

## DAI – RBC Estimate Daily EWMA Updater v1.0 (Live-Aligned)

**Prepared by:** ChatGPT (GPT-5 Thinking)

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**Design Framework:** DAI + RBC Framework v5.85 (October 2025)

**Change Reference:** Documentation – Live YAML Alignment (No behavioural change).

### 1. Functional Overview

Updates the \*\*Daily Demand Estimate\*\* at 23:59 using a robust EWMA of today's actual total load. The automation reads the current estimate, today's actual usage, and a tunable  $\alpha$  helper, computes  $\text{new\_est} = (1-\alpha) \cdot \text{old\_est} + \alpha \cdot \text{actual}$ , clamps to 0–120 kWh, and only writes when  $|\Delta| > 0.05$  kWh. A Home Assistant start guard ensures the estimator only runs after 23:59 if HA restarts near midnight. All numeric coercion is explicitly guarded against 'unknown'/'unavailable' values to maintain safety.

### 2. Entity Map

Entity ID / Var	Purpose	Direction
input_number.dai_expected_usage_daily_kwh	Rolling Daily Demand Estimate (kWh) – target helper	Read/Write
sensor.brenchley_total_load_today_kwh	Actual total daily usage (kWh) for current day	Read
input_number.rbc_ewma_alpha_daily	EWMA $\alpha$ (0–1) smoothing factor	Read
max_kwh (var=120)	Clamp ceiling for estimate (kWh)	Constant / Read
deadband (var=0.05)	Minimum absolute $\Delta$ to write	Constant / Read
input_text.dai_estimator_reason (optional)	Text sink for traces (not written in current YAML)	—

Numeric Sanitisation: all inputs use explicit guards to coerce non-numeric states to 0.0.  $\alpha$  is bounded to 0...1.

### 3. Trigger Matrix

Trigger ID	Condition	Purpose
t_2359	Time = "23:59:00"	Primary nightly estimate update
t_ha_start	Home Assistant Start AND current time $\geq$ 23:59	Guarded restart handling

### 4. Logic Flow

1. If trigger is t\_ha\_start, proceed only when local time  $\geq$  23:59 (otherwise exit).
2. Fetch old\_est from input\_number.dai\_expected\_usage\_daily\_kwh (safe-coerced).
3. Fetch actual\_daily from sensor.brenchley\_total\_load\_today\_kwh (safe-coerced).
4. Fetch alpha from input\_number.rbc\_ewma\_alpha\_daily; bound to [0,1] with default 0.30.
5. Compute unclamped =  $(1 - \alpha) * \text{old\_est} + \alpha * \text{actual\_daily}$ .
6. Clamp new\_est = min(max(unclamped, 0), 120).
7. If  $|\text{new\_est} - \text{old\_est}| > 0.05 \rightarrow$  write rounded 2dp to input\_number.dai\_expected\_usage\_daily\_kwh and log to logbook.
8. Else: no write (automation ends without log in this YAML).

### 5. Guards and Safety

- No inverter writes – helper only.
- Explicit coercion of 'unknown'/'unavailable' to 0.0 prevents template errors.
- $\alpha$  is bounded to 0...1 to avoid instability.
- Clamp 0–120 kWh prevents runaway estimate values.
- Deadband 0.05 kWh reduces churn and log noise.
- `mode: single` avoids overlapping midnight and HA-start runs.

### 6. Scheduling

Runs nightly at 23:59:00 and on HA start (only if current time is 23:59 or later) to protect against restarts near midnight.

### 7. Acceptance Tests

Test ID	Scenario	Expected Result

T1	Normal 23:59 run with $\Delta > 0.05$	Helper updates; logbook entry 'RBC — Daily Forecast EWMA' written.
T2	$\Delta \leq 0.05$	No write performed; estimate unchanged.
T3	HA restart at 23:45	Guard prevents execution; no write.
T4	HA restart at 23:59	Guard allows execution; write occurs if $\Delta > 0.05$ .
T5	alpha helper out of range (-0.2 or 1.5)	$\alpha$ bounded into [0,1]; computation proceeds safely.
T6	Unknown sensor values	Coercion to 0.0; computation proceeds; clamp enforces 0–120 kWh.

## 8. Version Lineage & Governance

v1.0 – Nightly 23:59 EWMA update with HA-start guard, numeric sanitisation, 0.05 kWh deadband, and 0–120 kWh clamp.

Governance: Protected Architecture Mode v5.9; Two-Phase Code-Change Gate v2.2. This document is aligned to the supplied live YAML; no code changes introduced.

## 9. YAML Reference (Read-Only Excerpt)

```
triggers: t_2359 @ "23:59:00", t_ha_start (guard: time ≥ "23:59")
vars: old_est, actual_daily, alpha (bounded), unclamped, max_kwh=120, new_est (clamped),
deadband=0.05, delta, need_write
write: input_number.dai_expected_usage_daily_kwh when need_write; logbook name "RBC
— Daily Forecast EWMA".
```

## 10. Compliance Checklist

- Entity ↔ ID alignment confirmed against live YAML: dai\_expected\_usage\_daily\_kwh, brenchley\_total\_load\_today\_kwh, rbc\_ewma\_alpha\_daily.
- Triggers have IDs and HA-start time guard present.
- Visual-Editor-safe structure; no anchors/includes.
- No inverter writes; Master-only rule unaffected.
- Design references retained in description when editing YAML in future.