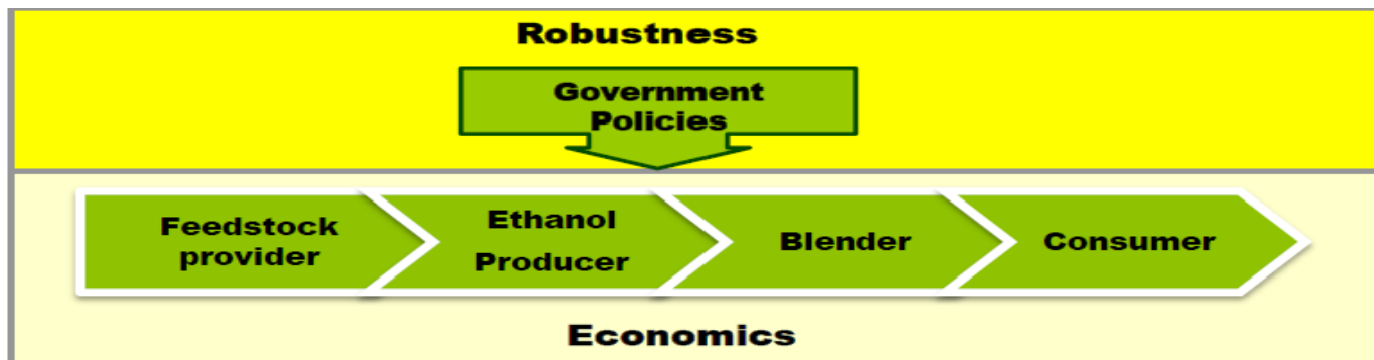
- Currently 11 cross border interconnections with capacity of 3,489 MW
- 10 projects with capacity of 7,192 MW ongoing and expected completion 2018/2019
- Beyond 2020, at least 17 cross border interconnections with power capacity of 25,424 MW
- Pilot: Lao-Thailand-Malaysia-Singapore

Case 2: Bio-fuel and Food Security Nexus in Indonesia



- Crop based bio-fuels are considered as most promising source of renewable and sustainable energy
- The crop based bio-fuel production has direct impact on water, energy and food security
- Clear understanding of sustainability issues could result in better agricultural practices, industrial output and improve the bottom lines.

Do-ability of Bio-fuel Production: Policies

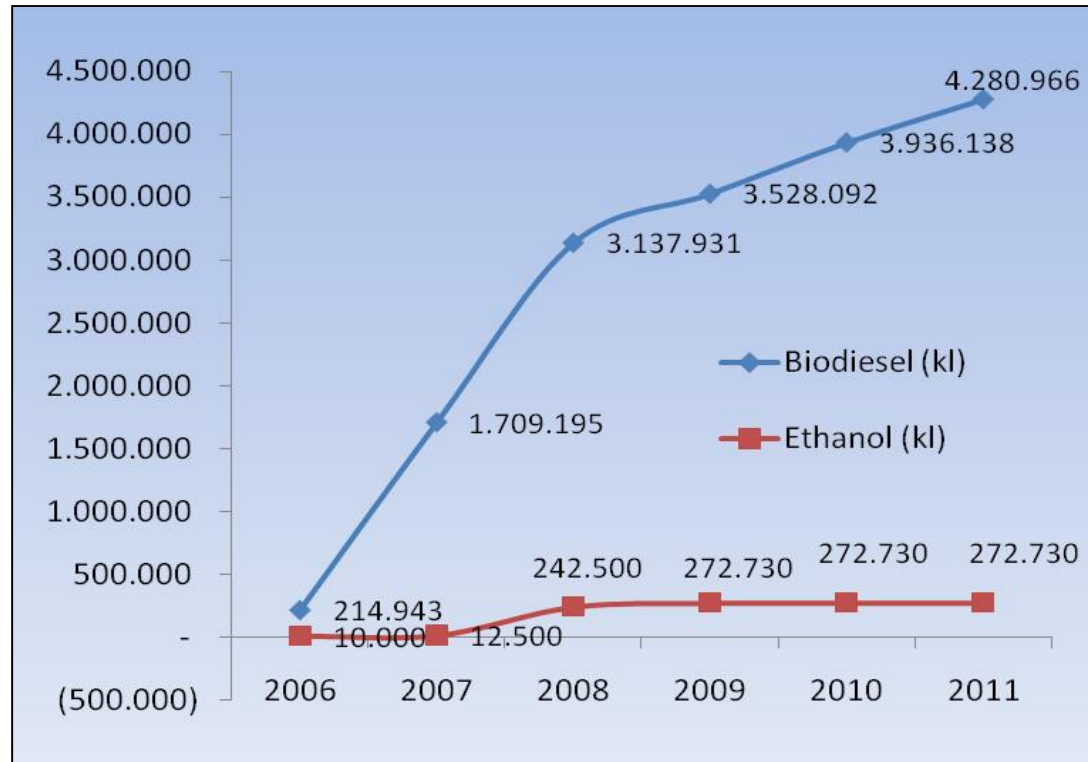


Resultant Biofuel Business Development in Indonesia

Biofuels Producers

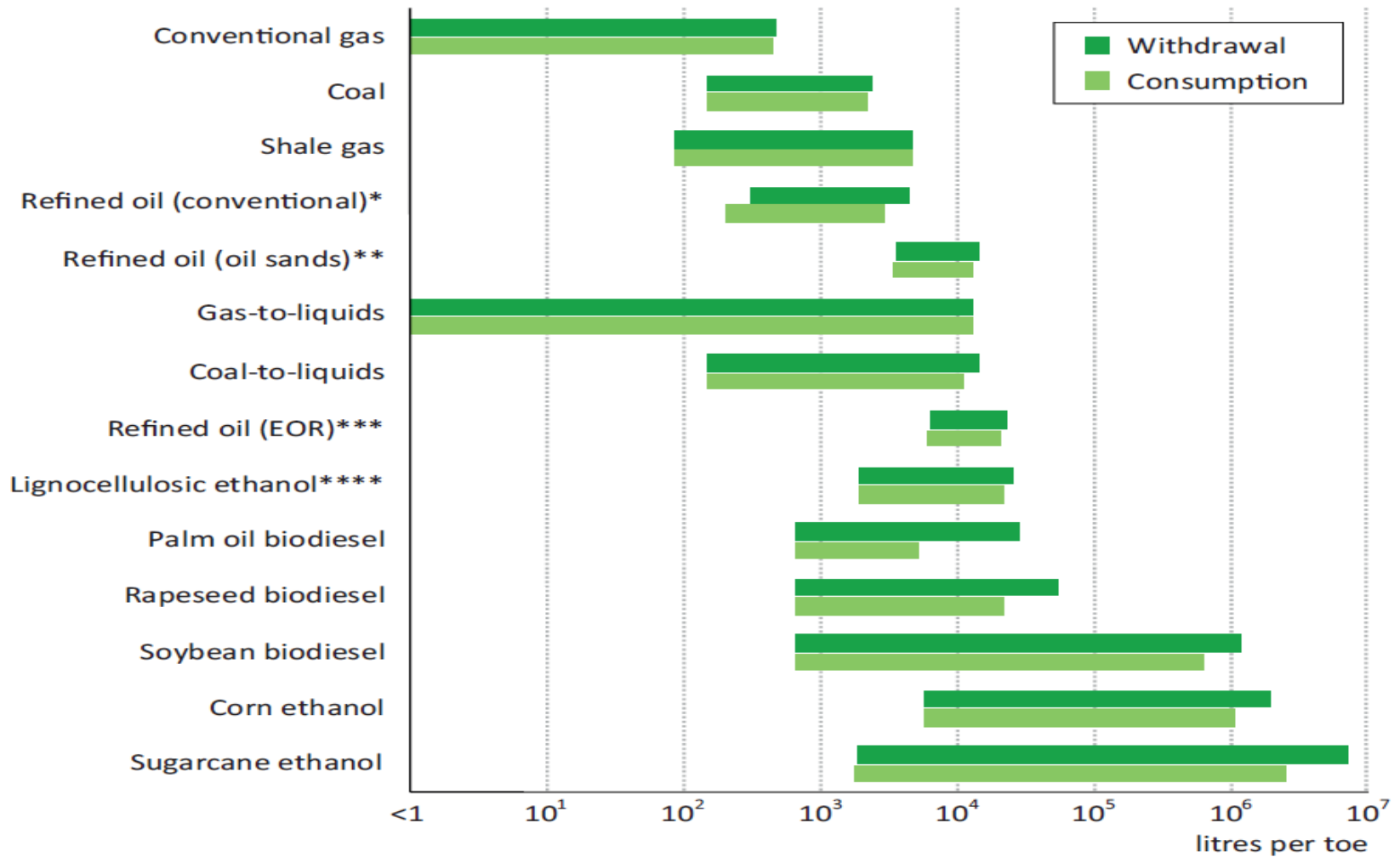
- Biodiesel
 - 23 Producers
 - Raw Materials: Palm Oil
- Ethanol
 - 13 Producers
 - Raw Materials: Molasses, Cassava

Installed Capacity (kl)

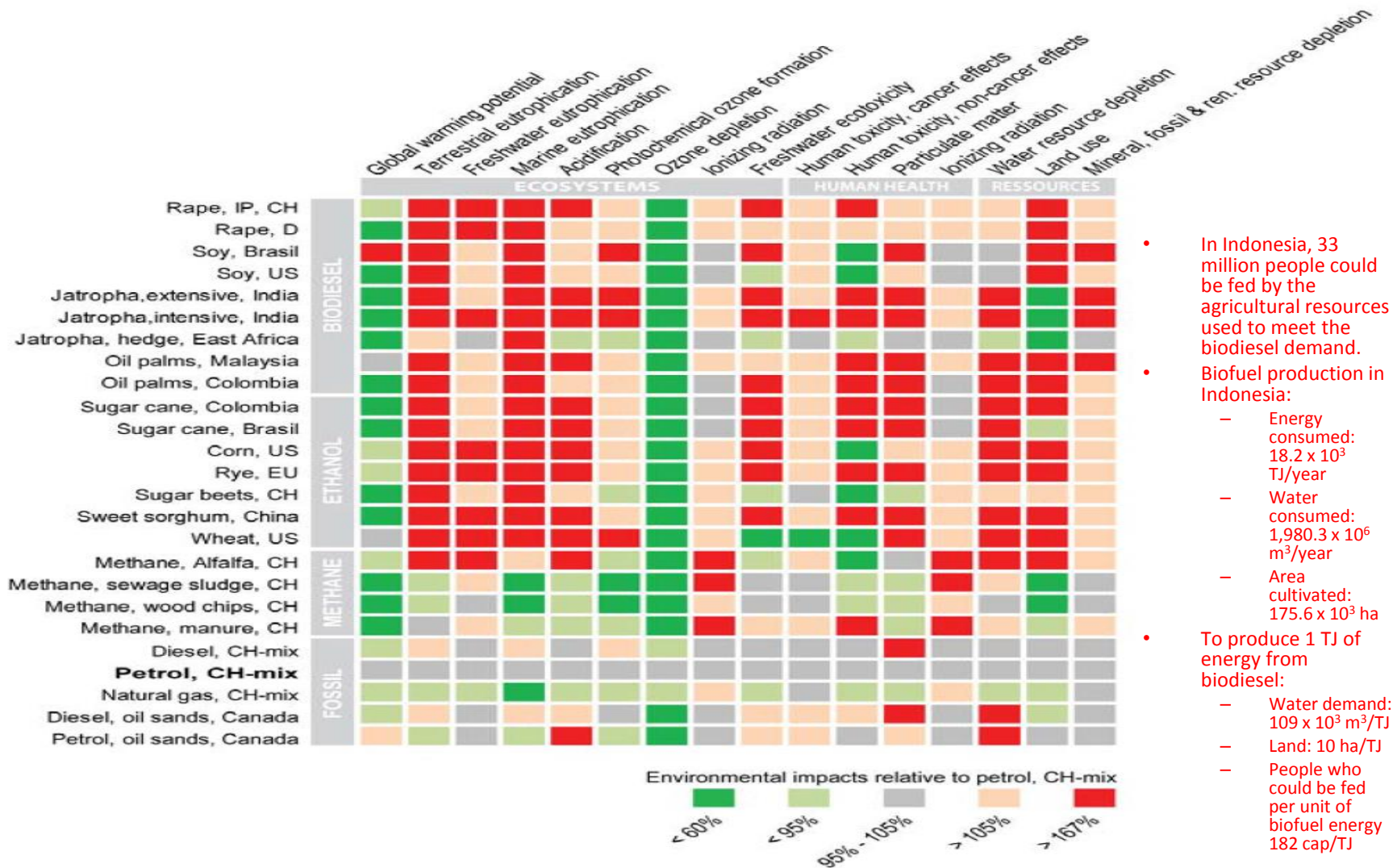


Source, APROBI,(2012)

Water Use in Energy Production

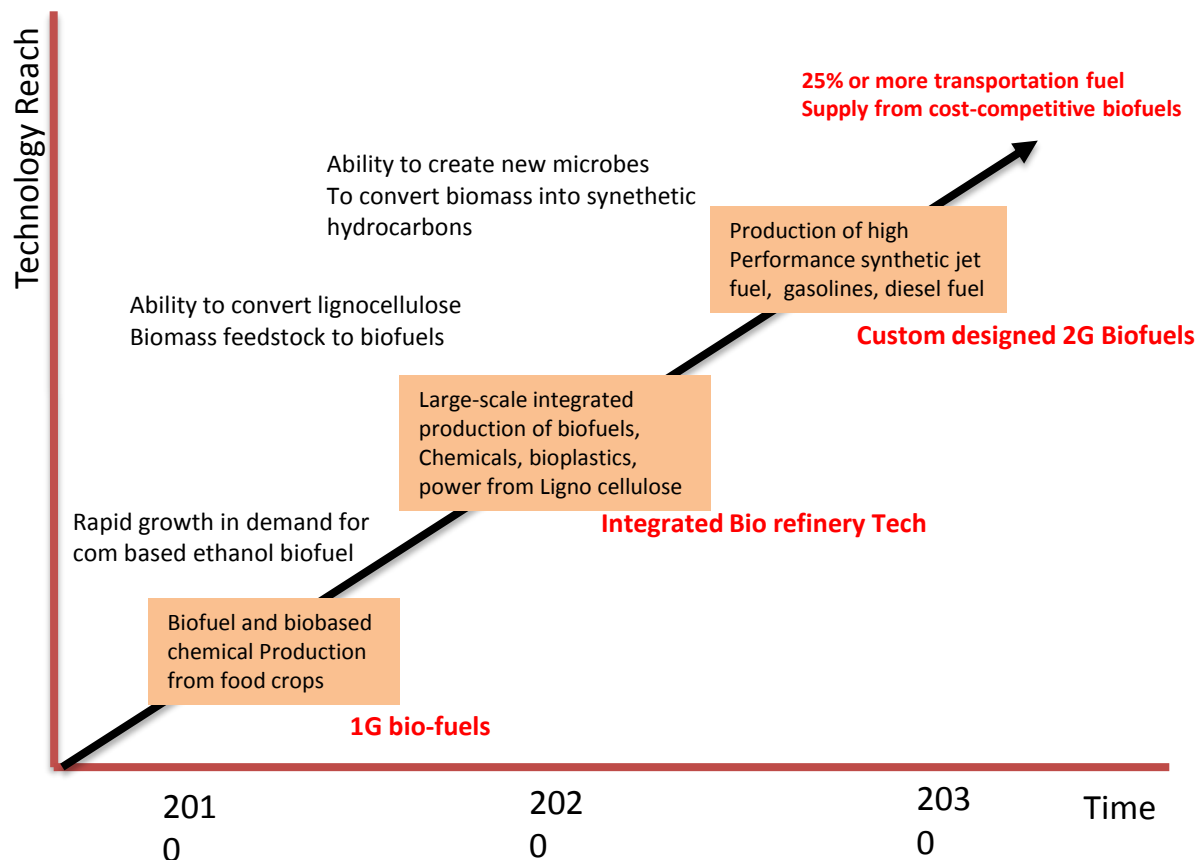


Environmental Impact of Energy Production



- In Indonesia, 33 million people could be fed by the agricultural resources used to meet the biodiesel demand.
- Biofuel production in Indonesia:
 - Energy consumed: 18.2×10^3 TJ/year
 - Water consumed: $1,980.3 \times 10^6$ m³/year
 - Area cultivated: 175.6×10^3 ha
- To produce 1 TJ of energy from biodiesel:
 - Water demand: 109×10^3 m³/TJ
 - Land: 10 ha/TJ
 - People who could be fed per unit of biofuel energy: 182 cap/TJ

A Technology Road Map for tackling the challenges with WEF nexus



Indicative biofuel range per ton of feedstock

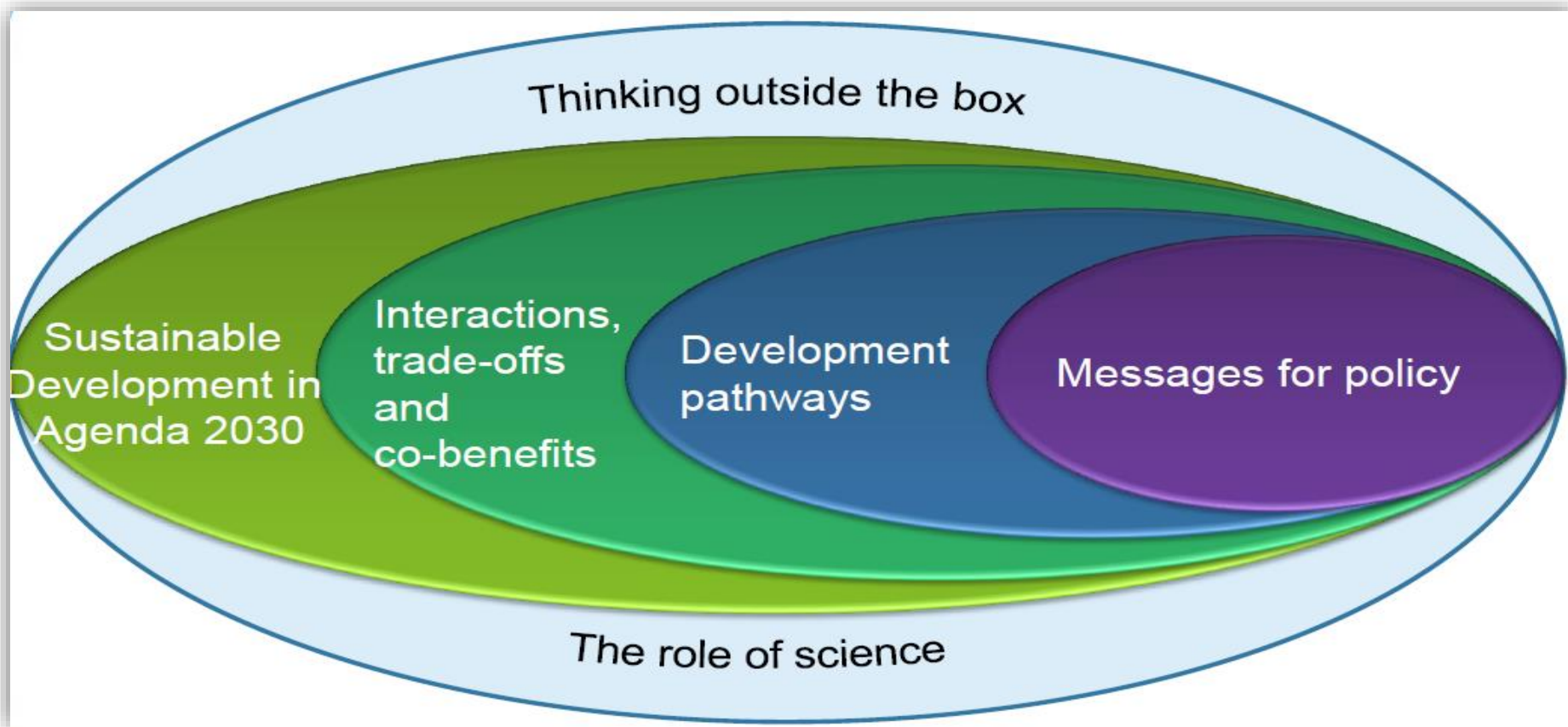
| Process | Bio Chemical | Thermo-chemical | |
|---------------------------|----------------------------|-----------------------------------|-------------------|
| Biofuel Type | Enzymic Hydralysis ethanol | Syngas to Fischer Tropsch ethanol | Syngas to ethanol |
| Bio-fuel yield (lt/dry t) | 110- 300 | 75 -200 | 120 -160 |
| Energy Content (MJ/l) | 21.1 | 34.4 | 21.1 |
| Energy yields (GJ/t) | 2.3-6.3 | 2.6-6.9 | 2.5 – 3.4 |

Source: IEA, 2008

Sustainable Bio-energy Policy in Indonesia: Close to Realities?

- Accelerate successful commercialization of breakthrough biofuel technologies to facilitate the transition from the laboratory to market place
- Develop a globally competitive investment environment through improve regulatory process, streamline standards, trade and tax policy reforms, and venture capital action plans tailored to supply and demand potentials at regional level.
- Establish a strong and coordinated biomass supply chain at national and sub-regional levels
- Support investment in research and development to build foundations of a strong bio-based economy in the region.

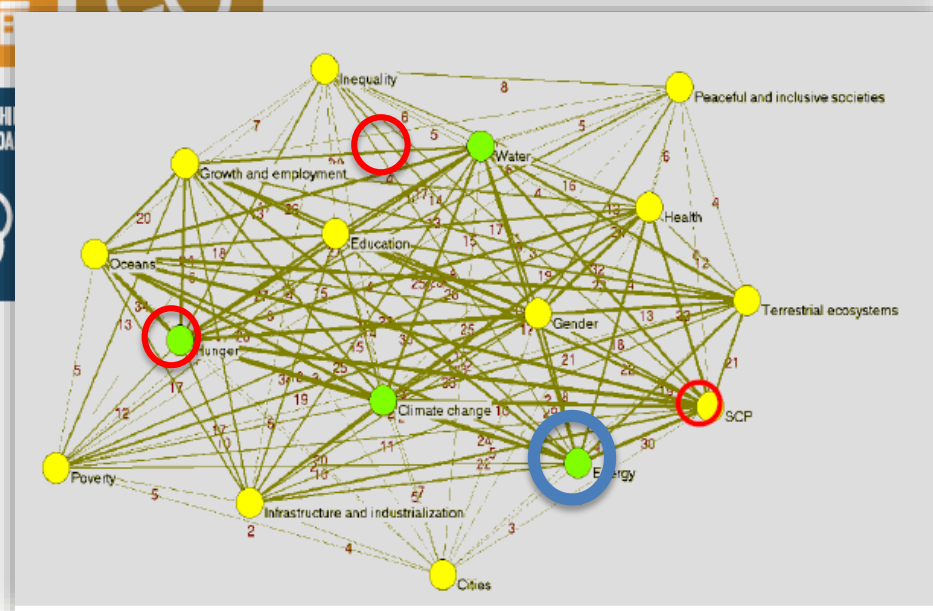
SDG and WEF nexus: Thinking outside the Box on the role of Science and Technology



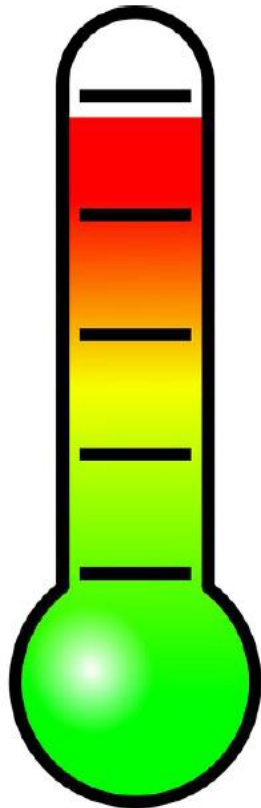
17 SDGS and Inter-connectness of WEF



Dealing with goals individually may lead to perverse outcomes on WEF nexus



The Strength of Interaction



Food security and health

Policy coherence is one of the targets of SDGs

Goal 7 and associated targets need to be integrated

Land resource use and energy infrastructure

Challenges in all Countries: How to deal with inter-linkages in practice

- Water, Energy and Food – policy makers work in silos
 - How to have quick and easy matchmaking with the most obvious targets?
- Much of the knowledge on interactions is to be updated.
 - How to avoid the use of preconceptions?

Main consideration in applying the scale

- Reversibility
- Bi/one directional
- Strength
- Certainty
- Timeline
- Spatial scale

GOALS SCORING

The influence of one Sustainable Development Goal or target on another can be summarized with this simple scale.

| Interaction | Name | Explanation | Example |
|-------------|---------------|---|--|
| +3 | Indivisible | Inextricably linked to the achievement of another goal. | Ending all forms of discrimination against women and girls is indivisible from ensuring women's full and effective participation and equal opportunities for leadership. |
| +2 | Reinforcing | Aids the achievement of another goal. | Providing access to electricity reinforces water-pumping and irrigation systems. Strengthening the capacity to adapt to climate-related hazards reduces losses caused by disasters. |
| +1 | Enabling | Creates conditions that further another goal. | Providing electricity access in rural homes enables education, because it makes it possible to do homework at night with electric lighting. |
| 0 | Consistent | No significant positive or negative interactions. | Ensuring education for all does not interact significantly with infrastructure development or conservation of ocean ecosystems. |
| -1 | Constraining | Limits options on another goal. | Improved water efficiency can constrain agricultural irrigation. Reducing climate change can constrain the options for energy access. |
| -2 | Counteracting | Clashes with another goal. | Boosting consumption for growth can counteract waste reduction and climate mitigation. |
| -3 | Cancelling | Makes it impossible to reach another goal. | Fully ensuring public transparency and democratic accountability cannot be combined with national-security goals. Full protection of natural reserves excludes public access for recreation. |

Is the interaction among SDGs reversible or not?

Potentially reversible

- Converting land use from agriculture to biofuel production (goal 7) counteracting food security (goal 2) and Poverty reduction (goal 1).

Potentially irreversible

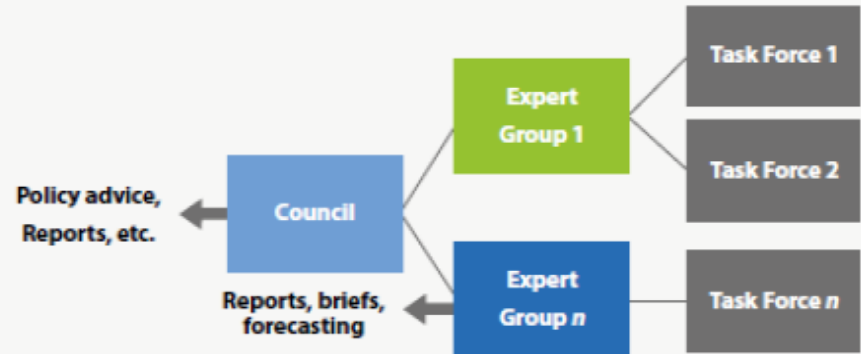
- Lack of action on climate change (goal 13) and clean water and sanitation (goal 6)

How certain or uncertain are the interactions : We need new STP Interface Models on WEF

The Independent Model



The Nested Model



The Integrated Model



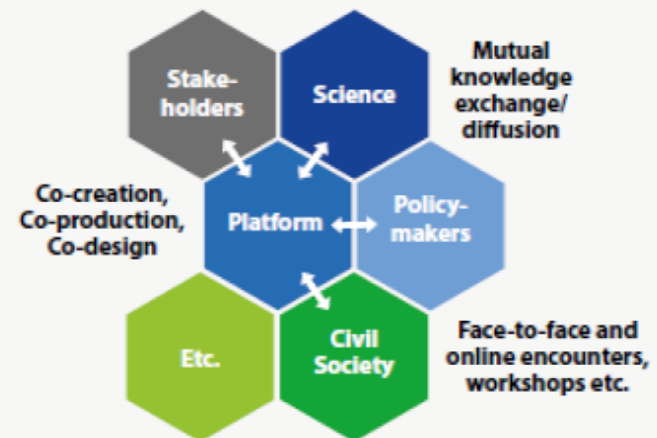
The Assignment Model



The Adviser Model



The Platform Model



Moving Foreword

- Guidance on the state of WEF nexus
 - *Provide successful lessons learned, while focusing on challenges, address and emerging issues and highlight the actions to be completed, from a S&T perspective*
- An integrated STP approach on SDGs to examine policy options
 - *with a view of to sustaining the balance between SDGs 7, 6, 2 and 13*