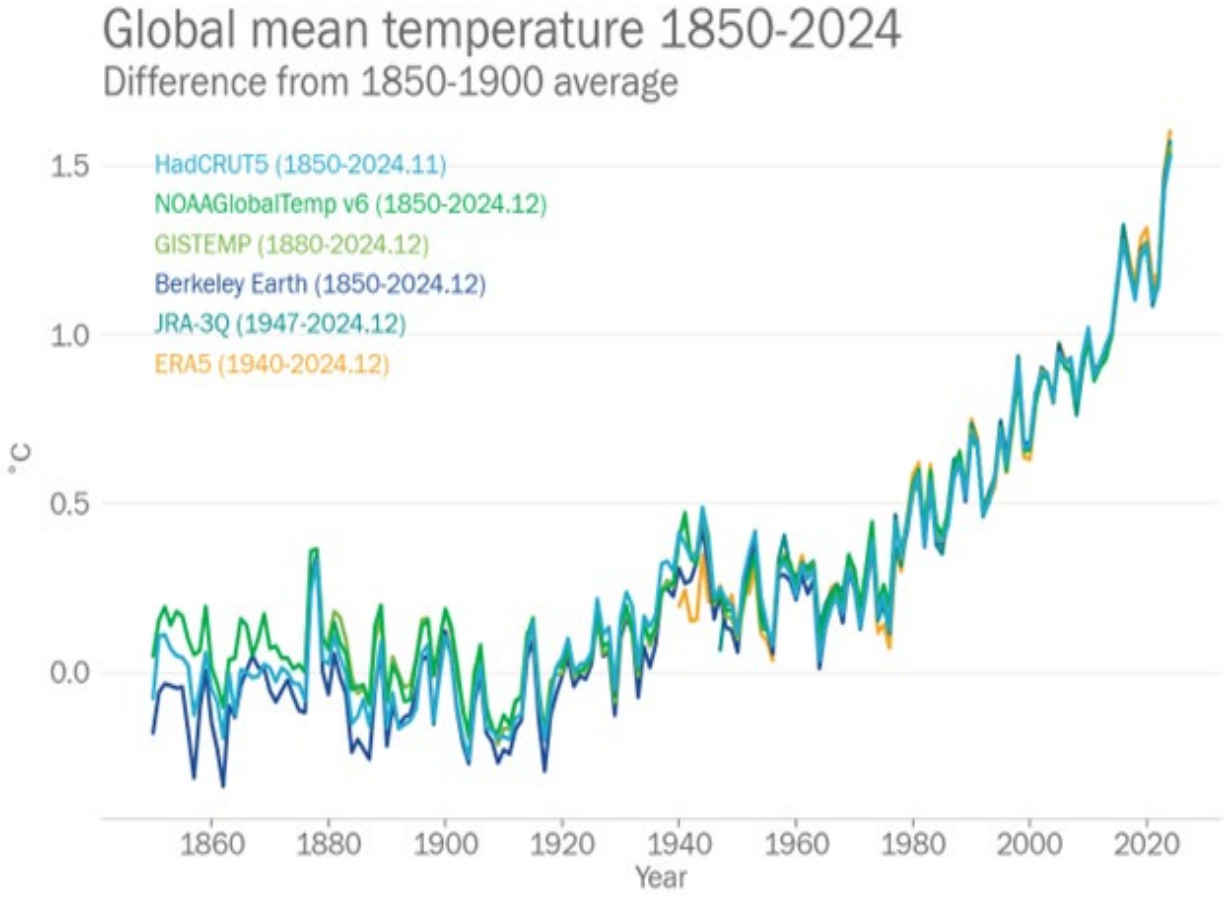
災害級に熱い夏、日本の石炭火力は今後どうなる？

What lies ahead for Japan's coal-fired power plants?

桃井貴子（気候ネットワーク東京事務所）
Takako Momoi, Kiko Network

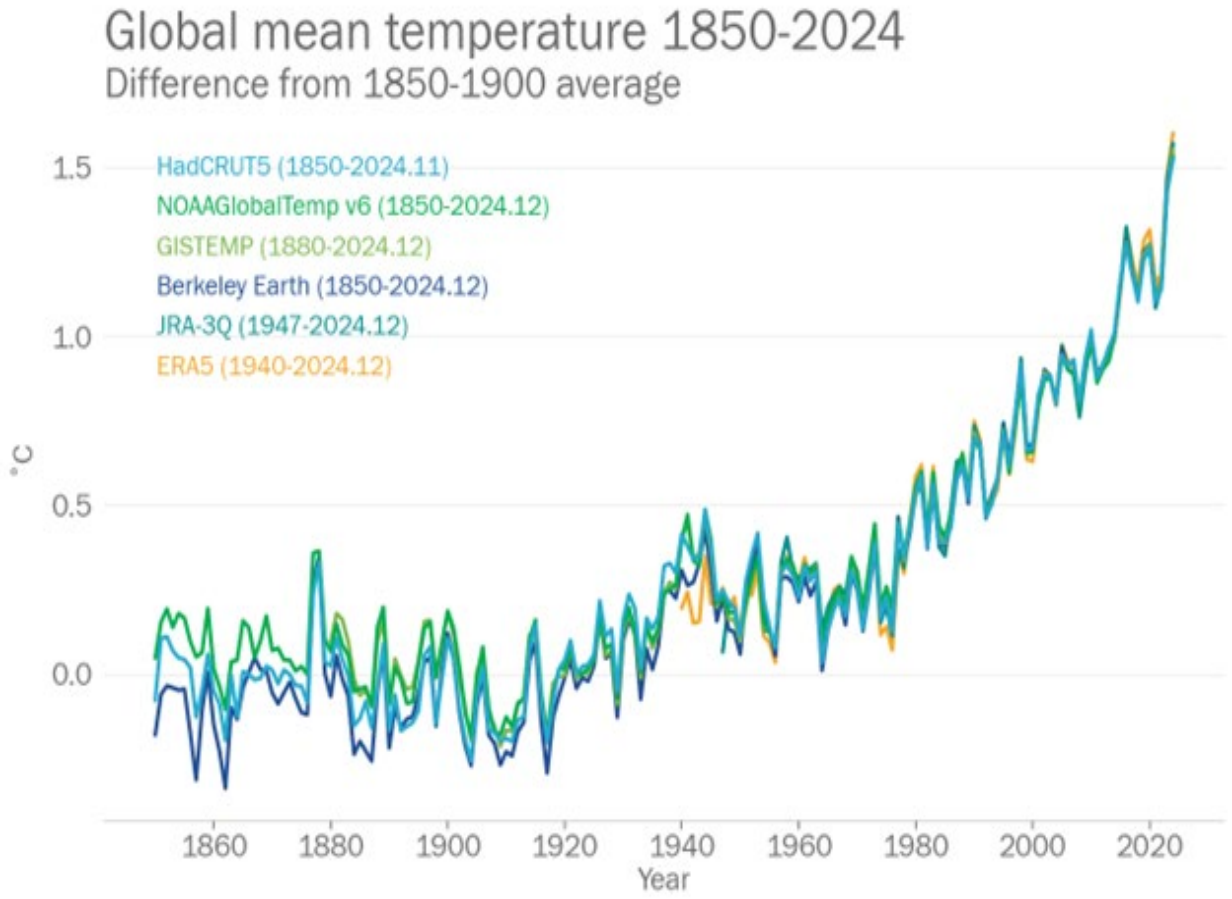
気候危機
各地の災害で多数の犠牲　日本でも顕著に



出典）WMO　https://wmo.int/news/media-centre/wmo-confirms-2024-warmest-year-record-about-155degc-above-pre-industrial-level

- 猛暑・熱中症の多発（都市部中心）
- 集中豪雨と河川氾濫（九州・東北など）
- 台風の大型化と進路の変化（南西諸島～本州）
- 雪不足と異常降雪（北海道・中部山岳地帯）
- 農業への影響（米・果樹・野菜など）

Numerous disasters across the country have claimed casualties
Climate crisis is becoming more significant in Japan

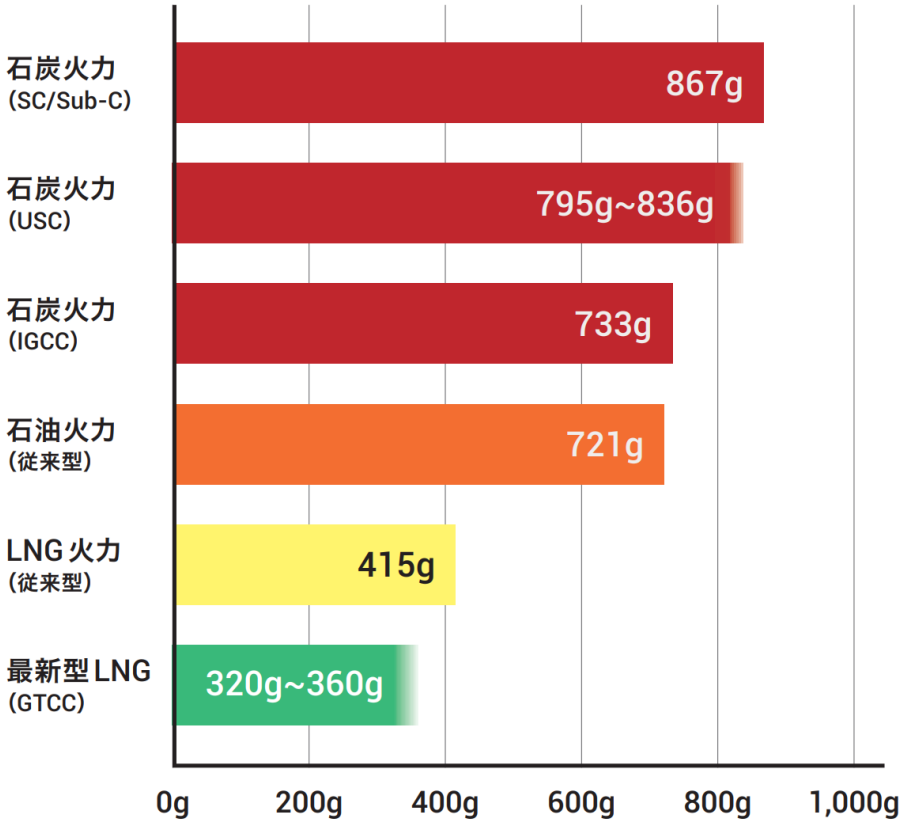


Source: WMO <https://wmo.int/news/media-centre/wmo-confirms-2024-warmest-year-record-about-155degc-above-pre-industrial-level>

- Extreme heat, frequent heatstroke (primarily in urban areas)
- Intensive rain/storm and river flood (Kyushu, Tohoku, etc.)
- Increasing size and changing path of typhoons (The effects of the typhoon are widely spread from the Nansei Islands to Honshu.)
- Snow deficit and abnormal snowfall (Hokkaido and mountainous region in central Japan)
- Impact on agriculture (rice, fruit trees, vegetables, etc.)

気候変動対策の１丁目１番地
2030年までに行うべき国際的な約束

図表1 火力発電所の燃料別の排出係数（g-CO_2/kWh）



- **2030年代前半の対策のとられていない石炭火力の段階的廃止**（G7合意）

  2030年代前半、または各国のネットゼロの道筋に沿って気温上昇を1.5度に抑えるスケジュールで既存の排出削減対策がとられていない石炭火力を段階的に廃止する

- **2035年の電力部門の完全または大宗の脱炭素化**（G7合意）

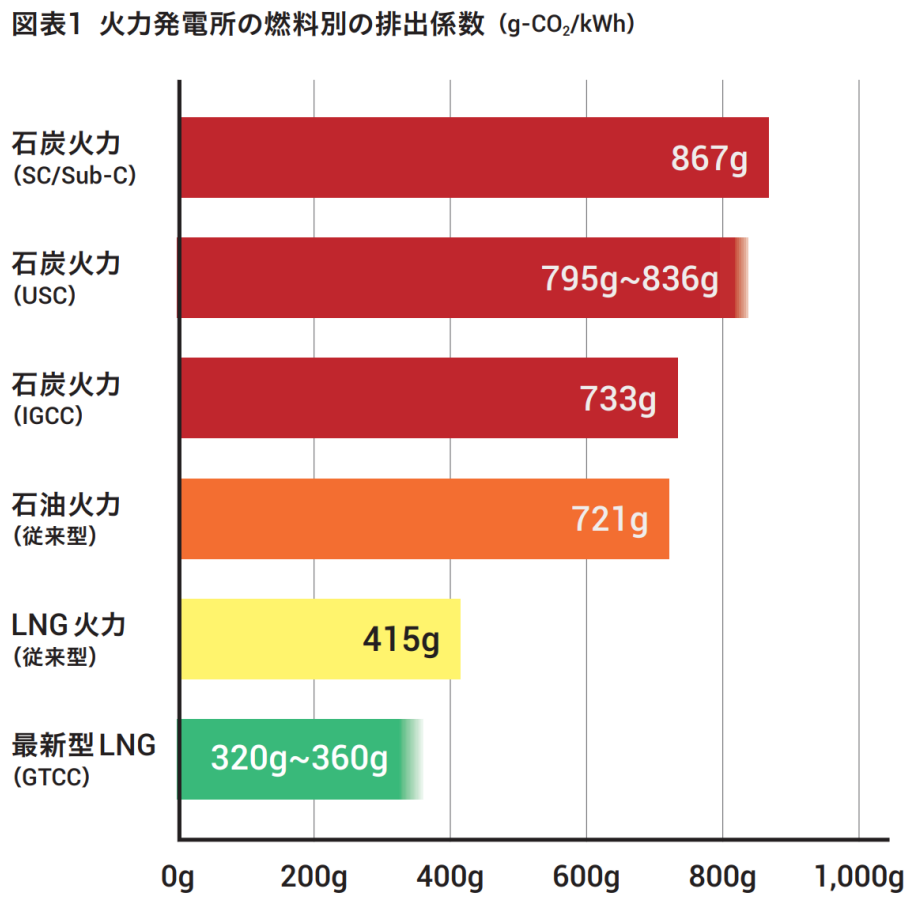
  2035年までに電力部門の全部または大宗を脱炭素化する

- **再エネを2030年までに3倍、省エネ2倍**（COP28）

  2030年までに発電容量を世界全体で3倍にする

Climate change countermeasures are the top priority
International commitment to be made by 2030

Emission factors by fuel types for thermal power plants (g-CO2/kWh)



- Phase-out unabated coal-fired power plants in the early 2030s (G7 agreement)

  Phase out existing unabated coal power generation in energy systems during the first half of the 2030s, or within a timeframe consistent with own net-zero pathway to keep the 1.5°C global warming limit within reach.

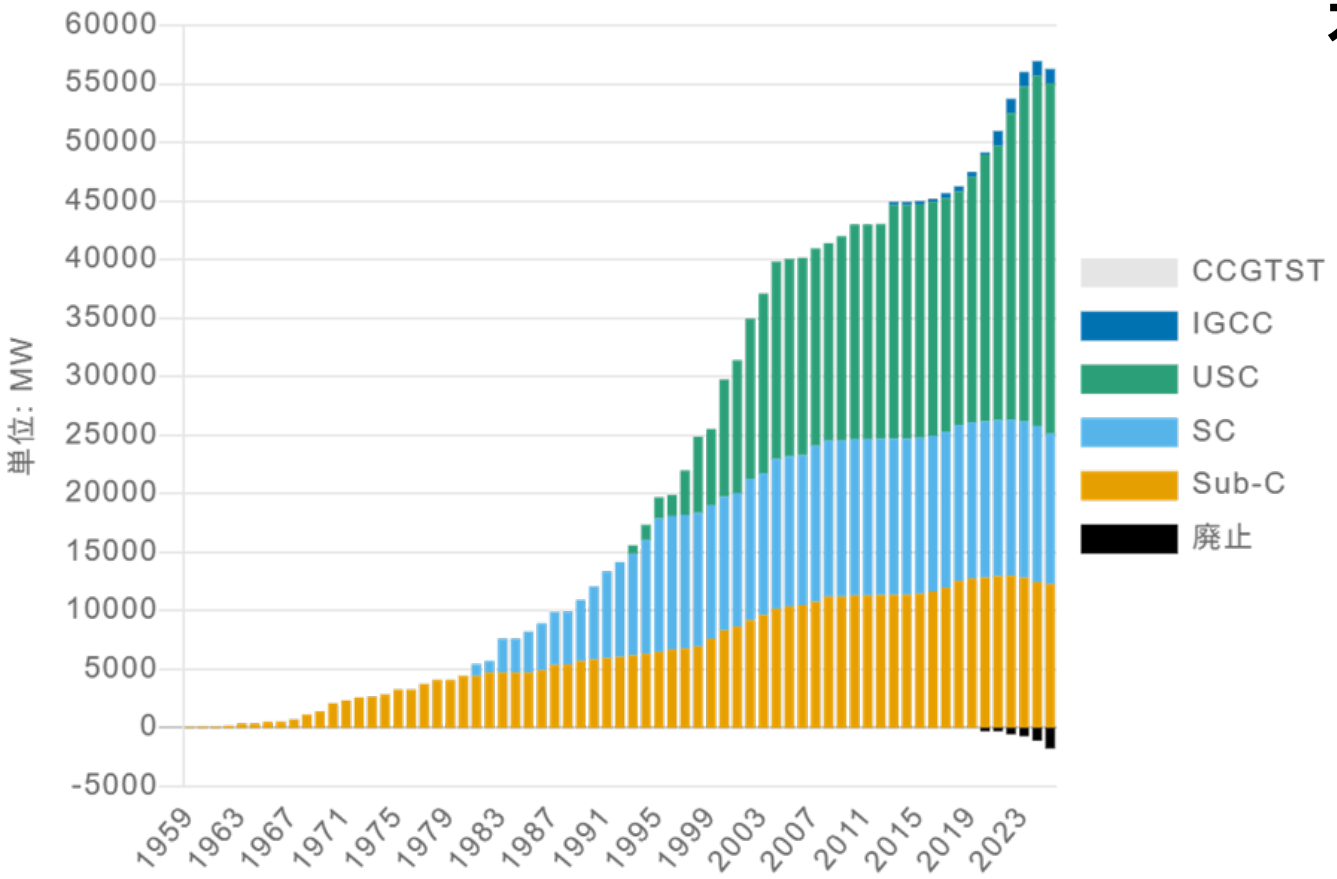
- Achieve a fully or predominantly decarbonized power sector by 2035 (G7 agreement)

  fully or predominantly decarbonized power sector by 2035

- G7 commits to work together to triple renewable energy capacity and double energy efficiency by 2030.（COP28）

  Triple global renewable energy capacity by 2030.

日本では2012年以降の石炭ラッシュで2023年まで建設が続いた

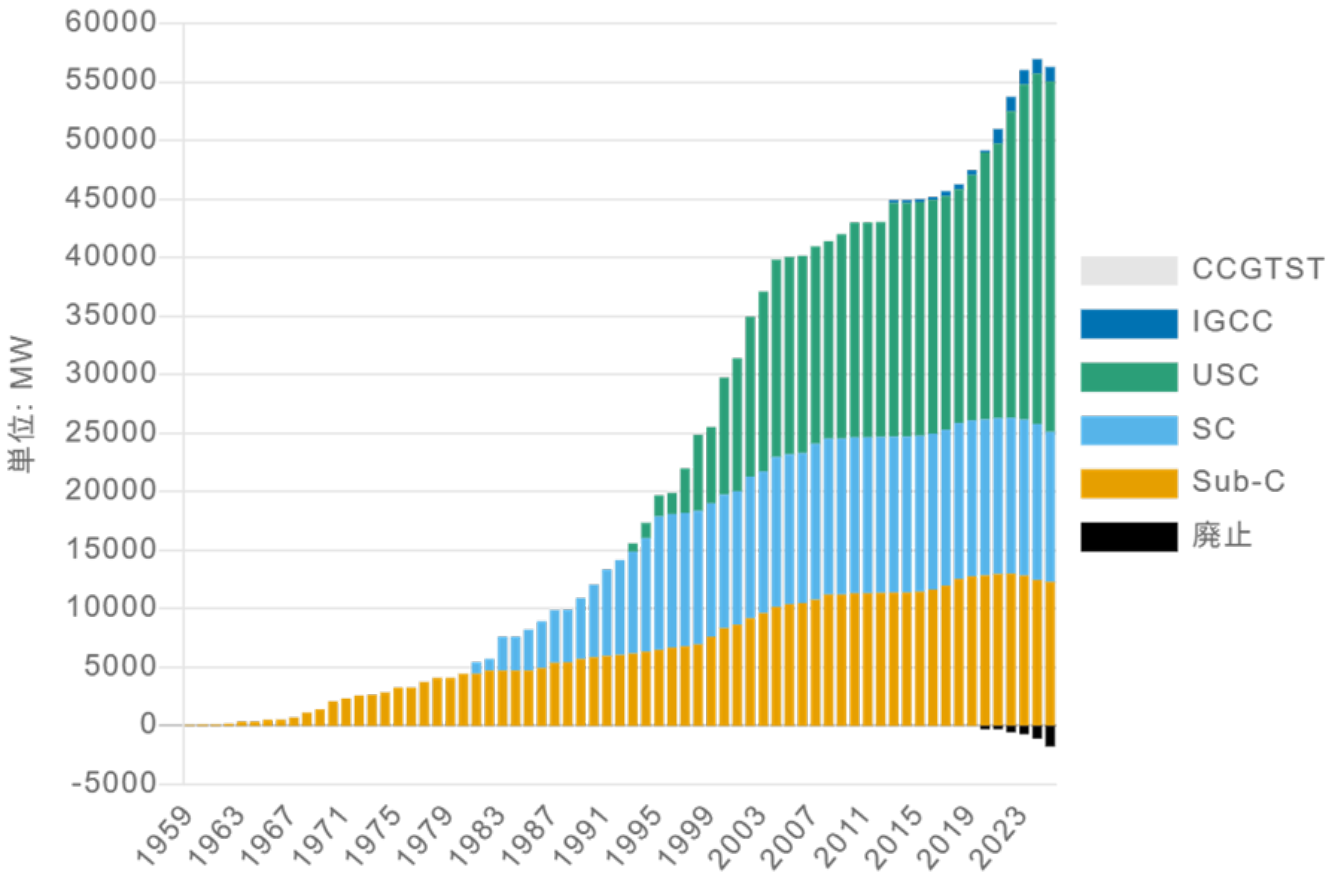


出典）Japan Beyond Coal データベース

石炭火力推進側の理由

- 電力不足への対応／安定供給
- 経済性と価格安定性
- 高効率化でCO2を削減
- 国際貢献＝世界のCO2を削減

In Japan, the construction boom of coal-fired power plants since 2012 continued until 2023.



Source: Data base from Japan Beyond Coal

Reasons for promoting coal-fired power

To deal with power shortage
To provide stable power supply

Economic efficiency and price stability

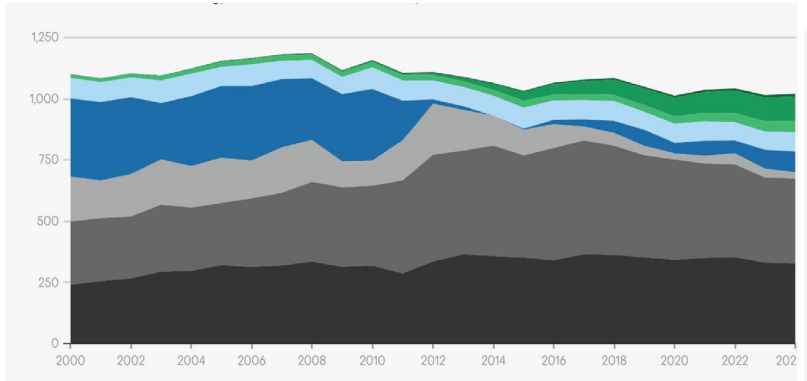
Reduce CO_2 emission by increasing efficiency

International Contribution
= Reducing Global CO_2 Emissions

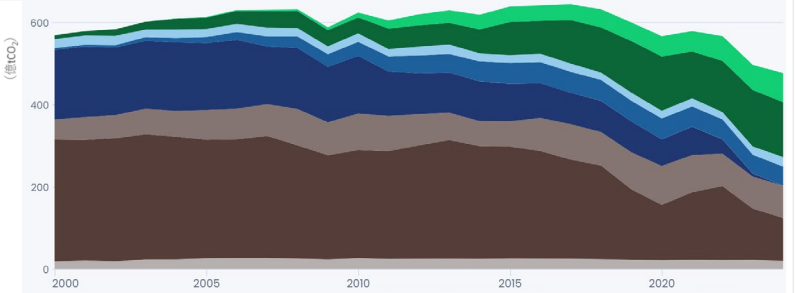
G7で日本だけ減らない石炭

・G7の中で日本だけが唯一2020年以降も石炭火力を増やしてきた。

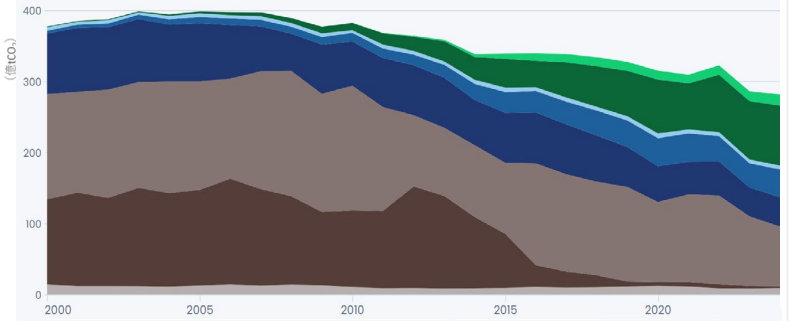
日本



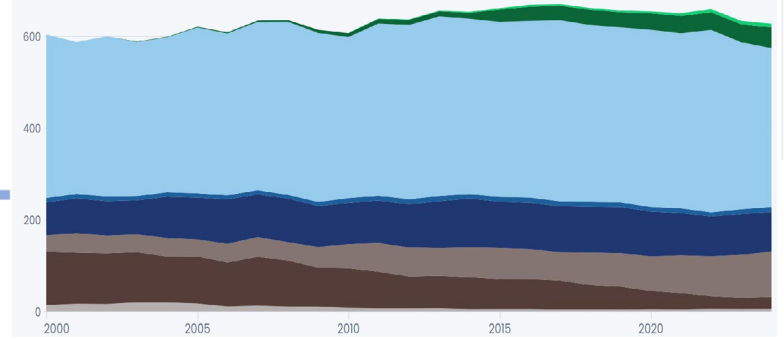
ドイツ



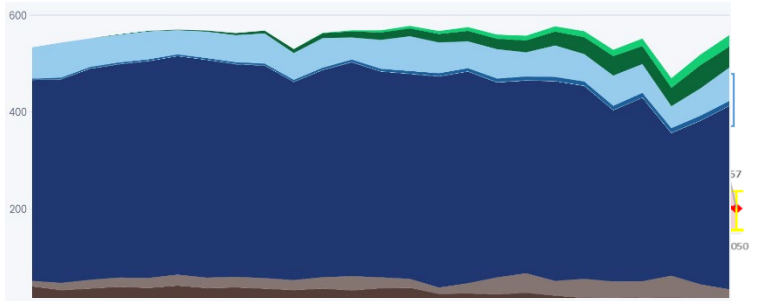
英国



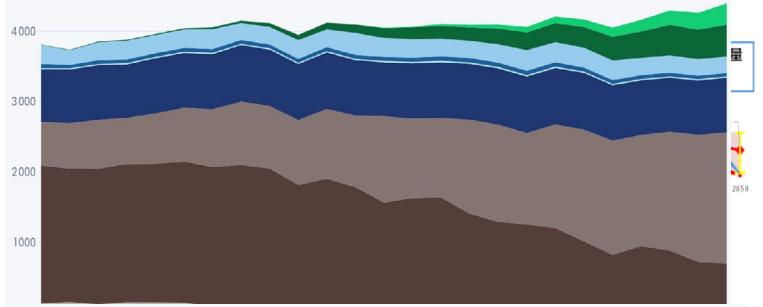
カナダ



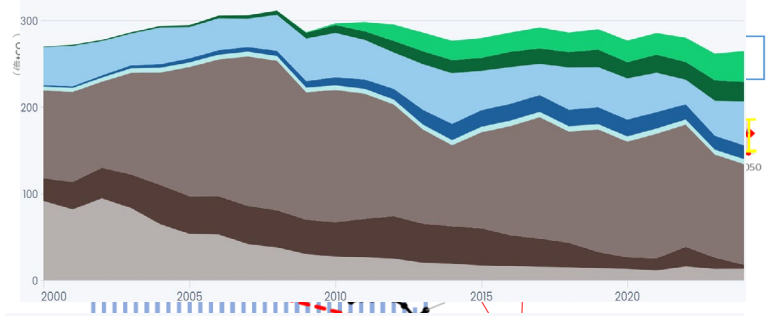
フランス



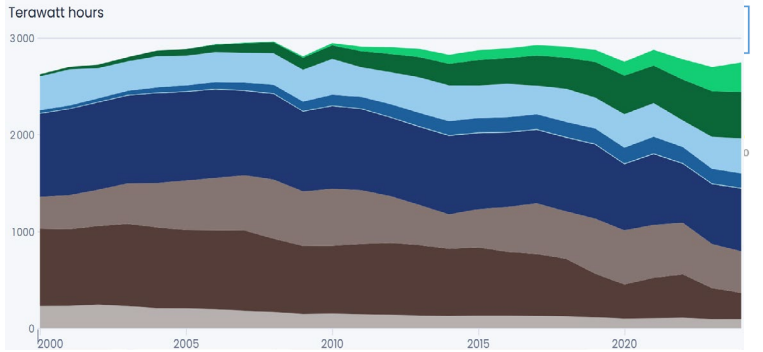
米国



イタリア



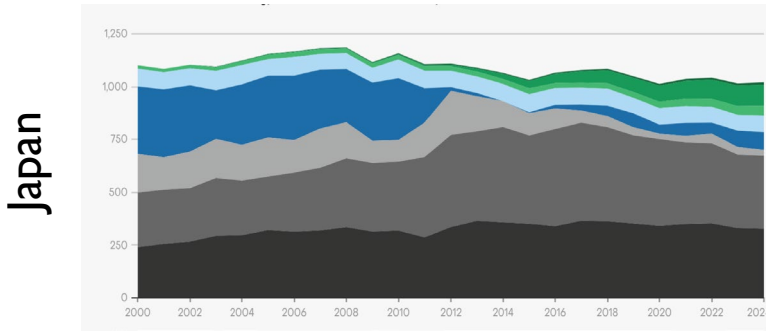
EU

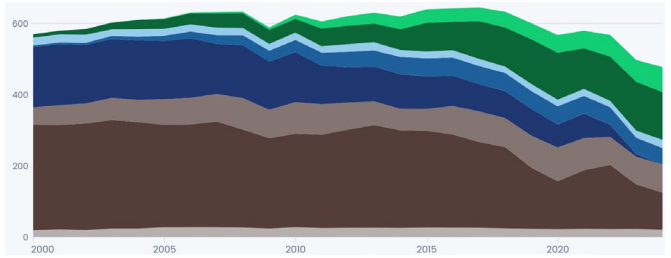


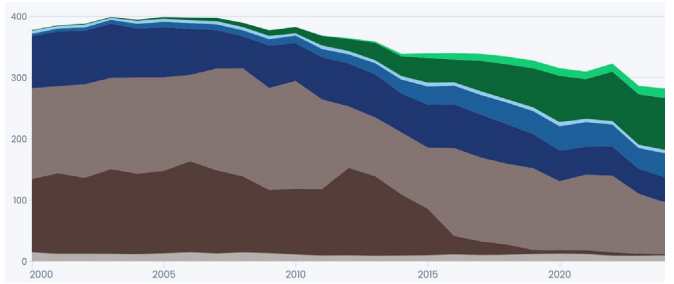
https://ember-energy.org/data/electricity-data-explorer/

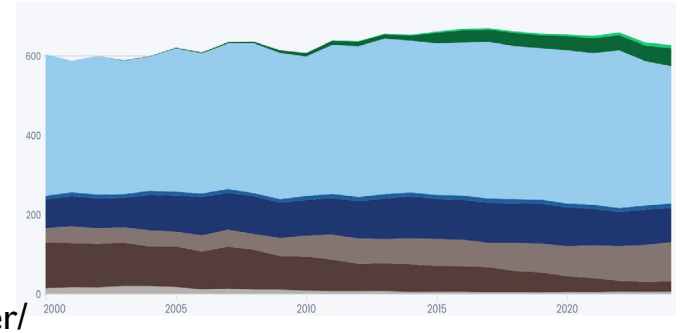
Only Japan is not reducing coal among G7 nations

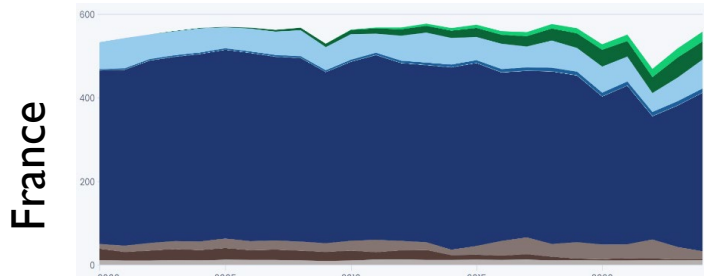
- Japan is the only G7 nation that has continued to increase its coal-fired power generation since 2020.

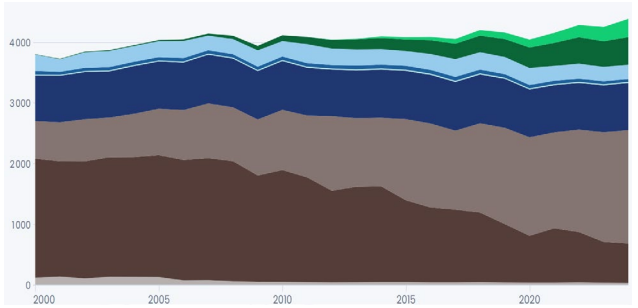


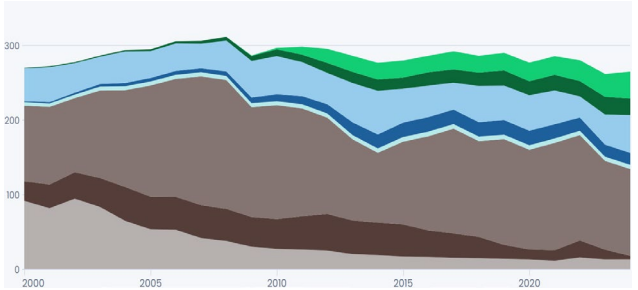


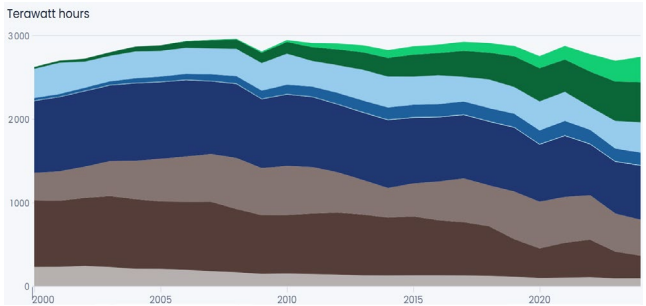












Source: https://ember-energy.org/data/electricity-data-explorer/

第７次エネ基（2025年2月決定）での石炭の位置づけ

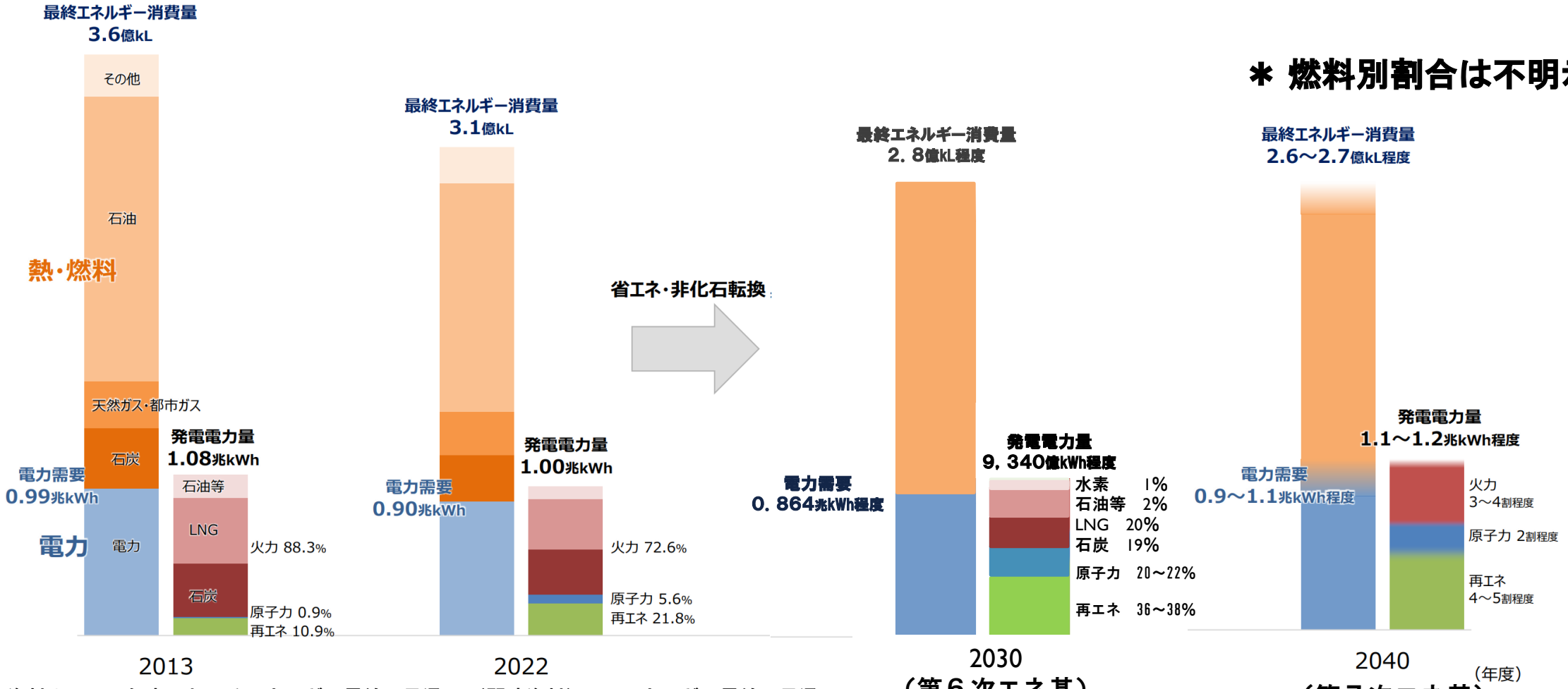
- 第６次エネ基の「安定供給性と経済性に優れた重要な電源」は削除
- 非効率な石炭火力のフェードアウトを進める
- 高効率化やゼロエミッション技術（アンモニア混焼・CCS等）の導入を促進
- 電源構成の多様性確保の観点から、一定の役割を果たす
- 将来的には脱炭素化された火力電源への転換が必要

The Role of coal in the 7th Strategic Energy Plan (Cabinet approved on February 18, 2025)

- Delete “important power sources with excellent supply stability and economic efficiency” from the 6th Strategic Plan
- Promote the phase-out of inefficient coal-fired power plants
- Promote the introduction of high-efficiency and zero-emission technologies such as ammonia co-firing, CCS, etc.
- Coal still plays a certain role from the perspective of ensuring diversity in the power source mix
- Transition to decarbonized thermal power is necessary towards the future

第７次エネ基：エネルギー需給見通し
2030年と2040年の電源構成はほとんど変わらず、原発・火力を維持する方針

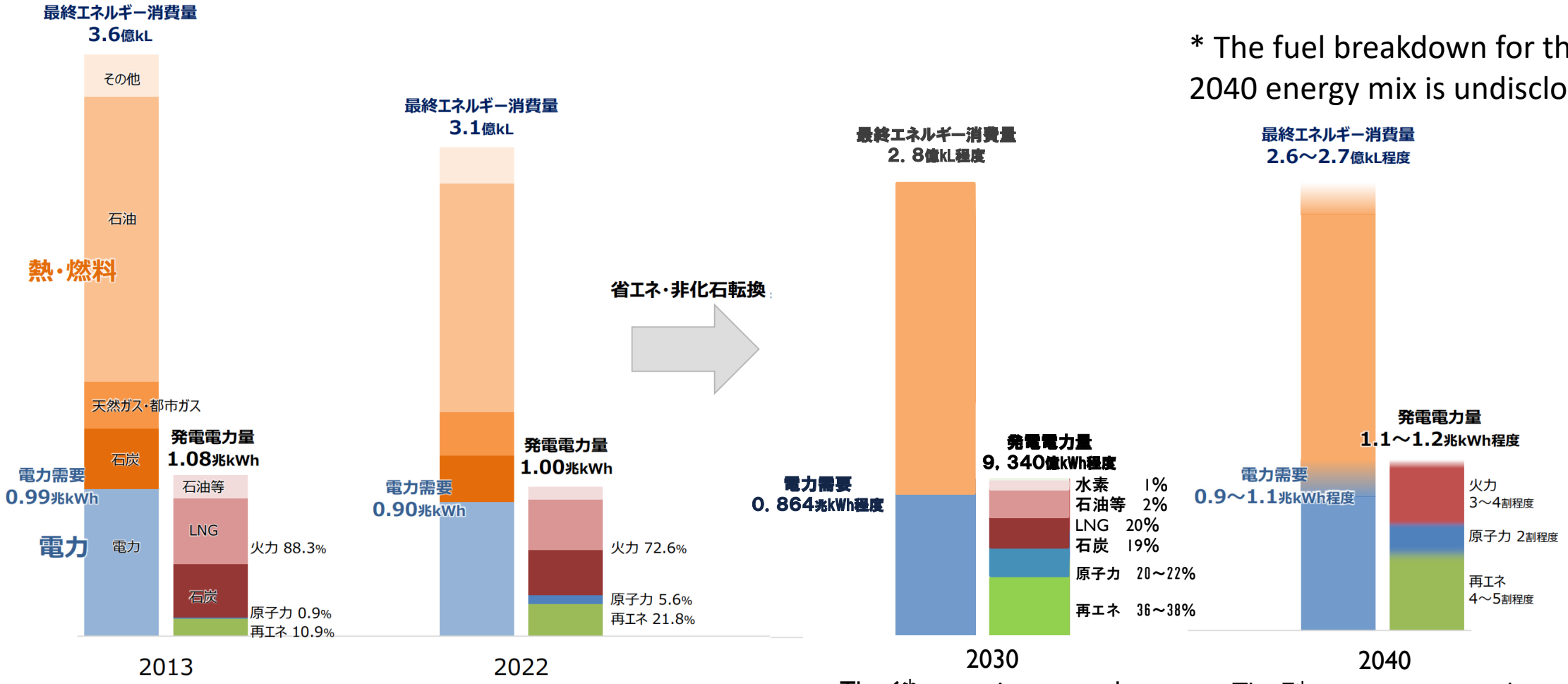
＊ 燃料別割合は不明示



パブコメ資料２　2040年度におけるエネルギー需給の見通し（関連資料）P31 エネルギー需給の見通し（https://public-comment.e-gov.go.jp/pcm/download?seqNo=0000285102）に第６次エネルギー基本計画の2030年の需給見通しを加筆

The 7th Strategic Energy Plan : Energy supply and demand outlook

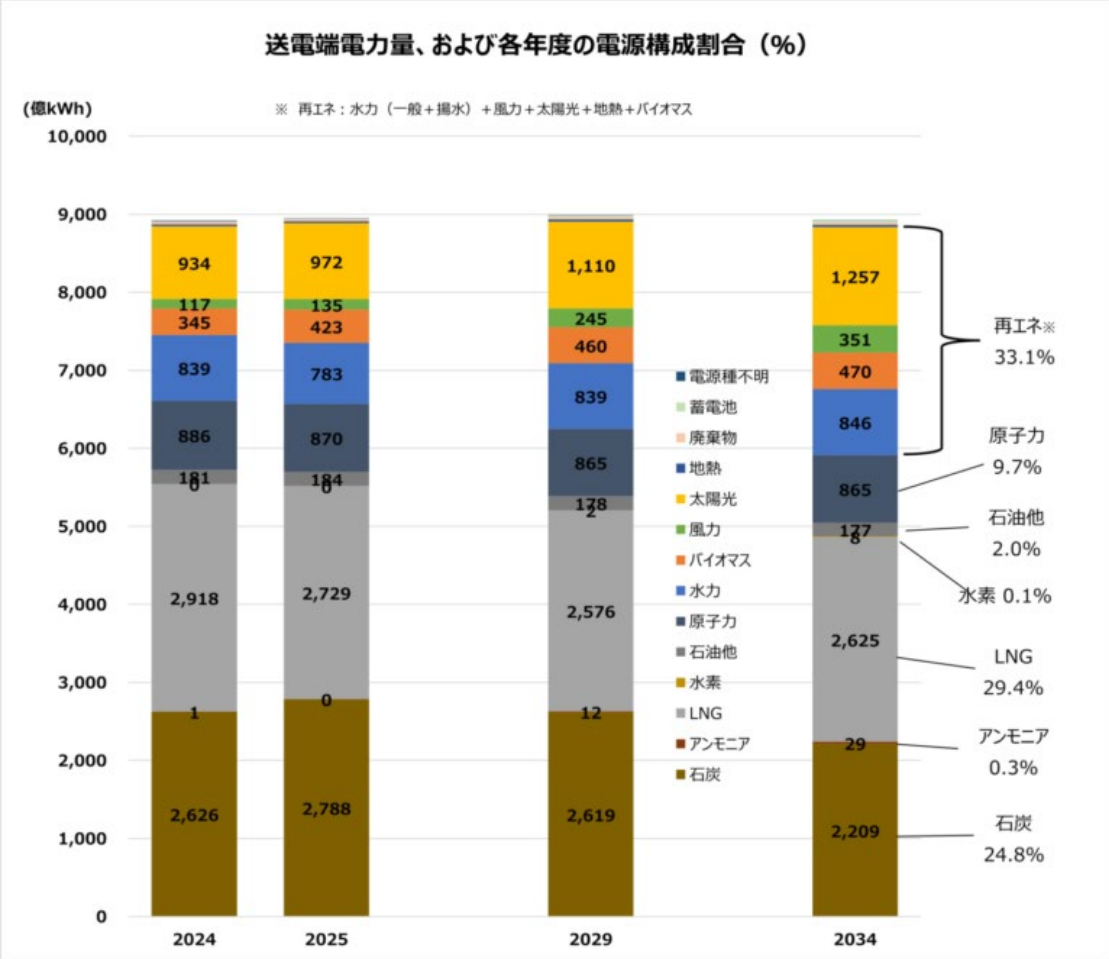
No major change in the power source mix for 2030 and 2040, with a policy to maintain nuclear and thermal power generation.

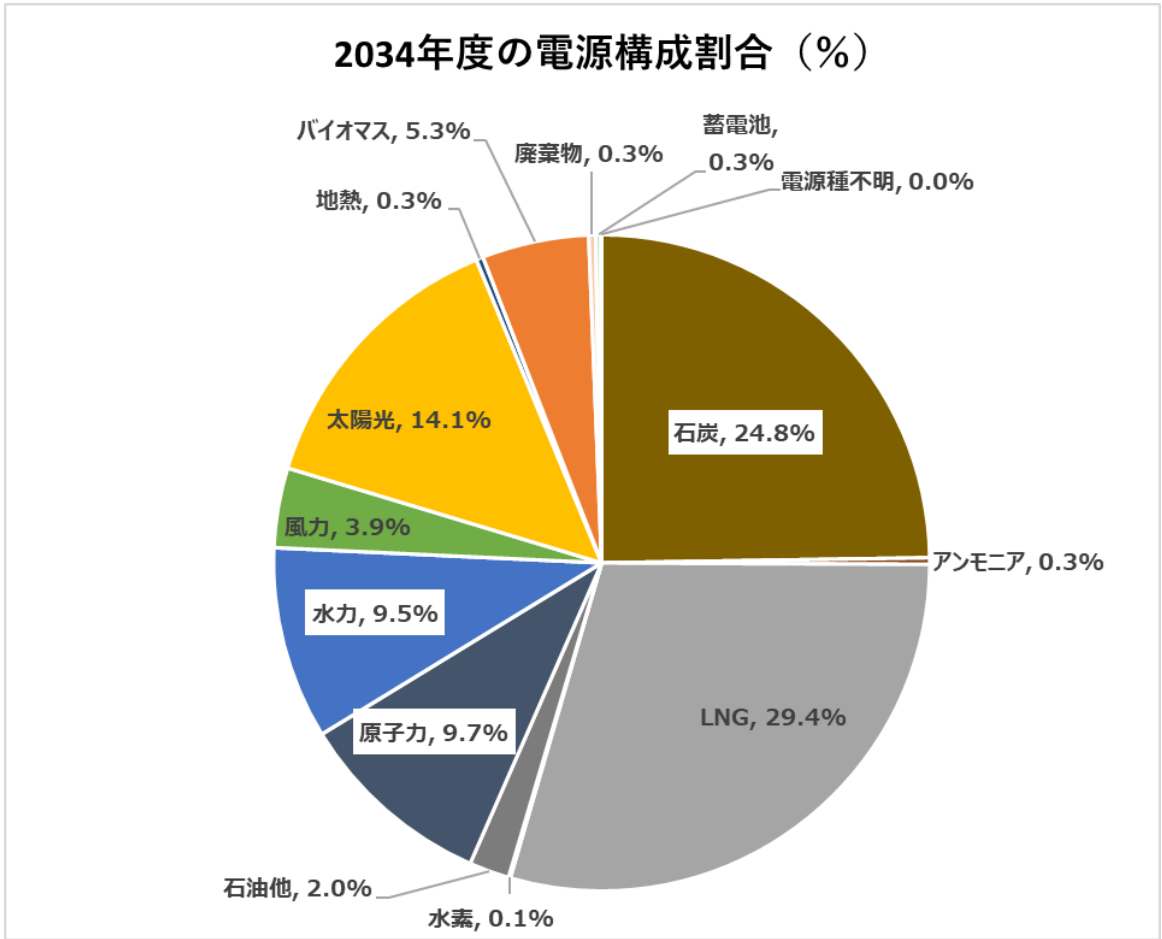


* The fuel breakdown for the 2040 energy mix is undisclosed.

Source: created by Kiko Network based on the public comments document 2 <https://public-comment.e-gov.go.jp/pcm/download?seqNo=0000285102>

電力供給計画の取りまとめによる2034年の電源構成の見通し
石炭火力は現状からほとんど変化なし



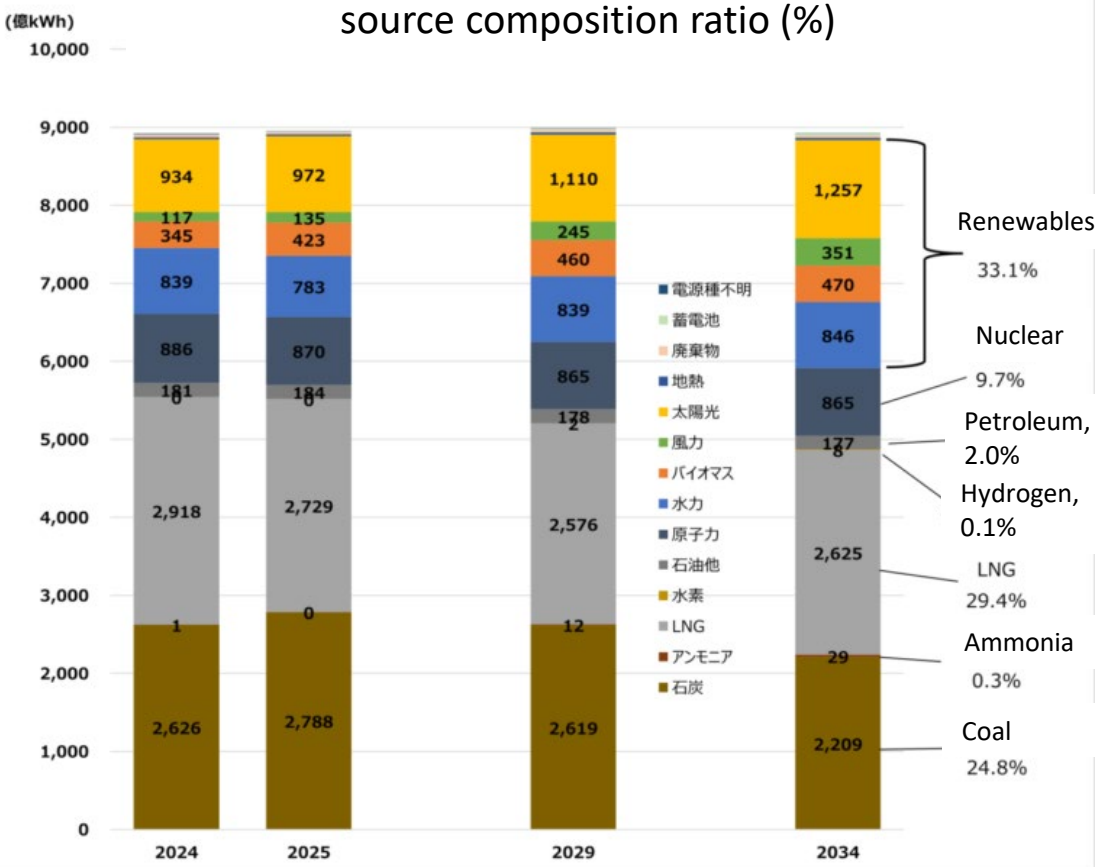


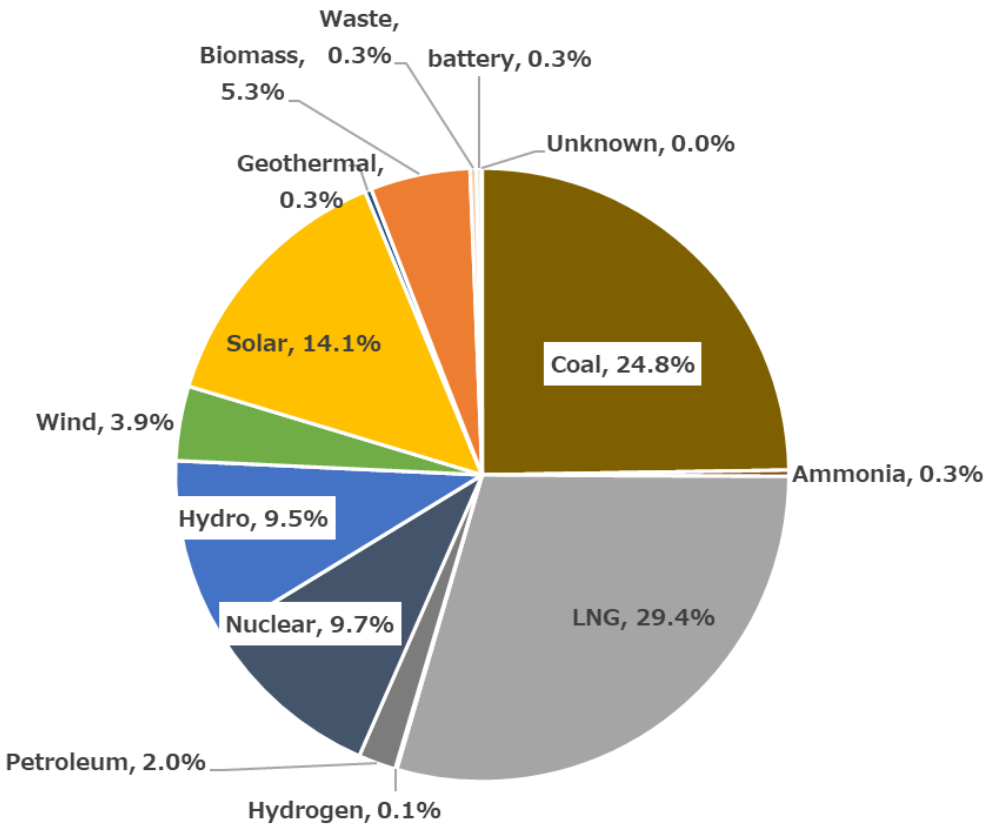
出典）https://beyond-coal.jp/news/occto-electricity-supply-plan2025/

Projected power source mix for 2034 based on the Electricity Supply Plan

Coal-fired power generation will remain largely unchanged from current levels

Energy at sending-end power and annual power source composition ratio (%)





Source: https://beyond-coal.jp/news/occto-electricity-supply-plan2025/

石炭火力の「ゼロエミッション技術」
環境的・経済的・技術的に様々な課題が山積

アンモニア混焼

- ✓ 現状はグレーアンモニア
  （製造時にCO2を大量排出）
- ✓ いまだ実用化していない
  ※20%混焼の実証のみ（碧南４号）
- ✓ 専焼化には技術的ハードル
- ✓ 燃料コストが石炭の数倍
- ✓ 新たなサプライチェーンの構築が必要
- ✓ 燃料の海外依存／エネルギー安全保障
- ✓ 補助金なしで成立しない
- ✓ アンモニアの大気汚染問題
- ✓ 環境アセスなし

CO2回収・貯留（CCS）

- ✓ 回収に大量のエネルギーが必要
  （発電効率は大幅に低下）
- ✓ 回収率は６～７割以下
- ✓ 運搬にもエネルギーとインフラ整備が必要
- ✓ 地震国日本に貯留適地は少ない
- ✓ 長期的なモニタリング体制未整備
- ✓ リスク管理の体制が未整備
- ✓ 2030年から事業化の見通し・遅延の可能性
- ✓ 補助金なしで成立しない
- ✓ 海外貯留には法的・外交的リスク
- ✓ 環境アセスなし

“Zero-Emission” technology for coal-fired power plants
Pile up issues : environmental, economic, and technological challenges

- **Ammonia co-firing**
  - ✓ Currently using gray-ammonia
    (emit large amount of CO2 during production)
  - ✓ Not commercially viable yet
    * demonstration testing in 20% ammonia with coal at Hekinan Unit 4
  - ✓ Technically high hurdles for ammonia mono firing
  - ✓ Fuel cost can be several times that of coal
  - ✓ Need to build new supply chains
  - ✓ Depend on imported fuel （foreign energy sources) / energy security issues
  - ✓ Not viable without subsidies
  - ✓ Ammonia air pollution issues
  - ✓ No EIA requirement

- **Carbon capture and storage (CCS)**
  - ✓ Capturing CO2 requires massive energy input
    (significantly reducing generation efficiency)
  - ✓ Capture rates are 60-70% or lower
  - ✓ Need extra energy and infrastructure for transport CO2
  - ✓ Few suitable storage sites exist in earthquake-prone Japan
  - ✓ Long-term monitoring systems remain undeveloped
  - ✓ Risk management framework remain undeveloped
  - ✓ Expected commercialization from 2030 might be delayed
  - ✓ Not viable without subsidies
  - ✓ legal and diplomatic risks for overseas storage
  - ✓ No EIA requirement

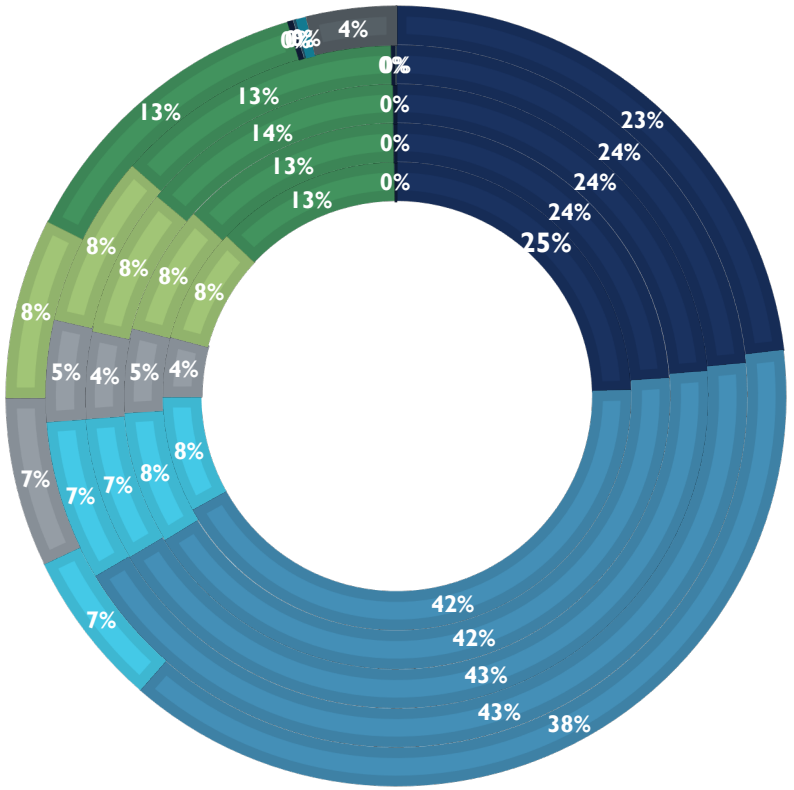
石炭火力の支援策①
「容量市場」の深刻な問題

将来(４年後)の電力供給力を確保するために**既存発電設備**の「容量」に対して、電力会社に報酬を支払う制度。シングルプライス方式で一律に約定価格が支払われる。（kWあたり数千円から１万5000円）
費用は電力小売り事業者に請求。電気代に上乗せされ国民負担に。

- **石炭火力の実質的な延命措置**
- **公的資金（電気代）で石炭を支援**
- **非効率石炭火力も対象**

■ 容量市場落札電源の割合

2020年（内側）～2024年（外側）



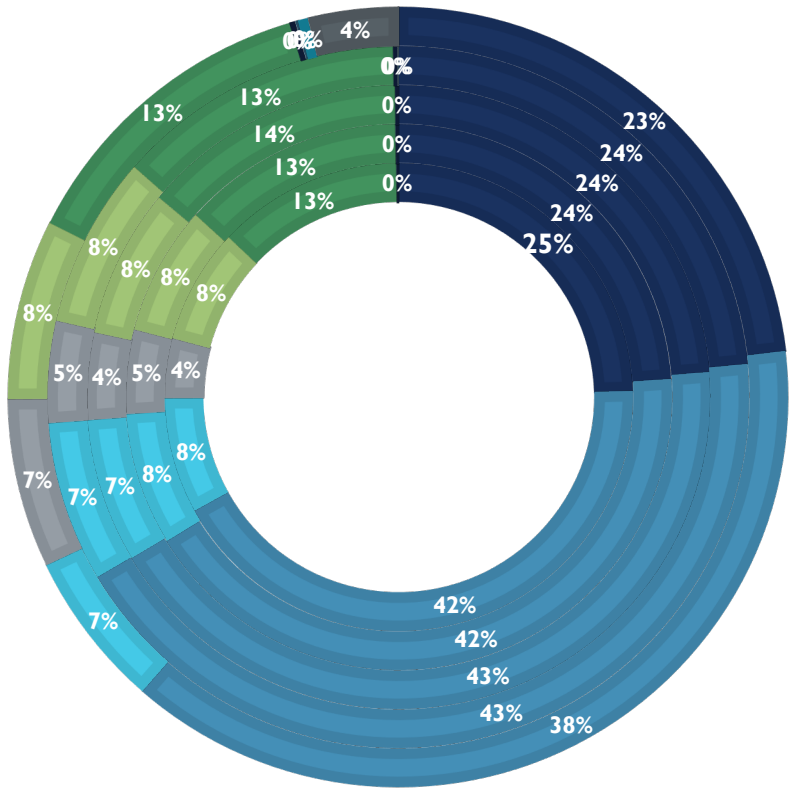
Support measures for coal-fired power (1)
The serious problems with the “Capacity Market”

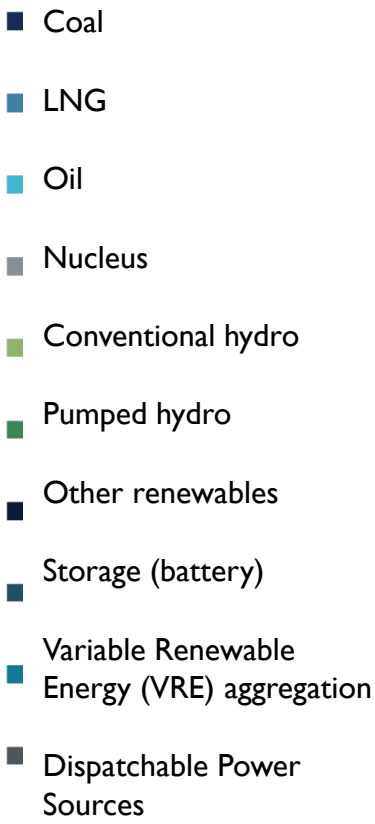
Capacity Market is a system that pays a fixed price per kilowatt-hour to electricity companies to secure future (four-year-future) power supply capacity based on the “capacity” of existing power generation facilities. In the single-price auctions, all winning producers receive a uniform contracted price (ranging from several thousand yen to 15,000 yen per kW). The cost is billed to small electricity retailers and eventually added to electricity bills. Then it will be a burden on the public.

- Measured to effectively extend the lifespan of coal-fired power plants
- Supporting coal with public funds (electricity bills)
- Including inefficient coal-fired power plants

- Capacity Market Winning Power Sources (%)

  from 2020 (inside) to 2024 (outside)





石炭火力の支援策②
「長期脱炭素電源オークション」の深刻な問題

再エネや脱炭素火力などの新設・改修に対し、20年間の固定収入を保証する制度。巨額投資の回収を支援し、供給力の確保と脱炭素化の両立を目指す。石炭火力のアンモニア混焼20%が対象。今年からCCS付の回収20%以上も対象に。アンモニア混焼やCCSの上限価格の設定が他の電源より大幅に上乗せされた。

- 石炭火力の“脱炭素”名目の延命
- 実質的なCO_2削減効果が乏しい
- 既設石炭火力の改修を公的資金で補填

- グレーアンモニアでも支援対象
- 脱炭素ロードマップが形式的
- 事後的なコスト増も補填対象
- 再エネとの競争を歪める
  （再エネが事実上対象外）
- 消費者負担が累積的に増加
- フェーズアウトではなく“改修”促進

Support measures for coal-fired power (2)

The serious problem of “Long-Term Decarbonization Power Source Auction”

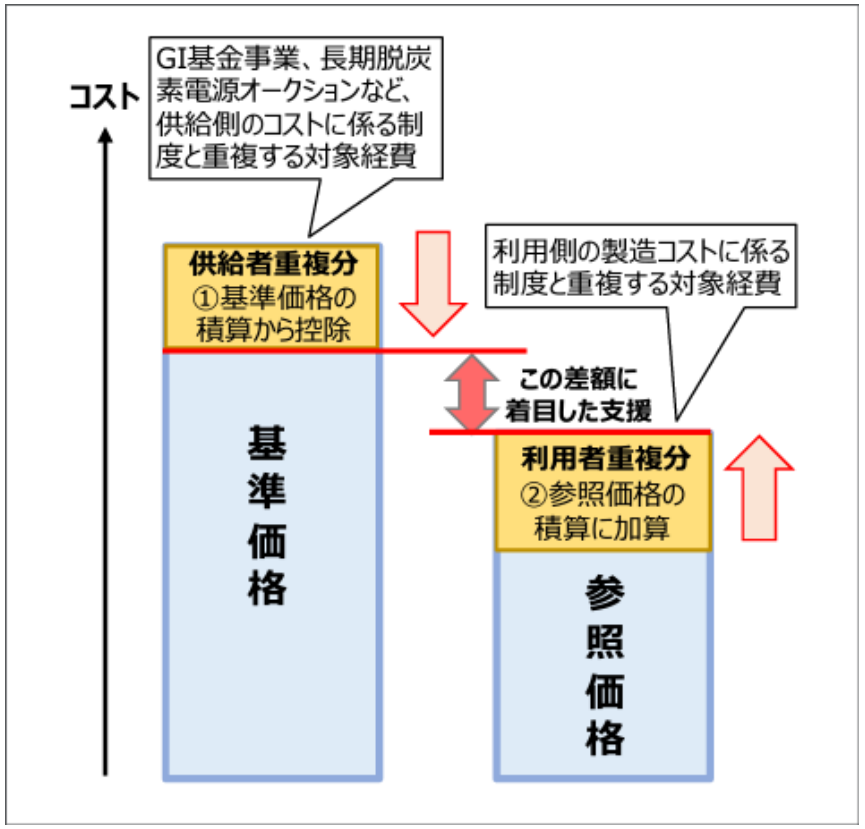
The Long-Term Decarbonization Power Source Auction is a system to guarantee fixed income for 20 years for new construction or retrofitting of renewable energy and decarbonized thermal power plants. Supporting the recovery of massive investments while aiming to balance securing supply capacity with decarbonization. 20% ammonia co-firing is included as a target of this auction. Starting this year, projects achieving over 20% emission reduction with CCS have also become eligible. And the price cap for ammonia co-firing and CCS has been set significantly higher than for other power sources.

- Extend the life of coal-fired power plants as “decarbonized” power sources.
- Substantial CO_2 reduction effects are limited
- Subsidize to retrofit existing coal-fired power plants with public funds

- Support even gray ammonia
- Decarbonization roadmap is merely a formality
- Compensation will cover ex post cost increases
- Prevent healthy competition with renewables (Renewables effectively excluded of this auction)
- Cumulatively increase consumer’s burden
- Promote “retrofitting” rather than phase-out

石炭火力の支援策③
価格差補填制度の深刻な問題

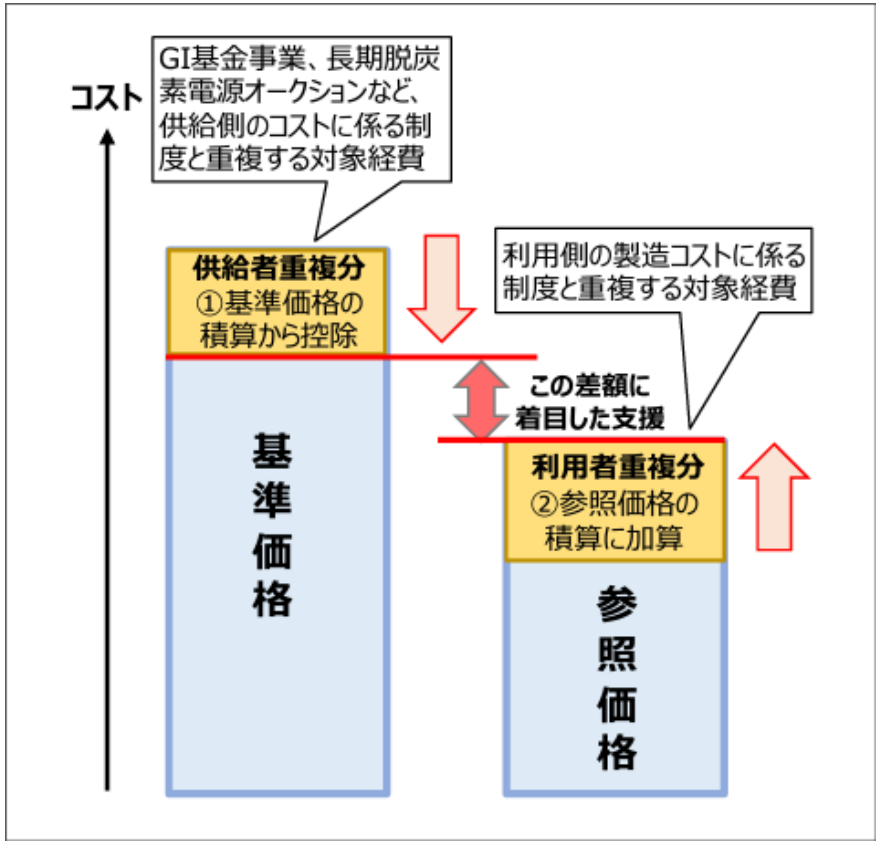
水素社会推進法に基づき、低炭素水素やアンモニアなどの脱炭素燃料の供給コストが既存燃料より高い場合に、その差額を政府が補填する仕組み



- 火力もグレーアンモニアも支援対象
- CO_2削減効果が限定的でも支援対象
- 市場原理を歪める補助金依存構造
- 排出係数や環境性能を評価しない
- 再エネとの競争を阻害
- 支援額の妥当性評価が不透明
- 長期的な財政負担の懸念

Support measures for coal-fired power (3)
The serious problem of “Support focusing on the price gap”

Based on the Hydrogen Society Promotion Act, a mechanism whereby the government compensates for the cost of hydrogen and its derivatives (including ammonia) exceeds that of existing fuels.



- Thermal power and gray ammonia are covered by the governmental support
- Eligible even with limited CO_2 reduction effects
- A subsidy-dependent structure distorting market mechanisms
- No evaluation of emission factors or environmental performance
- Prevent healthy competition with renewables
- No transparency in assessing support amount appropriateness
- Concerns over long-term fiscal burden

まとめ：今後、石炭火力はどうなるのか？

- 現在の政府の様々な支援策が石炭火力を長期にわたって温存する。
- 2030年の目標「石炭19%」の達成も危うい。
- 「脱炭素化」で実施しようとしている手法はCO2削減にならず、かなり高額。

  S＋３E（安全性、経済性、環境性、エネルギー安全保障）を同時に達成できていない

  ↑業界はこれをトリレンマと呼んでいる
- 価格上昇分は、電気代・税金など社会的コストの上昇に確実につながり、その金額は相当大きくなる。
- S＋３Eの達成には、再エネ大量導入＋蓄電池や系統連携強化が最有力となる。

Summary: what lies ahead for Japan's coal-fired power plants?

- The current government's various support measures are keeping coal-fired power plants for the long term.
- Achieving the target of “Coal-19%” in 2030 is in jeopardy.
- The methods the government is planning under “decarbonization” do not reduce CO2 and are quite expensive.

  It is impossible to achieve S + 3E (Safety, Economy, Environment, Energy Security) simultaneously.

  ↑ The industry calls this the trilemma.
- Price increases will certainly lead to higher electricity bills, taxes, and other social costs, and the amount of those cost will be substantial.
- The most effective way to achieve S + 3E requires developing large-scale renewable energy and enhancement of storage and grid integration.