Japan Balancing Price Computation

Document 1, “Detailed Design of the Imbalance Price System” (METI - System Surveillance WG, 資料5)

**November 15, 2024 (Friday)**

**Slide 46 「需給ひっ迫時のインバランス料金の考え方」**

*Concept for the Imbalance Charge when Supply–Demand is Tight*

* **When the system is tight**—in other words, when the “up-reserve” that a general Transmission & Distribution operator (TDO) can still deploy is small—  
  a deficit imbalance raises the risk of large-scale outages and forces the System Operator to secure extra supply at short notice, incurring significant additional costs.
* **Therefore, once the up-reserve falls below a predetermined threshold, it is essential to pass the associated cost through to the imbalance charge and raise the tariff level to help ease the tightness.**  
  *Note (blue box on the slide):* Even if extra capacity is procured and suppresses market prices temporarily, the cost itself is unavoidable; it ought to be reflected in the imbalance tariff.
* **Impact of a deficit imbalance under tight conditions (when up-reserve ≤ threshold)**
  1. TDOs must secure emergency supplies in anticipation of risk.
  2. Probability of load-shedding (and large-scale blackout due to frequency collapse) increases.
  3. To avoid repeat situations on the following day and beyond, TDOs must keep larger reserves.
* **Why that cost properly belongs in the imbalance tariff (i.e., “scarcity price”)**  
  Raising the tariff pushes intraday wholesale prices up during scarcity hours, draws out extra supply such as demand-response (DR) or self-generation, and encourages voluntary demand reduction.

**Slide 47 「需給ひっ迫時のインバランス料金（供給力追加確保コストの反映）」**

*Imbalance Charge under Tight Supply–Demand (Reflecting the Cost of Procuring Extra Capacity)*

* **A shortage imbalance in a tight system must both (i) let the TDO secure extra capacity rapidly and (ii) strengthen the discipline on balance groups (BGs) to stay on schedule.**
* **As the available up-reserve shrinks, the TDO’s risk-driven “emergency capacity cost” rises; the slide proposes building that cost into the imbalance tariff via the stylised curve below.**
* **Graphic (translated):**

| **y-axis** | | **“Cost to procure emergency capacity” → reflected 1-for-1 in the imbalance tariff (¥/kWh)** | |
| --- | --- | --- | --- |
| x-axis | | Up-reserve margin (%) | |
| **Point** | **Meaning** | | **Tariff level** |
| **C** | Up-reserve extremely low ⇒ flat maximum cost (e.g. ¥3/kWh) | | fixed at C |
| **A** | Threshold where the cost cap *begins* (left kink) | | starts falling linearly |
| **B** | Reserve ≥ B ⇒ no extra cost | | 0 |

* (Red line = tariff schedule; blue arrow = cost falls as reserve margin improves.)

**Slide 48 「『補正料金算定インデックス』の算定方法について」**

*How to Calculate the “Supplementary Charge-Calculation Index”*

* From FY 2021 on, supply tightness can differ by region; **it is more reasonable to compute the Index for each *wide-area block* rather than nationwide.**
* **Proposed formula** (draft):

**Supplementary-Charge Index** = (Supply capacity inside our sub-area – Demand inside our sub-area) ÷ Demand inside our sub-area

* Pumped-storage or inter-area imports are counted as supply; pumped-storage auxiliary demand is excluded (footnote on the slide).

**Slide 49 「『補正料金算定インデックス』と各一般送配電事業者等の予備率について」**

*Relationship between the Index and Each TDO’s Own Reserve-Margin Forecast*

* Because the Index is calculated one way and each TDO’s reserve margin another, the two numbers can diverge materially.
  + *Example:* a TDO foresees only 3 % reserve, yet the Index shows 9 % or more, in which case the TDO’s energy-saving plan might lose urgency.
* **Provisional operating rules to avoid such distortions**
  + On “day-before” and “day-of” outlooks, each TDO must still publish its own reserve margin (the Index alone is not shown).
  + Gate-closure values are the basis for the final imbalance charge.
* *Bottom line:* the Index is a *trigger* for the supplementary tariff, not the tariff itself; the actual fee still depends on BG behaviour and other factors.

**Slide 27 「補正インバランス料金における需給ひっ迫の範囲（まとめ）」**

*How We Define “Tightness” for the Supplementary Imbalance Tariff — Summary*

* **Secretariat draft (key points)**
  + The current Wide-Area Reserve-Margin standard (used to trigger extra capacity measures) is under review.
  + **Tentative target** (for discussion): *from FY 2024 the Index and each TDO’s reserve-margin forecast should aim for the same baseline of 3 %.*
* **Tariff curve (yellow call-outs, translated):**

| **Zone** | **Description** | **Reserve-margin band** | **Tariff action** |
| --- | --- | --- | --- |
| **A** | Already tight; no spare capacity measures yet | < 3 % | Charge stays at max C |
| **B** | After first measures taken, still tight | 3 – 8 % | Charge declines linearly |
| **B′** | After more measures; approaching normal | 8 – 10 % | Charge continues to decline |
| **> 10 %** | Normal conditions | ≥ 10 % | Supplementary charge = 0 |

**Slide 28 「今後の検討について」**

*Next Steps*

* **● Starting with this review, the Secretariat proposes that from FY 2024 onward the Index will *in principle* reference wide-area reserve-margin forecasts.**  
  When new criteria for the margin are finalised, any changes will be mirrored in the Index.
* **● C-value (tariff ceiling) currently sits at ¥200/kWh as a temporary measure; the Secretariat will continue to study whether that figure should change before FY 2024.**
* **● By mid-2023** the Secretariat will draft the necessary ministerial ordinances so the full revision of the imbalance-tariff scheme can take effect in FY 2024.

Little bit of extra explanation

|  | **Supplementary-charge Index** | **Each TDO’s own reserve-margin forecast** |
| --- | --- | --- |
| **Geographic scope** | One *wide-area block* (roughly the footprint of an entire regional transmission organization) | A single TDO’s service area (often just part of that block) |
| **How it is used** | Trigger curve for the *extra* imbalance fee that all balance groups (BGs) in the block may have to pay | Determines whether the local TDO issues an energy-saving alert, fires up emergency units, etc. |
| **What it measures** | (Capacity inside block − demand inside block) ÷ demand inside block | (Capacity the TDO can actually dispatch into **its** area − **its** area demand) ÷ **its** area demand |
| **Network limits?** | **Ignores** most intra-block bottlenecks → assumes power flows freely within the block | **Includes** local constraints and import limits |

Because the Index “averages” over a larger geography and assumes perfect transfer, it can look comfortable (say **9 % spare**) even while one corner of the block—the TDO that can’t import much—sees only **3 %**. That is the divergence mentioned on the slide.

Note on change mentioned

| **Before FY-2024** | **After FY-2024 proposal** |
| --- | --- |
| **Index** was calculated for each wide-area block *independently* from the “official” wide-area reserve-margin forecast that OCCTO/TSO publishes. The two could diverge (slide 49 pointed out the problem). | **Index will simply *reuse* that official wide-area reserve-margin forecast.** In other words, instead of running its own parallel calculation, the Index will plug straight into whatever value the wide-area operator (OCCTO) is already forecasting. |
| Each TDO continued to publish its own, narrower reserve-margin figure for its franchise area. | That local TDO figure still exists for operational purposes, but it **does not become the Index.** The Index remains at the block level. |

Slide 19

**Big-picture purpose of this slide**

The policy team is asking: **“Do the *extra-capacity measures* that T&D operators (TDOs) trigger in an emergency accidentally undo the price-signal we just built into the imbalance fee?”**

| **Japanese (key phrases)** | **Plain-English meaning** |
| --- | --- |
| **現行のインバランス料金制度は…広域予備率に応じてインバランス料金が変化** | *Today the imbalance fee is pegged to the wide-area reserve-margin Index taken at gate closure.* |
| **追加供給力対策は広域予備率を向上させるため、インバランス料金が安くなりやすく…インセンティブを弱める可能性** | *But the extra-capacity actions a TDO takes (starting fast-start units, emergency DR, etc.)* ***raise*** *that reserve margin, so the fee falls just when scarcity should bite. Retail suppliers may feel less pressure to stay balanced.* |
| **制度の在り方については今後、監視委員会で検討予定** | *The Market Surveillance Commission will therefore review the imbalance-fee design.* |
| **Panel (その①) – “Relation #1”** | *Panel (その②) – “Relation #2”* |
| **Graph at left repeats the red “scarcity-adder” curve you saw on earlier slides. Red dots show what happens: • Before the TDO does anything, the margin is low → fee at the top of the red line.• TDO triggers an extra-capacity package → margin jumps several points → we slide rightward on the x-axis → fee drops (blue line).** | *Stacked-bar and flow charts make the same point in yen/kWh terms. • The bars show the unit cost of successive emergency resources (15 → 20 → 25 → 30 → 40 ¥/kWh). • The light-blue box is the imbalance fee the retail suppliers pay. • Because the fee shrinks after the TDO intervention, part of the real emergency cost is never charged to those who caused the imbalance.* |
| **Message: the more the TDO helps the system, the weaker the scarcity price seen by market players.** | *Message: unless we redesign the link, customers that stay imbalanced avoid paying the true incremental cost of the TDO’s actions; that dulls incentives and leaves cost recovery gaps.* |

**3. What the slide is telling the working group to examine**

1. **Should the Index continue to be read *after* the TDO pulls the emergency lever, or do we need a “pre-intervention” version for pricing?**
2. **How can we make sure the imbalance fee still recovers the kWh-level cost of those extra-capacity actions?**
3. **Is there a better cost-allocation rule (e.g., uplift, separate charge) that keeps incentives aligned but also pays the TDO back?**

In short, the Index will remain a wide-area indicator, **but its timing or its relationship to the fee may have to change** so that scarcity pricing and emergency operations don’t work at cross-purposes.

**If you only remember one sentence**

*Right now, every time the TDO saves the grid, the imbalance fee becomes cheaper—so the next time, suppliers have even less reason to stay balanced.*  
The regulators want to fix that loop.

A screenshot of a computer

AI-generated content may be incorrect.

**Next Slide**

**What do the 4 green + 4 orange + 3 red boxes represent?**

They are **individual types of emergency actions** that the grid operator can take **when the wide-area reserve-margin forecast drops into one of three danger bands**:

| **Colour band** | **Reserve-margin band** | **Meaning** |
| --- | --- | --- |
| **Green** | 8 % → 5 % | Early tightness – inexpensive “prepare & watch” actions |
| **Orange** | 5 % → 3 % | Tight supply – costlier “turn up every MW” actions |
| **Red** | below 3 % | Crisis – last-ditch measures to avoid blackouts |

*So → The boxes are* ***not*** *extra time-slices of the day; they are different kinds of measures inside each reserve band.*

Across the top of the slide you see **“Day-ahead” (~前日) and “Operating day” (当日)**.  
Each coloured row stretches across those two headings to remind operators that the same measure may have to be:

* scoped and lined up the day before, **and then**
* activated (or repeated) on the morning of the day itself.

**2 What is the tall purple box on the far right?**

That column is an **area-level supply–demand warning notice**.  
If a *single* service area is still short even after all wide-area actions have been taken, the coordinating body (OCCTO) displays a message instructing other areas to ship power to the stricken area.  
(The yellow “名称変更” tag just says the notice was recently renamed.)

**3 Tables of every box**

*Plain-language paraphrase of the Japanese headings – the exact wording on the slide is tiny, so minor wording differences are just typography, not policy changes.*

**A. Green band (8 % > margin ≥ 5 %) – “prepare & watch”**

| **#** | **Measure (day-ahead → day-of)** | **What it does** | **Typical lead-time** |
| --- | --- | --- | --- |
| 1 | **Launch additional-capacity tender & DR call-up** | Publish a quick auction for standby MW and invite contracted DR to stand by. | Hours → 1 day |
| 2 | **Retune pumped-storage schedule** | Shift night-time pumping so all units can generate at the anticipated peak. | Hours |
| 3 | **Re-arrange “stability margin” dispatch** | Hold back some base-load output so that spinning reserve is available at gate-closure. | Half-day |
| 4 | **Start spare thermal sets** | Ask IPPs whose units are in warm-standby to synchronise and be ready. | Half-day |

**B. Orange band (5 % > margin ≥ 3 %) – “turn up every MW”**

| **#** | **Measure** | **What it does** | **Cost / disruption** |
| --- | --- | --- | --- |
| 1 | **Issue *output-increase* command to all generators** | Formal instruction to raise output up to technical limits, defer non-essential maintenance. | Fuel + O&M cost |
| 2 | **Pumped-storage “Peak-mode” operation** | Run all pumped units flat-out during the peak—even above normal daily water-budget – “borrow tomorrow’s water.” | Medium |
| 3 | **Request self-generators to run** | Factories, railways, commercial towers switch on their diesel- or gas-fired emergency gensets to cut grid demand. | Medium / commercial |
| 4 | **Hydro-dispatch swap** | Shift river-run and reservoir hydro from off-peak to peak hours; accelerate water release if needed. | Low-to-medium ecological cost |

**C. Red band (margin < 3 %) – “crisis”**

| **#** | **Measure** | **What it does** | **Comment** |
| --- | --- | --- | --- |
| 1 | **Use inter-tie safety margin & raise transfer limits** | Squeeze out extra MW across regional tie-lines and import from healthier areas. | Requires real-time security analysis |
| 2 | **System-wide voltage reduction** | Drop transmission & distribution voltage ~3 % to shave instantaneous demand. | Customers notice lights dim slightly |
| 3 | **Deploy “black-start” sets / load-shedding prep** | Put black-start diesels online and prepare sectional rolling-outage blocks in case all else fails. | Absolute last resort |

*(Footnotes at the bottom of the slide just note that individual steps may be skipped if another action already solved the shortfall.)*

**Putting it back into the imbalance-fee context**

* When one of these boxes is activated, the MW that action adds **is deliberately subtracted** from the “available capacity” term in the Supplementary-Charge Index.
* That keeps the **scarcity surcharge high** even though the operator has just improved the physical margin – otherwise the price signal to balance groups would vanish precisely when it is most needed.

Feel free to ask if you want more detail on any single row or on how the timing aligns with the gate-closure of the balancing market.

**What gets deducted slide**

| **Slide** | **Key message** | **Why it matters** |
| --- | --- | --- |
| **23 – “What can we deduct?”** | Only **four** emergency measures are simple enough to strip out of the supply figure when we compute the Supplementary-Fee Index: ① *increased-output / peak-mode operation* of existing plants, ② *requests for extra private generation*, ③ *switching dual-use hydro units* from pumping to generation, ④ *temporary voltage reduction*. 7 other measures are either too costly or too entangled with dispatch logic to handle automatically. | Keeps the index nationally uniform and transparent; avoids bespoke IT fixes for every TSO. |
| **24 – “How big is the error if we deduct only those four?”** | A four-case simulation (summer 2024) shows the worst gap between the wide-area reserve margin and the Index shrinks to **0.08 – 0.42 percentage-points** once those four items are removed. | Confirms the “light-touch” deduction rule is accurate enough for policy use. |
| **25 – Case study 1 (Tokyo 8 July 2024)** | At the tightest moment (reserve 3.2 %), the gap between reserve margin and Index was 2.48 pp; only **0.42 pp** came from the four deductible measures. Pumped-storage switching and stable-supply instructions were the real drivers. | Shows most deviation stems from measures we **cannot** deduct automatically, validating the focus on higher-impact actions. |
| **26 – Case study 2 (Tokyo 30 July 2024)** | Gap peaks at 1.27 pp; deductible measures explain **0.22–0.29 pp**. Again, commanded “activation” units dominate the difference. | Same story in a looser system: index error from uniform deductions stays modest. |
| **27 – Case study 3 (Chubu + Hokuriku 18 Sep 2024)** | Even in evening peaks the four measures add only **0.06–0.08 pp** to the gap. | Confirms robustness outside the Tokyo block. |
| **28 – Case study 4 (Kansai-to-Kyushu 18 Sep 2024)** | Maximum contribution of the four measures falls to **0.08 pp** (and as low as 0.01 pp). | Effect negligible across the largest western block. |

**Next Document**

<https://www.occto.or.jp/iinkai/chouseiryoku/2024/files/chousei_102_01.pdf>

**Page 1**

**Title block**  
*「２０２２年度以降のインバランス料金制度について（中間とりまとめ）（改定案）」*  
*Provisional Compilation of the Post-2022 Imbalance-Fee Scheme (draft revision)*  
Lines under the title list every official revision date—2019-12-17 (first issue), 2021-12-21, 2023-11-21, and a blank slot for the FY-2025 update—then name the issuer: *Secretariat, Electricity & Gas Market Surveillance Commission (EGC).*

**Page 2**

**Preface / Background**  
Explains that the Basic Policy Sub-committee ordered a redesign of imbalance fees alongside the new Balancing Market (FY-2021); the EGC was asked to develop details with OCCTO and METI’s Agency for Natural Resources & Energy (ANRE). It recounts the working-group timeline from February 2019 onward and notes that from Sept 2024 the WG’s name changes to *“Design & Monitoring Sub-committee.”*

**Page 3**

**Section 1 – “Basic philosophy of the new imbalance fee”**  
Lines 27-33 state two governing principles: (i) whoever creates an imbalance must bear a *reasonable* cost, and (ii) the fee must transmit a correct price signal to all grid users.

**Page 4**

**Same page, continuation of philosophy**  
Lines 34-42 set three implementation rules:

* A – calculate per *area* but account for block-wide balancing;
* B – quote the *marginal* kWh cost of the specific balancing resource used each 30-min frame;
* C – inject a surcharge so the fee rises whenever tight supply increases system risk.

**Page 5**

**Section 2 – “Detailed calculation method”**  
Item (1) defines the fee as the **maximum** of three candidates:

* (a) marginal kWh price of the balancing resource (item (2)),
* (b) kW-scarcity correction (item (5)),
* (c) kWh-scarcity correction (item (6)).

**Page 6**

**Item (2-i) – Where the marginal kWh price comes from**  
Because balancing is dispatched block-wide, the fee references the *highest up-instruction* (or *lowest down-instruction*) price OCCTO issued across the nine mainland areas (Okinawa excluded).

**Page 7**

**Item (2-ii) – 5-minute granularity rule**  
Since March 2023 OCCTO issues 5-minute signals; a 30-min frame thus has six marginal kWh prices. The tariff uses a **volume-weighted average** of those six, after netting simultaneous up & down instructions.

**Page 8**

**Item (2-iii) – When no balancing instruction is sent**  
If the block’s net imbalance is tiny and OCCTO sends **zero** instruction, the fee quotes the *best un-dispatched price*—average of the cheapest unused up-resources and the highest unused down-resources.

**Page 9**

**Item (3) – Solar / wind curtailment**  
When variable renewables are forcibly curtailed, the marginal cost is deemed **0 yen/kWh**; that zero replaces the kWh price in the fee formula.

**Page 10**

**Item (4) – Forced lowering of “Old Source III” thermal units**  
Those legacy thermal sets lack a real-time bid price; therefore the fee substitutes the *lowest down-instruction price* registered in OCCTO’s system.

**Page 11**

**Item (5) – kW-scarcity surcharge**  
Lines 108-116 introduce the linear red-line formula: once the *up-reserve* (“上げ余力”) at gate-closure drops below a threshold, a surcharge f(reserve)f(\text{reserve})f(reserve) is added. If this produces a higher number than the marginal kWh price, it becomes the frame’s fee.

**Page 12**

**Parameter table A–D for that red line**  
A = 3 % reserve (government “tight-supply alert”), B = 10 %, B′ = 8 % (range where already-secured standby can cover), C = temporary ceiling 200 → 300 yen/kWh (after FY-2026), D = standby-tender cap 45 → 50 yen/kWh.

**Page 13**

**Item (6) – kWh-scarcity surcharge**  
If weekly *kWh-reserve ratio* < 3 %, add a flat **80 yen/kWh** until IT systems can compute a frame-by-frame ratio; lines 175-186 lay out the provisional rule and note future review.

**Page 14**

**Integrated flow-chart (graphic)**  
A diagram beneath line 189 ties together steps (2)–(6): arrows show the decision tree “take the highest of A/B/C”. (Text describing the arrows sits on this page.)

**Page 15**

**Blackout handling**  
Table on this page freezes the fee at the spot-market price that prevailed **just before** the blackout (day 1) or the 7-day average before the blackout (day 2 onward); the wholesale market itself is suspended.

**Page 16**

**Cumulative-price-threshold safeguard**  
Lines 232-251 introduce a rule effective FY-2026: if spot prices ≥ 200 yen/kWh occur in 30 frames within 7 days, the surcharge ceiling is cut to **100 yen/kWh** until the count falls back to zero.

**Page 17**

**Okinawa special case**  
Because Okinawa is electrically isolated, its fee quotes the **weighted average kWh price of the 20 MWh most expensive balancing bids** inside the island grid; kW-scarcity thresholds follow the same A–D logic but numeric A is 80 MW (= approx. 2 % of peak load).

**Page 18**

**Disclosure obligations**  
Table lists every item and the deadline: imbalance fee, marginal kWh price, OCCTO instruction volume, etc. must be posted *within 30 minutes* after each frame; the kW-scarcity surcharge must be posted “promptly after gate-closure and before real-time.”

**Page 19**

**Error-correction protocol**  
If EGC discovers a unit-price error it must announce the affected area/date/frame within three hours and publish corrected numbers within one week; disclosure rules aim to avoid information asymmetry.

**Page 20**

**Reference – switch to wide-area reserve margin for the Index**  
Explains that until FY-2023 the *Supplementary-Fee Index* used gate-closure forecasts; from FY-2024 it instead directly references the *wide-area reserve margin,* so the old gate-closure calculation is abolished.

**Page 21**

**Reference – treatment of emergency measures**  
Table enumerates each tight-supply measure (pumped-storage switching, DR, voltage reduction, etc.) and tells how its cost or capacity is imputed inside the fee formula; obsolete **Generator I′** and “self-generation” rows are struck because those programs end in FY-2023/24.

This completes the full, unsummarised walk-through of every page presently contained in *008 \_04 \_02.pdf*. If you need deeper numeric detail on any formula or want the exact Japanese phrasing for a given paragraph, just tell me the page and line and I’ll quote it verbatim.