ISSUE BRIEF

United Nations Development Programme

FUTURE ENERGY DEVELOPMENT IN CHINA[1]

A brief on *White Paper: Energy in China's New Era*

In December 2020, the State Council Information Office published a White Paper (WP) titled Energy in China's New Era. This is the third white paper published on energy policy and development in China, but the first of the New Era that started with the 18th National Congress of the Communist Party of China in 2012. The aim is to "provide a full picture of China's achievements in its energy development [between 2012 and 2019] and its major policies and measures for energy reform". This note summarizes the WP, and then offers some policy-related insights.

UNDP, as a solution provider for sustainable development, stands ready to work with China on realizing the full potential of the WP's agenda, aligning with Sustainable Development Goals (SDGs).

China's Energy Profile

China uses and produces different types and sources of energy.

They are measured in different physical units, including standard coal equivalent (SCE), cubic metre (cu.m), tons, terawatthours (tWh) and kilowatthours (kWh).

Energy sources can be categorized as primary (一次能源) and secondary (二次能源).[2] Secondary energy sources are generated (produced) from primary ones.

Primary	Secondary
raw coal, crude oil, natural gas, nuclear, renewables (e.g., hydro, wind, solar, geothermal, biogas), etc.	electricity, washed coal, coke, coal gas, refined oil, thermal, etc.

Energy Production

China is the largest energy producer in the world. According to the WP, in 2019 China's primary energy production was 3.97 billion tons of SCE (BtSCE) - coal (69.6%), crude oil (6.9%), natural gas (5.7%) and non-fossil energy resources (18.8%). [3] Latest data from the National Bureau of Statistics (NBS) shows that in 2020, energy production increased by 2.7%, reaching 4.08 billion tons of SCE (BtSCE).[4]

1. The data in this briefing note is from (1) White Paper: Energy in China's New Era by the State Council; (2) China Statistical Yearbook 2020 by the National Bureau of Statistics (NBS), unless otherwise cited.
2. This terminology can be found *here*.
3. In the *National Bureau of Statistic's official data*, 'non-fossil energy resources' are labelled as 'primary electricity and others', which refers to electricity generated from nuclear energy, hydropower, wind, solar, etc.
4. National Bureau of Statistics (NBS). (2021). *Statistical Communique of China on the 2020 National Economic and Social Development.*

Figure 1. WP: China's Energy Production (2012-2019)

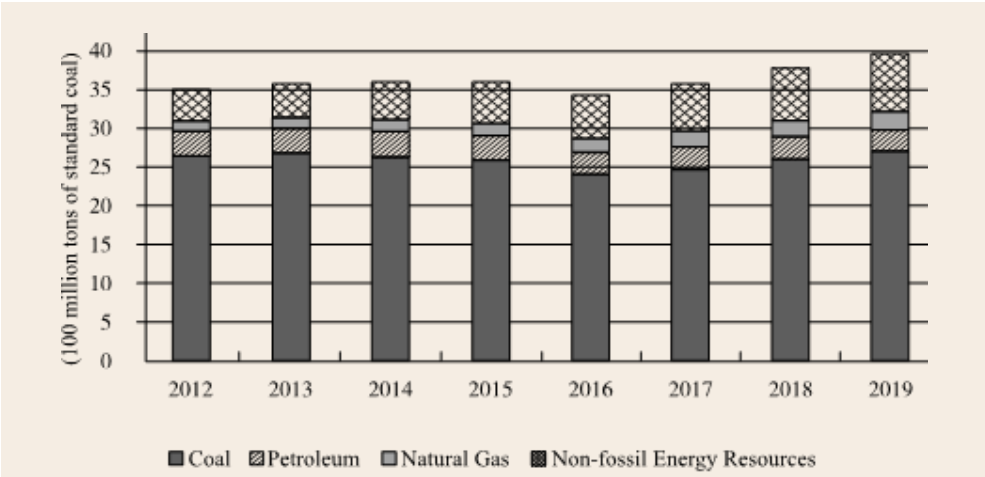
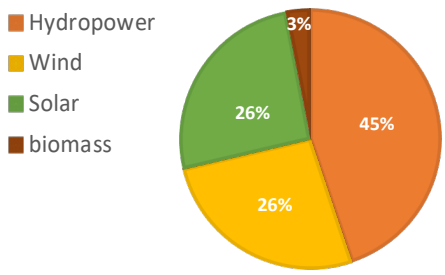


Figure 2. China's primary energy production structure in 2005 and 2019

	COAL	OIL	NATURAL GAS	NON-FOSSIL
2005	77.4%	11.3%	2.9%	8.4%
2019	68.6% ▼	6.9% ▼	5.7% ▲	18.8% ▲

Increased installed renewable power facilities and investments are supporting the expanding share of non-fossil sources in total energy production. By the end of 2019, China's total installed capacity of renewable power generation reached 790 GW, accounting for about 30% of the global total. Since 2010, China has also invested a total of about US$818 billion in renewable energy power generation, accounting for 30% of the global total investment over the same period.

Figure 3. Structure of installed renewable power capacity (2019)



Energy Consumption

China's energy consumption has been larger than domestic energy production since the early 1990s. In 2018, imported energy resources accounted for 23.5% of total energy consumption; it was 9.9% in 2000. Imported oil accounts for 87% of total oil consumption, imported coal for 7%.

China's total energy consumption, at 4.98 BtSCE in 2020, has more than doubled since 2004 (when it stood at 2.30 BtSCE). The increase in consumption was moderated by improving energy efficiency. Since 2012, energy consumption per unit of GDP has been reduced by 24.4%. From 2012 to 2019, China recorded an average annual GDP growth of 7%, but annual energy consumption rose by 2.8%.

According to the latest data from the NBS,[5] in 2020, while coal remains dominant (56.8%) in energy consumption, the share of clean energy that include natural gas, hydro, nuclear, wind and solar power has increased to 24.3%; excluding gas, as shown in Figure 5, the share of non-fossil energy stands at 15.8%.

5. National Bureau of Statistics (NBS). (2021). *Statistical Communique of China on the 2020 National Economic and Social Development.*

Figure 4. WP: China's Energy Consumption structure (2012-2019)

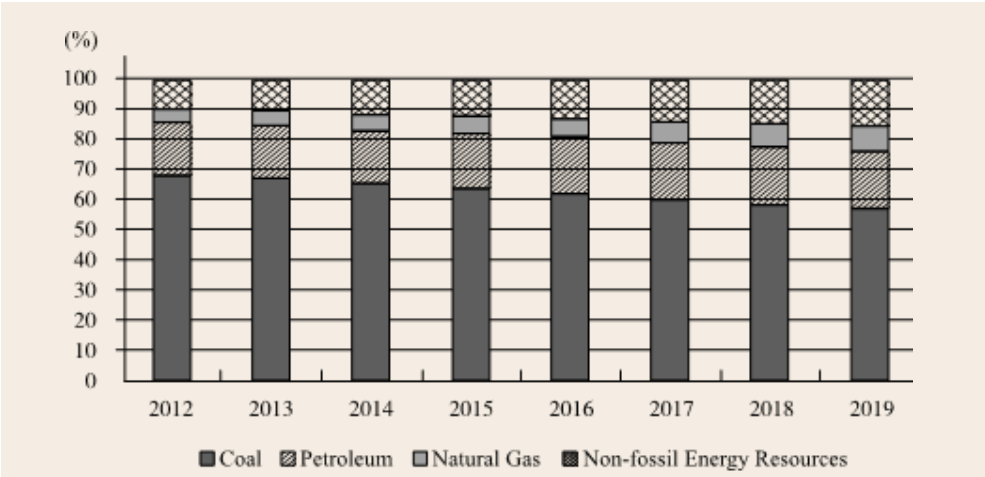


Figure 5. China's energy consumption in 2005 and 2020

	COAL	OIL	NATURAL GAS	NON-FOSSIL	TOTAL (BtSCE)
2005	72.4%	17.8%	2.4%	7.4%	2.6
2020	56.8% ▼	18.9% ▲	8.5% ▲	15.8% ▲	4.98

Increasing non-fossil energy share in generating electricity will be a key development focus and challenge in China. Given fast-growing social and economic needs, ***electricity consumption is soaring*** - from 1,347 tWh in 2000 to 7,511 tWh in 2020, and expected to continue to grow rapidly as several sectors, e.g., transportation, are increasingly shifting toward electricity use, and the share of the service sector in economic growth is rising.

Coal-based electricity (% of total)[6]	
2015	67.9%
2020	60.8%

Carbon Emission Intensity

By 2019, carbon emission intensity in China was 48.1% lower than the 2005 level (for more details see p.11 of the WP). The 2030 target is to reach more than 65% reduction against the 2005 level.

Energy Reform: points worth noting

The WP describes China's energy reform strategy, which follows five "guiding philosophies" in detail. There are several points worth noting:

- Domestically, to strive towards a low-carbon economy, the target is the "Beautiful China initiative". There is also a reference to "build a clean and beautiful world" (p.5), but ***no explicit mention of exporting non-green technology and projects overseas***.

Five guiding philosophies
1. putting people first
2. promoting clean and low-carbon energy
3. ensuring the core status of innovation
4. pursuing development through reform
5. building a "global community of shared future"

6. China Electricity Council. (2021). *2020-2021 National Electricity Supply and Demand Situation Analysis and Forecast.*

- There is a focus on ***enterprises and their key role in achieving national self-sufficiency in innovation***, alongside fostering collaboration with "universities and research institutes, to reduce technology imports and boost independent innovation". Lowering dependency on external technologies is also what seems to be driving the proclaimed objective of achieving "complete industrial chains for the manufacturing of clean energy equipment for hydropower, nuclear power, wind power, and solar power".

- To support the green and low carbon energy transformation, "advanced ***market-oriented reform***" and the need to "***improve the financial and fiscal systems***" are underlined repeatedly.

- ***Energy security*** is a key concern of China's long-term energy policy. Since 1993, China has not been self-sufficient in meeting its energy needs and the country's dependence on foreign energy sources has been increasing in recent years.[7] Whereas the 2012 energy WP clearly noted "grave challenges to energy security", the 2020 WP is even more pointed in this regard by putting "the new energy security strategy" announced by President Xi in 2014 at the centre of China's energy policy. This partly explains China's focus on energy saving, optimizing energy structure and domestic innovation - all of which contribute to a self-reliant energy landscape.

- ***Globally, China advocates for a "global community of shared future", a key message of the 'New Era'***, which started with the 18th National Congress of the Communist Party of China in 2012. For this, China calls for "greater international cooperation on energy governance, and a new round of energy reform directed towards clean and low-carbon development". The WP highlights China's multiple engagements in multilateral energy governance "based on mutual benefit and win-win results" (p.45), and its stated objective of facilitating climate actions in and "jointly address[ing] global climate change" with developing countries.

- On ***sustainable global energy development***, China proposes the following action points, calling for all countries to:
  - "Jointly promote the transition to green and low-carbon energy to build a cleaner and more beautiful world";
  - "Jointly consolidate multilateral energy cooperation to accelerate green economic recovery and growth";
  - "Jointly facilitate international investment in energy trading to protect global market stability";
  - "Jointly improve energy access in underdeveloped areas to address poverty".

In light of China's role in global energy cooperation, UNDP and the China Center for International Economic Exchanges (CCIEE) in a recently released report[8] recommended three forward-looking pathways to help facilitate low-carbon development within China and globally. First, boosting innovation, development and transfer of clean energy; secondly, channeling investment and funding towards low-carbon projects; and thirdly, strengthening human resources and institutional capacities. Evaluating investment proposals using aligned and harmonized sustainability standards forged through collaboration is also recommended to better support the SDGs.

---

7. The State Council. (2012). *White Paper: China's Energy Policy 2012.*
8. UNDP and China Center for International Economic Exchanges (CCIEE). (2021). *Paving the Way for Low-carbon Development Globally and along the Belt and Road.*

Future Energy Development in China

Targets

During the 75th United Nations General Assembly in September 2020, President Xi pledged that China will scale up its Intended Nationally Determined Contributions (NDC) by adopting more vigorous policies and measures, striving ***to have carbon dioxide emissions peak before 2030 and to achieve carbon neutrality before 2060.***

Based on existing statistics,[9] as well as energy-related key policy documents, including the "*Strategy for Energy Production and Consumption Revolution (2016-2030)*"[10] and the "*14th Five-Year Plan (2021-2025) for National Economic and Social Development*",[11] the table below presents some latest key targets that China outlined for the future energy sector:

	2015	2020	2025	2030	2050
Total energy consumption	4.3 BtSCE	4.95 BtSCE (target: below 5.0)		below 6.0 BtSCE	keep stable
% of coal	64%	56.8% (target: below 58%)			
% of non-fossil	12%	15.8%	20%	25%	above 50%
% of natural gas	5.9%	8.5%		15%	
% of non-fossil in electricity supply	27.2%	33.9%		50%	
Carbon emission intensity *(against 2005 level)*	reduce 36.7% [12]	reduce 48.6% [13] (target: reduce 40-45%)	reduce 57.9% [14]	reduce more than 65%	

Points for further reflection

China's energy transition is key to fulfilling its 2060 carbon neutral commitment. If successful, it will not only directly benefit millions of Chinese people, but it will also help unlock the desired

9. National Bureau of Statistics (NBS). (2021). *Statistical Communique of China on the 2020 National Economic and Social Development*; China Electricity Council. (2021). *2020-2021 National Electricity Supply and Demand Situation Analysis and Forecast;* Ministry of Ecology and Environment. (2021). *2020 Report on the State of the Ecology and Environment in China*.
10. National Development and Reform Commission (NDRC) and National Energy Administration (NEA). (2016). *Energy Supply and Consumption Revolution Strategy (2016-2030)*.
11. *14th Five-Year Plan (2021-2025) for National Economic and Social Development and the Long-Range Objectives Through the Year 2035*.
12. Page 50 of the *2020 Report on the State of the Ecology and Environment in China*. Calculation based on the official statement that "2020 carbon emission intensity decreased by 18.8 % comparing to the 2015 level".
13. Ibid. Calculation based on the official statement that "2020 carbon emission intensity decreased by 1 % comparing to the 2019 level".
14. Calculation based on the 14th Five-Year Plan target that carbon emission intensity will decrease by 18% by 2025.

high-quality economic development pathway, which has been placed at the core of China's 14th Five Year Plan.

Considering the challenges at hand, China and the world would benefit from front-loading required interventions for an acceleration of the transition towards green energy well before the end of the 14th FYP period. Delayed action runs the risk of contributing to a further buildup of emissions, aggravating risks and importantly also the costs of climate change impact, while adversely impacting intergenerational equity. Delays would also contribute towards the accumulation of stranded assets in the fossil fuel sector in light of the growing cost advantage of newly built renewable based power generation over newly built fossil fuel plants. Overall, the costs and risks of delays in greening the energy sector exponentially increase as time elapses.

As outlined in the WP, China is rolling out a comprehensive energy reform strategy, underpinned by the idea of "Four Revolutions, One Cooperation" (see section on 'Energy Reform: Points Worth Noting' above). Radical changes are expected in energy supply, energy consumption, green investment, regulations, financial market, institutional structure, renewable energy infrastructure, transportation, industries, and many other aspects including innovation and international cooperation (see section on 'Energy Development Path in the New Era' below). Foreseeably, this whole-of-society approach will bring about new relative prices, social rules and norms, which will generate substantially different costs on different groups for adaptation, creating asymmetrical and, at times unpredictable, social and economic impacts along the transition.

Mitigating unintended impacts and potential risks, and ***promoting a fast and fair transition***, therefore, become essential tasks that will need to be tackled. While China's advanced level of renewables technology and its substantial production capacity in this area will help in this, there will also be challenges stemming from its large population and the differences among provinces. In light of China's ongoing energy transformation path and policy focus, this brief provides below two points for further reflection and consideration.

Enriching people-centred thinking & the linkages with the SDGs

In addition to necessary supporting changes involving the transition of the entire economic model, sectoral reforms, value chain adjustments and enhanced incentives through pricing and taxation,[15, 16] it is important to "put people first". The WP places a strong emphasis on this aspect of the energy transformation and it constitutes the first among the five guiding philosophies of the WP. Its underlying focus is mostly directed at ensuring broad clean energy access, particularly for the rural population. This is a reasonable anchor. Given China's rising energy consumption, universal accessibility to green energies is a pre-requisite to equally distributing the benefits of the energy transition to its people.

15. Broad supporting policies can be found in the 14th Five Year Plan (FYP), including energy mix, energy distribution, improving efficiency in resource utilization, greening of all sectors, enhancing a green legal and policy environment, promoting the circular economy, as well as participating in and leading international cooperation on the climate change agenda. More details and verifiable new data are waiting to be seen in the sectoral five-year plans that expected by the end of this year. See more about the climate and environmental-related strategies and guidelines presented in the 14th FYP at: *www.cn.undp.org/content/dam/china/docs/Publications/UNDP-CN-v2Issue%20brief%2010.pdf*

16. See also UNDP and China Center for International Economic Exchanges (CCIEE). (2021). *Paving the Way for Low-carbon Development Globally and along the Belt and Road*. The report shows how the rapid application of best-in-class technologies, a supportive financial and regulatory framework and enhanced capacities can be used to accelerate the energy transition.

Building poor households' capacity to accept and effectively use such green energy is also crucial in this regard, so that access to clean energy will facilitate an inclusive outcome of the transition. Take decentralized renewable technology such as roof-top photovoltaic (PV) systems, as an example. Even if needed power lines and infrastructure are ready, installing and using the household-based PV will require an upfront down payment (which can be larger than for conventional sources of energy at today's prices) and subsequent maintenance expenses. These two in combination may not be affordable for poor households. Exclusion arising from such factors has already occurred in Sub-Saharan Africa, Bangladesh and India .

Unintended social consequences could occur throughout the whole transition process, disrupting socio-economic dimensions that deeply concern individuals such as job market, and rising inequalities in spending, land use and food security. While divesting from fossil fuels, China needs to prepare for the potential emerging social challenges and address them in ways that align with the WP's thinking - "for the people and answerable to the people".

One recommended first step would be to ***integrate a broader multi-dimensional people-centred concept into energy transition plans***. As part of this, line agencies can adopt measures such as conducting social impact pre-assessments, collecting bottom-up feedback in the process, identifying the groups that are most at risk of being left behind, and providing policy/programme support and/or financial support. All these would contribute to the necessary impetus to help realize the full potential of green energies. This will also be critical to advance the SDGs across the board. For instance, the fact that the WP links renewable energy infrastructure with rural revitalization efforts is essential to contributing to SDG 1 (no poverty) SDG 10 (Reduced inequalities) and SDG 7 (Affordable and clean energy) and SDG 9 (Industry, innovation and infrastructure). Utilizing systems thinking to strategically leverage these interlinkages will be instrumental in order to generate multiplier effects on energy investments.

To support the above initiatives, creating needed fiscal space will be necessary. Given existing budgetary constraints posed by the COVID-19 pandemic, one recommended step in this regard would be ***expanding carbon pricing mechanisms to better guide both the demand and supply side*** (including for the corporate sector). This would help balance market supply and demand in support of the WP's objectives of saving energy and reining in emissions. Effective price signals, generated through carbon taxes and fossil fuel subsidy reform and other mechanisms, notably auctioned emissions permits to large emitters, that reflect the full costs of burning fossil fuels (including social costs) would not only align market forces behind the energy transition - they would also generate government revenues and fiscal space that can in turn be used to buffer the unintended side effects on the most vulnerable and facilitate a just transition.

One step further: addressing existing social imbalances with the energy transition

Beyond addressing emerging social challenges directly linked with the energy transition, the energy sector reform may reap benefits that go beyond the sector by seizing the opportunity for a different type of recovery from the pandemic and build forward towards sustainability as part of a whole-of-society approach to attaining the SDGs.

---

17. Mohammed, Y. S., Mustafa, M. W. and Bashir, N. (2013). Status of renewable energy consumption and developmental challenges in Sub-Sahara Africa. Renewable and Sustainable Energy Reviews, 27, pp. 453-63
18. Wong, S. (2012). Overcoming obstacles against effective solar lighting interventions in South Asia. Energy Policy, 4 (1), pp. 110-20.

A case in point could be embedding targeted measures (i.e., gender-responsive; disability-neutral; elderly-friendly) into training and skills enhancement programmes. Much of the literature cites job creation in the renewable energy sector and job loss in the traditional fossil fuel sector as a direct consequence of green transition. Training programmes, alongside more inclusive and targeted social safety nets, could help facilitate the overall transition to a sustainable energy sector, as well as the necessary shifts in employment. Beyond that, there is an opportunity to make the green energy job market more inclusive than the traditional one, particularly since more positions will be created than eliminated - spending on renewables creates five more jobs per million dollars invested than spending on fossil fuels.[19] For instance, several studies found that gendered divisions of labour remained entrenched despite the introduction of new energy sources.[20] If the training programmes could be designed with more gender-sensitive components, the energy sector may become more balanced in the future, with more women represented. Likewise, instead of treating the aging population as a social challenge, China can tap into the potential of retirees through specific training programmes designed for them.

Addressing existing social imbalances through the green transition requires a focus on people who are already at risk of being left behind. To identify the entry points for targeted components and interventions, international cooperation and knowledge exchanges can be feasible channels. Through examining the international experience of similar schemes, as well as their similarities and differences, it would help compile a series of key considerations and recommendations for China to smooth the transition. Bearing those in mind, China's future energy system, as well as the society that hosts it, would become more inclusive and empowering.

Contact Information

United Nations Development Programme in China
jiawen.chen@undp.org

19. McKinsey & Company. (2020). *How a post-pandemic stimulus can both create jobs and help the climate.*
20. Johnson, O., et al. (2020). Intersectionality and energy transitions: A review of gender, social equity and low-carbon energy. Energy Research & Social Science, Vol. 70.

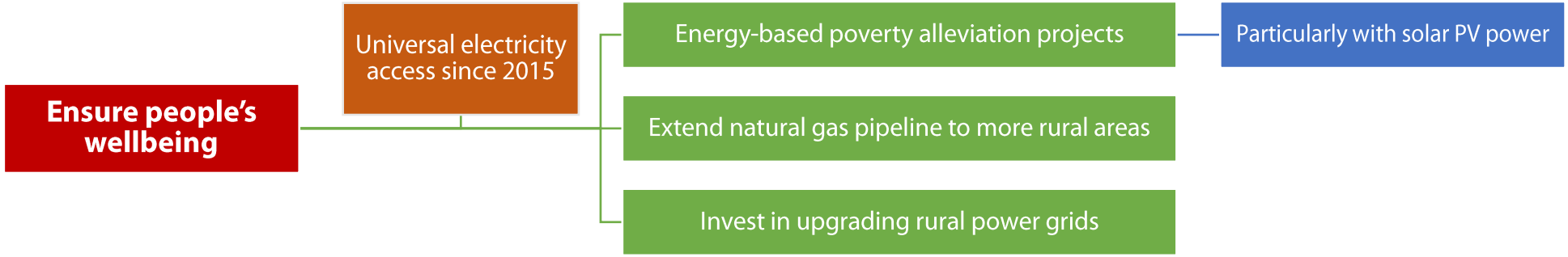
Annex.

Outline of White Paper on Energy in the New Era

The purpose of the graphics below is to provide a visual summary of the White Paper[1] with simplified technical concepts to facilitate reading for a non-specialised audience. The graphics are elicited from the WP by the authors of this brief. They are based on and organized along the five guiding principles of the WP, namely i) "putting people first"; ii) "promoting a clean and low-carbon energy"; iii) "ensuring the core status of innovation"; iv) "pursuing development through reform"; v) "building a global community of shared future".

I. Putting people first

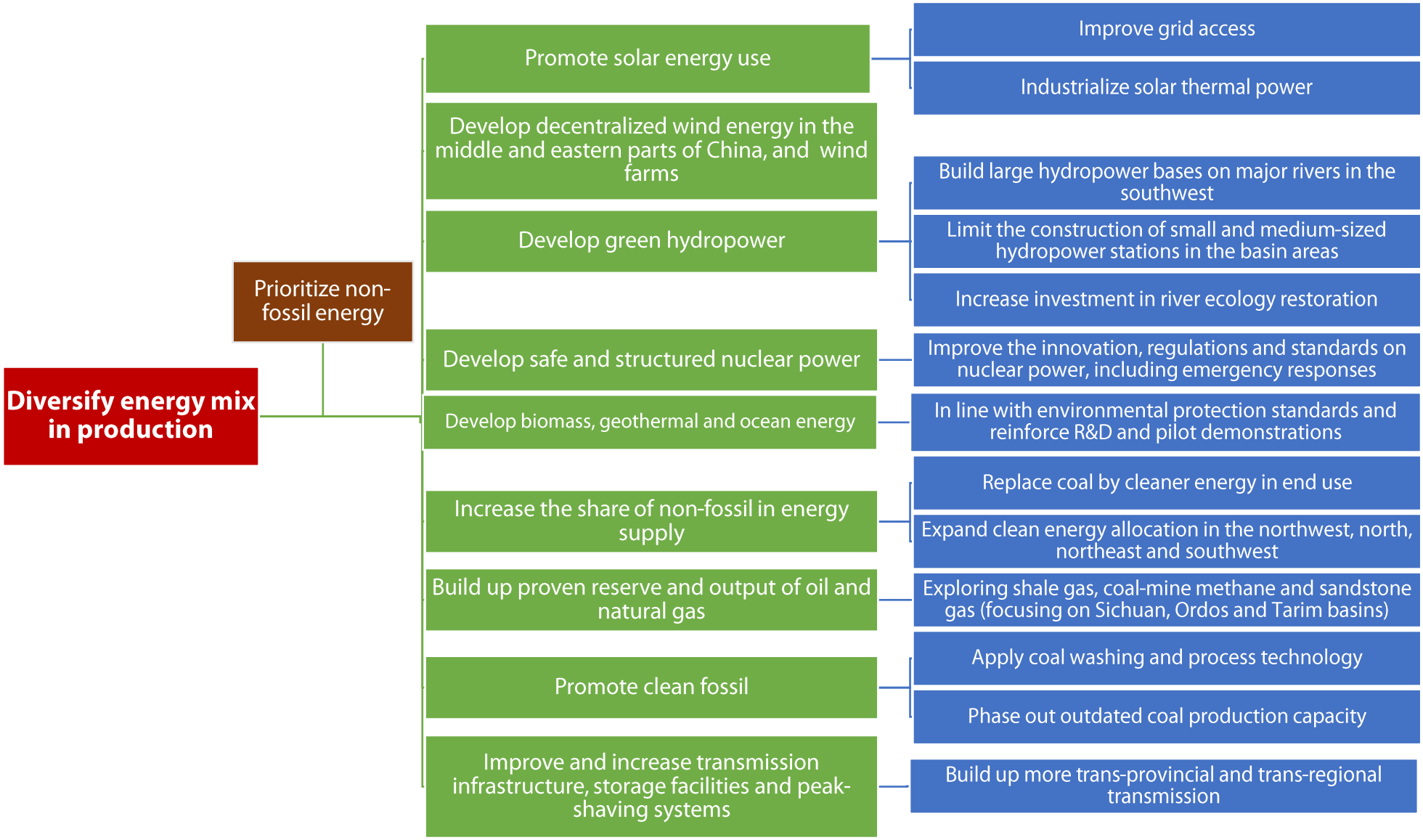
According to the first guiding philosophy of the WP, ***the primary goal of China's energy development*** is to ensure energy access for people's lives and particularly populations in poverty-stricken areas.



[1] http://english.www.gov.cn/archive/whitepaper/202012/21/content_WS5fe0572bc6d0f725769423cb.html

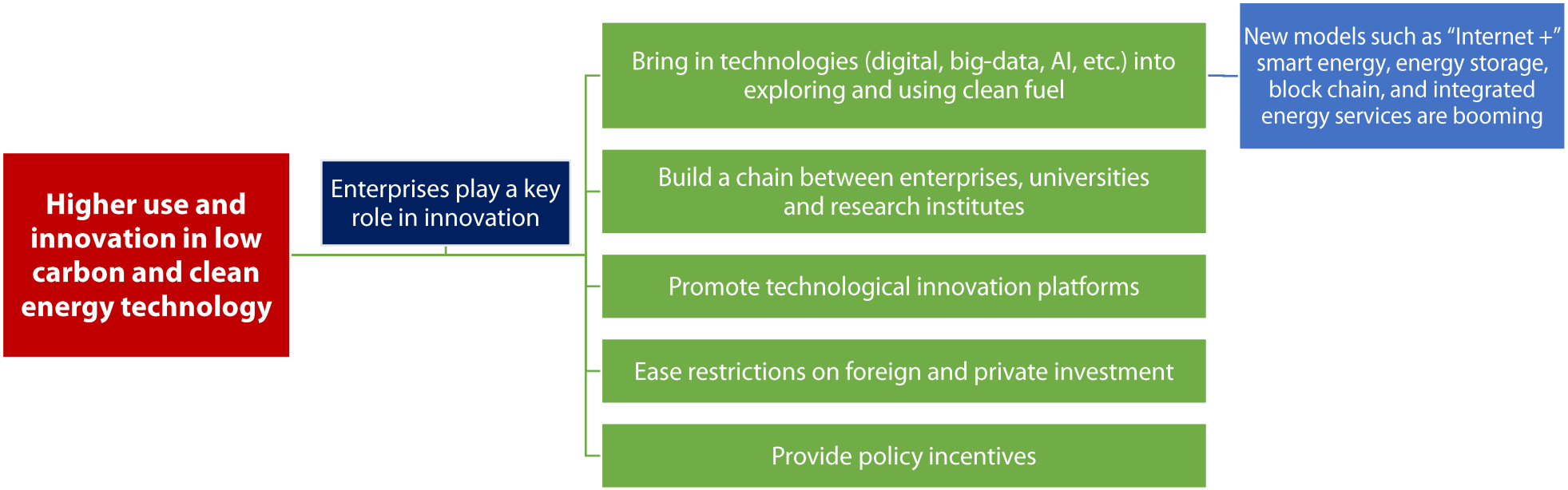
II. Promoting a clean and low-carbon energy

The WP notes that China gives priority to non-fossil energy, and strives to ***substitute low-carbon for high-carbon energy*** and ***renewable for fossil energy***.



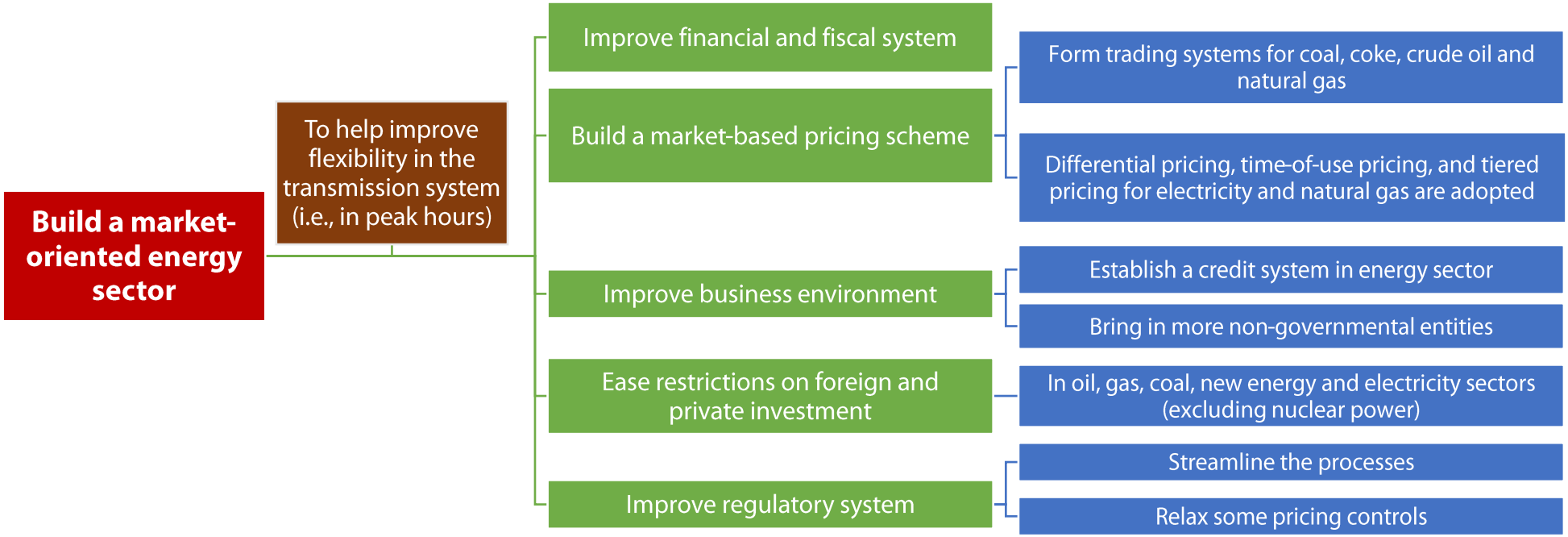
III. Ensuring the core status of innovation

As underlined in the WP, China is establishing an energy science and technology system in which ***"technological innovation is directed by the government and led by the market"***, and engages the whole of society, with enterprises playing a major role and all stakeholders coordinating with each other.



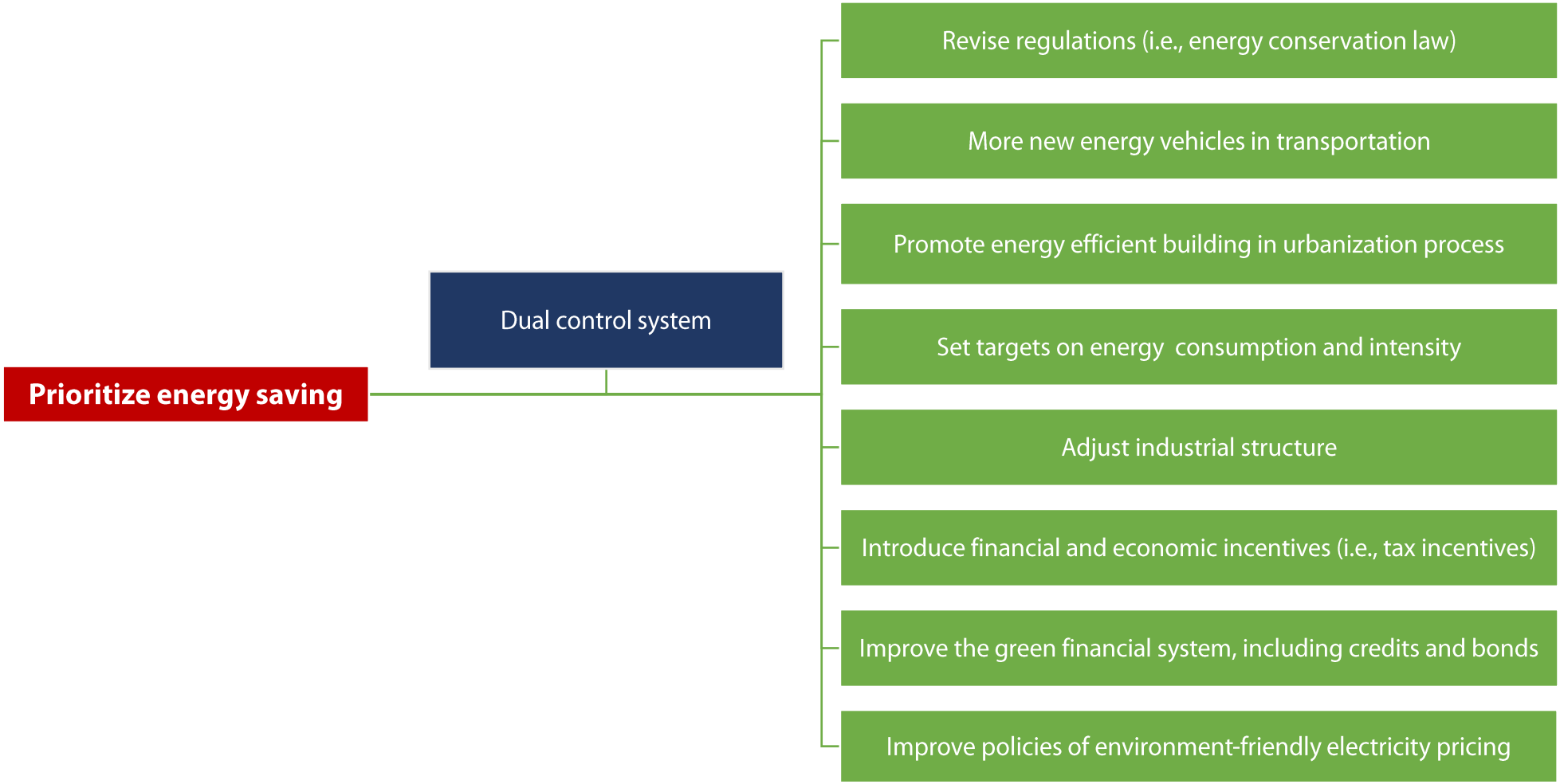
IV. Pursuing development through reform (1)

According to the WP, China is seeking to promote a unified and ***"open energy market with orderly competition"***.



IV. Pursuing development through reform (2)

The WP emphasizes putting in place a ***"dual control system"*** by setting the targets of both total energy consumption and energy use intensity.



V. Building a global community of shared future

The WP emphasizes that ***"China has joined the international community in building a new model of energy cooperation, maintaining energy market stability, and safeguarding common energy security"***. The WP describes energy cooperation as "pragmatic and mutually beneficial".