RESUME EXPORT REPORT

Generated: 2026-01-10 16:23:05

1. Dataset Summary

Item	Value
Device	Unknown Device
Date Range	26/12/2025 - 02/01/2026
Total Rows	1,955
Start Time	26-12-2025 23:53:12
End Time	02-01-2026 20:42:39
Median Interval	300 seconds (5.0 min)

2. First 10 Rows

Timestamp	V (V)	A (A)	W (W)	kWh	Hz	PF
26-12-2025 23:53:12	223.20	0.119	25.10	3.9700	50.0	0.950
26-12-2025 23:58:12	224.60	0.120	25.40	3.9720	50.0	0.940
27-12-2025 00:03:13	223.70	0.107	22.70	3.9740	50.0	0.950
27-12-2025 00:08:12	222.60	0.108	22.90	3.9760	50.0	0.950
27-12-2025 00:13:12	225.10	0.095	20.70	3.9780	50.0	0.970
27-12-2025 00:18:13	224.60	0.094	20.60	3.9790	50.0	0.980
27-12-2025 00:23:12	222.90	0.095	20.60	3.9810	49.9	0.970
27-12-2025 00:28:12	223.90	0.094	20.50	3.9830	50.0	0.970
27-12-2025 00:33:13	223.60	0.095	20.70	3.9840	50.0	0.970
27-12-2025 00:38:13	222.40	0.095	20.60	3.9860	50.0	0.980

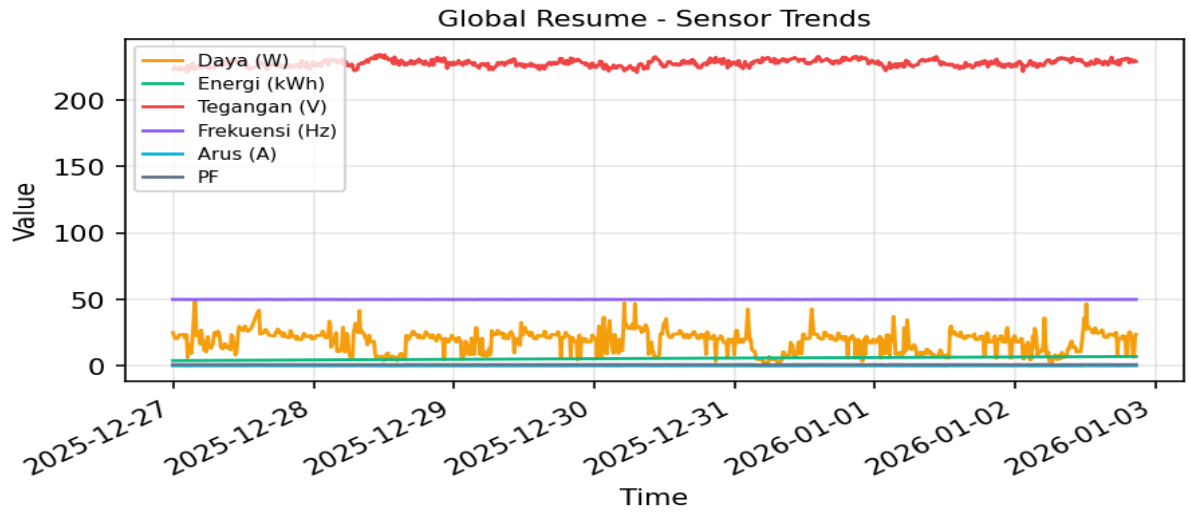
3. Last 10 Rows

Timestamp	V (V)	A (A)	W (W)	kWh	Hz	PF
02-01-2026 19:57:39	230.60	0.093	20.80	7.0390	50.0	0.970
02-01-2026 20:02:40	229.00	0.094	20.90	7.0410	50.0	0.970
02-01-2026 20:07:40	230.50	0.032	6.90	7.0410	50.0	0.940
02-01-2026 20:12:40	228.60	0.032	6.80	7.0420	50.0	0.930
02-01-2026 20:17:39	229.40	0.033	7.10	7.0420	50.0	0.940
02-01-2026 20:22:39	230.00	0.030	6.40	7.0430	50.0	0.930
02-01-2026 20:27:39	232.70	0.029	6.40	7.0440	50.0	0.950
02-01-2026 20:32:39	229.90	0.094	21.00	7.0450	50.0	0.970
02-01-2026 20:37:39	227.80	0.096	21.30	7.0470	50.0	0.970

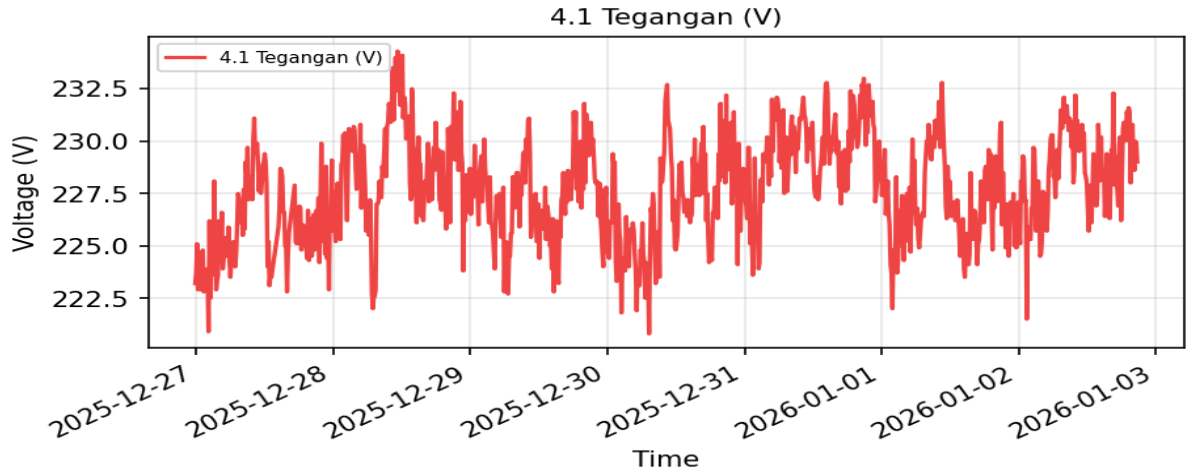
02-01-2026 20:42:39	229.00	0.108	23.80	7.0490	50.0	0.960

4. Global Resume

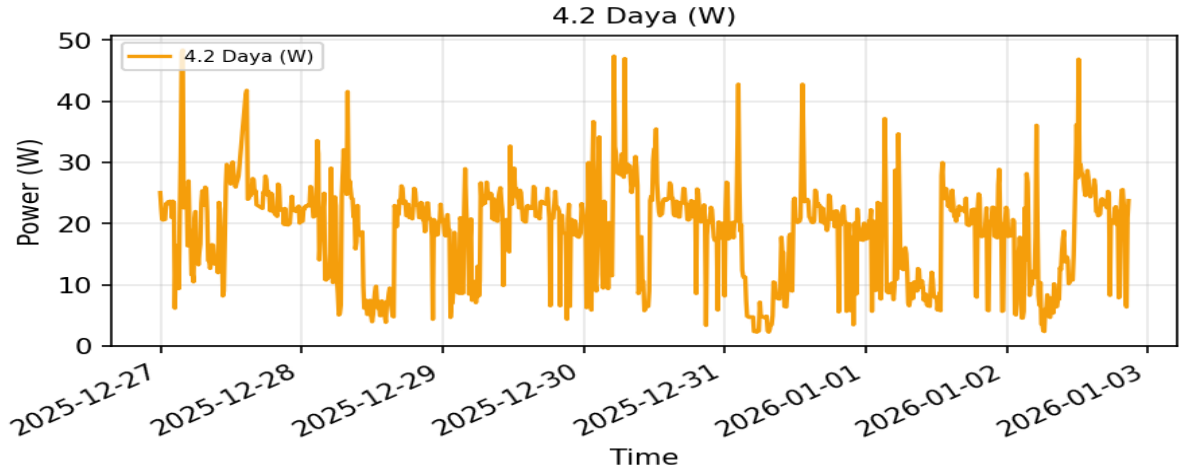
4.0 Overall



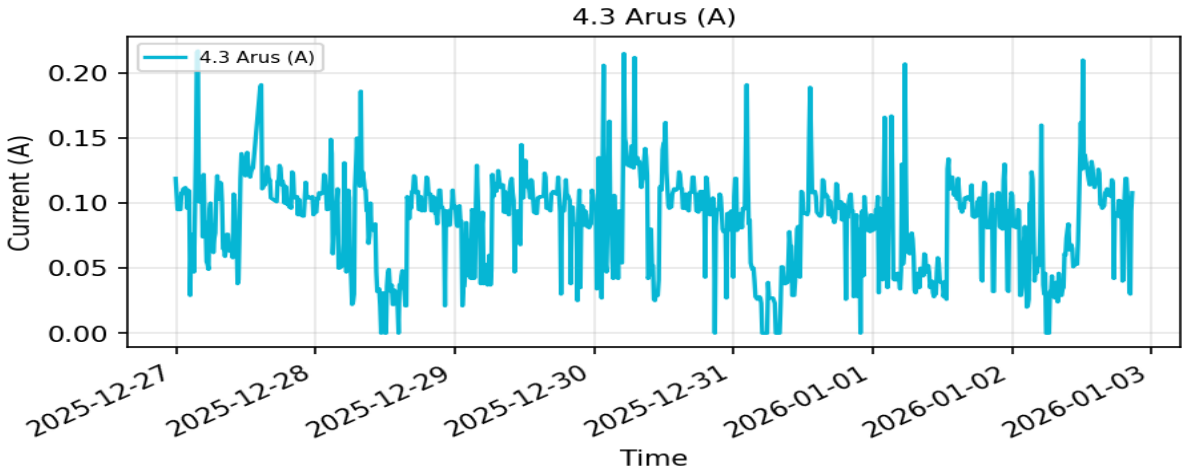
4.1 Tegangan (V)



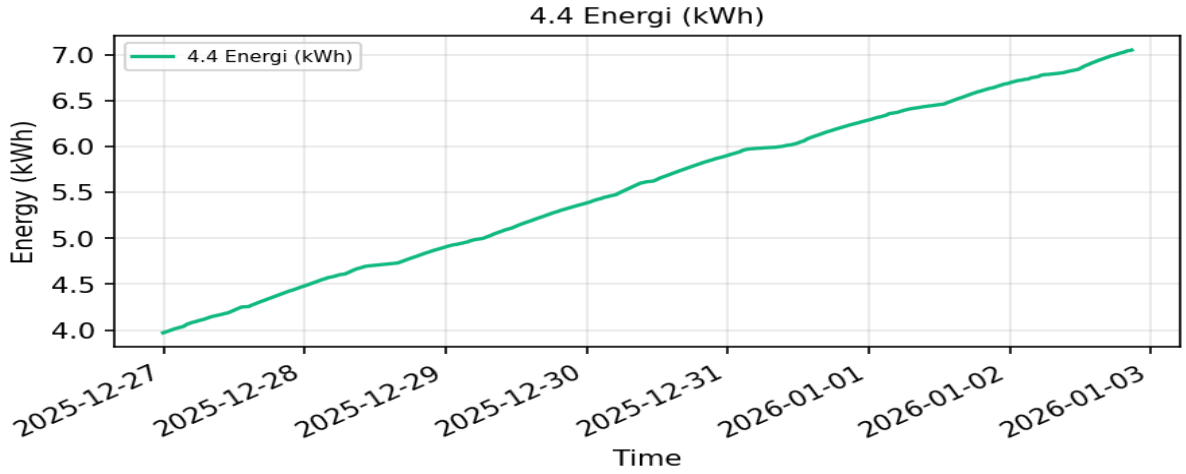
4.2 Daya (W)



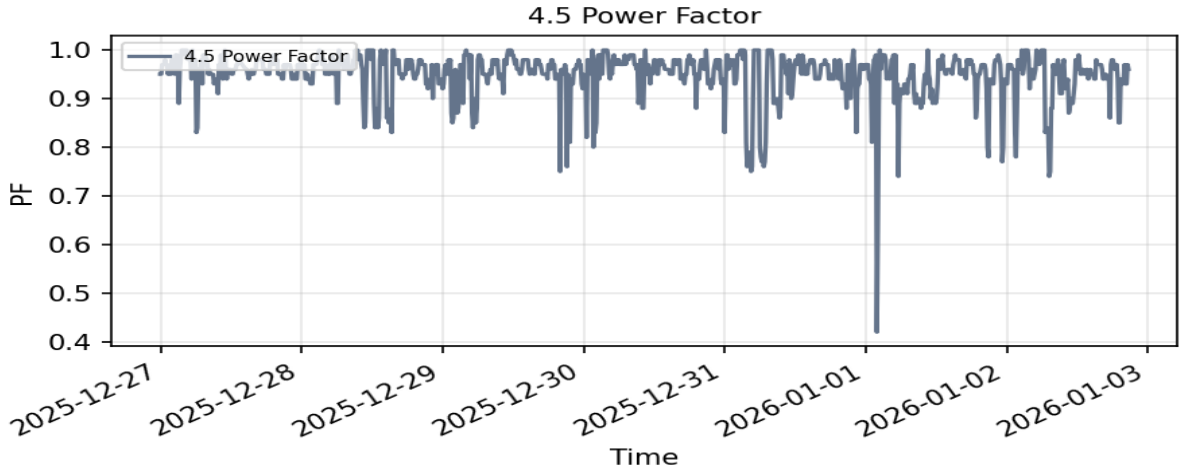
4.3 Arus (A)



4.4 Energi (kWh)



4.5 Power Factor



4.6 Highest Current Points (Arus)

Rank	Timestamp	A (A)	W (W)	V (V)	Hz	kWh	PF
1	01-01-2026 03:17:38	0.230	49.30	224.20	50.0	6.3520	0.960
2	27-12-2025 03:38:13	0.217	48.10	221.80	49.9	4.0520	1.000
3	27-12-2025 03:43:13	0.217	48.40	223.30	50.0	4.0560	1.000
4	27-12-2025 03:33:13	0.216	48.00	222.90	49.9	4.0480	1.000
5	30-12-2025 05:07:37	0.215	47.40	221.90	50.0	5.4810	0.990

4.7 Lowest Current Points (Arus)

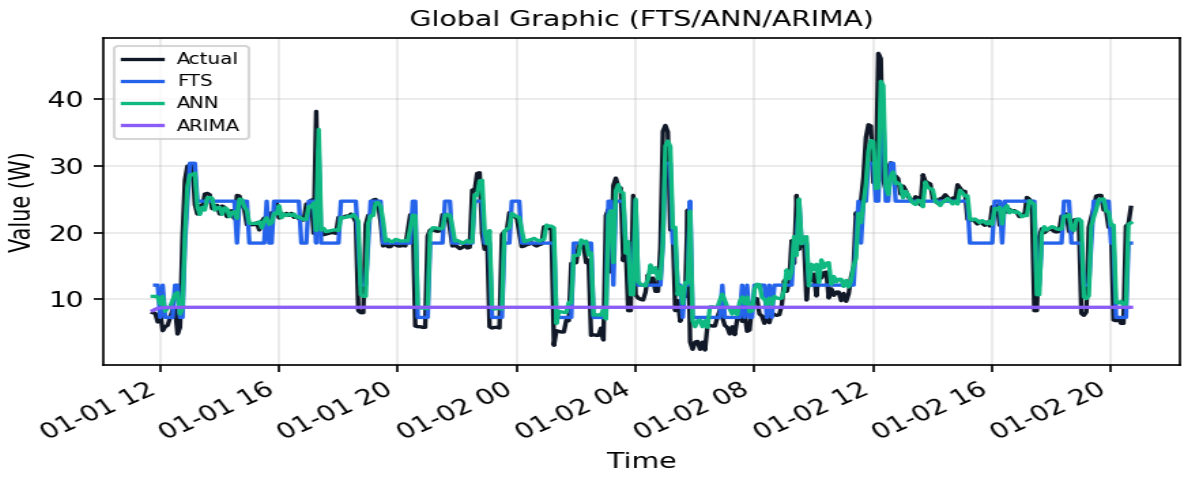
Rank	Timestamp	A (A)	W (W)	V (V)	Hz	kWh	PF
1	31-12-2025 07:52:37	0.000	3.50	229.00	50.0	5.9900	1.000
2	28-12-2025 14:17:34	0.000	3.90	229.60	50.0	4.7200	1.000
3	31-12-2025 07:17:37	0.000	2.50	230.20	49.9	5.9890	1.000
4	31-12-2025 07:22:37	0.000	2.40	229.00	50.0	5.9890	1.000
5	31-12-2025 07:27:37	0.000	2.30	227.60	50.0	5.9890	1.000

4.8 HOME Average Summary (Rata-rata)

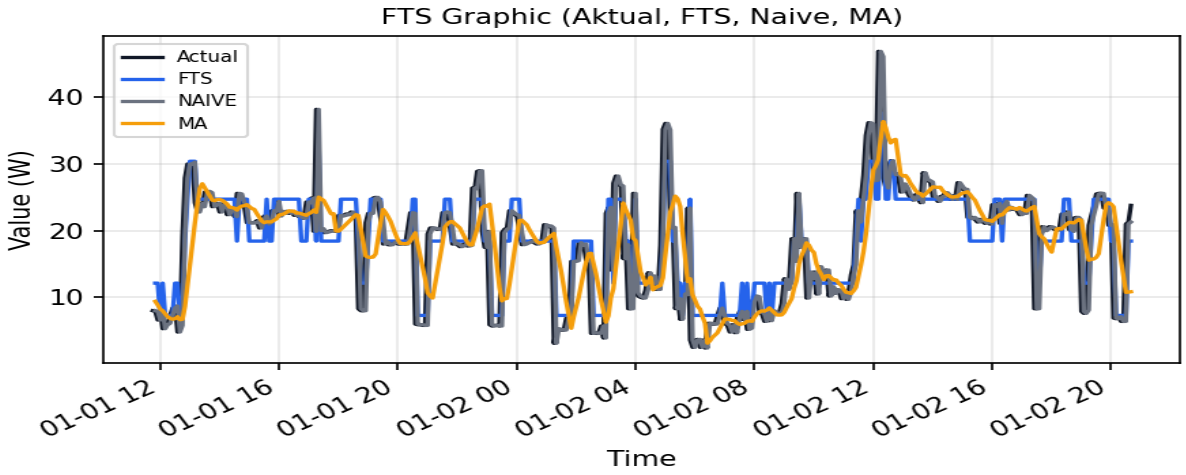
Tanggal Awal	Tanggal Akhir	Jumlah Data	V_avg (V)	A_avg (A)	W_avg (W)	E (kWh)	Hz_avg	PF_avg
26/12/2025	02/01/2026	1,955	227.75	0.086	18.77	3.0790	50.0	0.950

5. Resume Graphic (FTS/ANN/ARIMA)

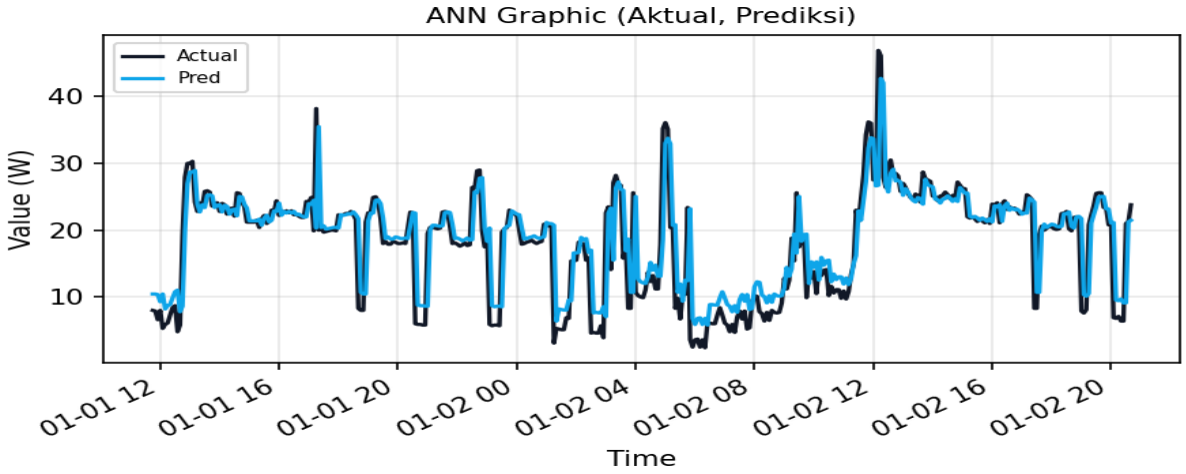
5.0 Global Graphic



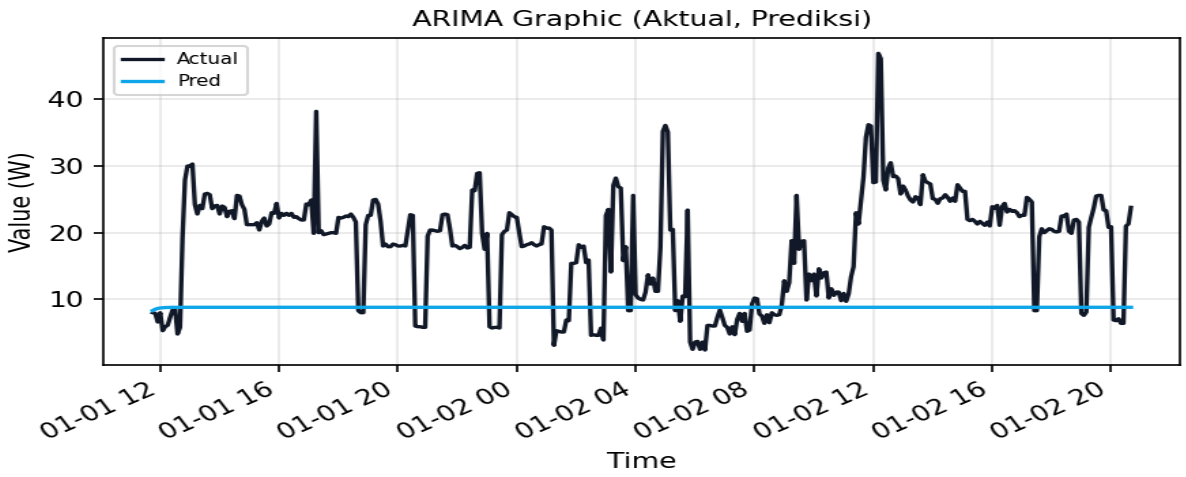
5.1 FTS Graphic



5.2 ANN Graphic



5.3 ARIMA Graphic



6. FTS Mathematical Documentation

5.1 Universe of Discourse (UoD)

Formula: D = [D_min, D_max], D_min = min(y) - pad, D_max = max(y) + pad, pad = padPct * (max(y) - min(y)).

$$D = [D_{min}, D_{max}]$$

$$D_{min} = \min(y) - pad$$

$$D_{max} = \max(y) + pad$$

$$pad = padPct \times (\max(y) - \min(y))$$

Calculation: min(y)=2.3000, max(y)=49.3000, span=47.0000, padPct=5.0%, D_min=-0.0500, D_max=51.6500

5.2 Partitioning (Equal-Width / Equal-Frequency)

Formula: w = (D_max - D_min) / n; A_i = [D_min + (i-1)w, D_min + i w), A_n = [D_min + (n-1)w, D_max].

$$w = \frac{D_{max} - D_{min}}{n}$$

$$A_i = [D_{min} + (i-1)w,\ D_{min} + iw)$$

$$A_n = [D_{min} + (n-1)w,\ D_{max}]$$

$$mid(A_i) = \frac{lo_i + hi_i}{2}$$

Method=Equal Width, n=7, width=7.3857

ID	Lower	Upper	Midpoint

A1	-0.0500	7.3357	3.6429
A2	7.3357	14.7214	11.0286
A3	14.7214	22.1071	18.4143
A4	22.1071	29.4929	25.8000
A5	29.4929	36.8786	33.1857
A6	36.8786	44.2643	40.5714
A7	44.2643	51.6500	47.9571

5.3 Fuzzification

Formula: L_t = A_i jika y_t berada pada interval [lo_i, hi_i).

$$L_t = A_i, \text{ jika } y_t \in [lo_i, hi_i)$$

Timestamp	W (W)	Label
26-12-2025 23:50:00	25.100	A4
26-12-2025 23:55:00	25.400	A4
27-12-2025 00:00:00	22.700	A4
27-12-2025 00:05:00	22.900	A4
27-12-2025 00:10:00	20.700	A3
27-12-2025 00:15:00	20.600	A3
27-12-2025 00:20:00	20.600	A3
27-12-2025 00:25:00	20.500	A3
27-12-2025 00:30:00	20.700	A3
27-12-2025 00:35:00	20.600	A3

5.4 Fuzzy Logical Relationship (FLR)

Formula: FLR = {(L_{t-1}, L_t)} atau A_i -> A_j.

$$A_i \rightarrow A_j$$

$$FLR = \{(L_{t-1}, L_t)\}$$

No	Relation
1	A4 -> A4
2	A4 -> A4
3	A4 -> A4
4	A4 -> A3
5	A3 -> A3
6	A3 -> A3

7	A3 -> A3
8	A3 -> A3
9	A3 -> A3
10	A3 -> A3

... 1572 relasi lainnya ...

5.5 Fuzzy Logical Relationship Group (FLRG)

Formula: A_i -> {A_j} dengan support = count(A_i->A_j) / total(A_i).

$$A_i \rightarrow \{A_{j_1}, A_{j_2}, \ldots\}$$

$$support(A_i \rightarrow A_j) = \frac{count(A_i \rightarrow A_j)}{\sum_j count(A_i \rightarrow A_j)}$$

Group	Next States (Support)
A1	A1 (70.1%), A3 (16.1%), A2 (12.1%), A4 (1.7%)
A2	A2 (74.1%), A3 (10.1%), A1 (8.9%), A4 (6.9%)
A3	A3 (78.5%), A4 (10.4%), A2 (5.5%), A1 (4.0%), A5 (1.5%), A6 (0.2%)
A4	A4 (80.6%), A3 (11.7%), A2 (2.4%), A5 (2.4%), A1 (1.3%), A6 (0.9%), A7 (0.6%)
A5	A5 (54.2%), A4 (31.2%), A7 (4.2%), A6 (4.2%), A1 (2.1%), A3 (2.1%), A2 (2.1%)
A6	A4 (43.8%), A6 (37.5%), A3 (6.2%), A5 (6.2%), A7 (6.2%)
A7	A7 (40.0%), A4 (40.0%), A6 (20.0%)

5.6 Forecasting (Cheng Method)

Formula: y_hat(t+1) = sum(support * midpoint). Fallback: y_hat = midpoint(A_i).

$$\hat{y}_{t+1} = \sum_j support(L_t \rightarrow A_j)\, mid_j$$

$$\hat{y}_{t+1} = mid(L_t) \quad \text{(fallback)}$$

t	Timestamp	Actual (W)	Pred (W)
2	01-01-2026 11:50:00	7.900	12.135
3	01-01-2026 11:55:00	6.600	12.135
4	01-01-2026 12:00:00	8.000	7.293
5	01-01-2026 12:05:00	5.300	12.135
6	01-01-2026 12:10:00	5.900	7.293
7	01-01-2026 12:15:00	6.100	7.293
8	01-01-2026 12:20:00	7.300	7.293
9	01-01-2026 12:25:00	8.400	7.293
10	01-01-2026 12:30:00	8.700	12.135
11	01-01-2026 12:35:00	4.800	12.135

5.7 Evaluation Metrics

Formula: MAE = mean(|y - y_hat|), RMSE = sqrt(mean((y - y_hat)^2)), MAPE = mean(|(y - y_hat)/y|) * 100.

$$MAE = \frac{1}{n}\sum_{t=1}^{n}|Y_t - \hat{Y}_t|$$

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(Y_t - \hat{Y}_t)^2}$$

$$MAPE = \frac{100\%}{n}\sum_{t=1}^{n}\left|\frac{Y_t - \hat{Y}_t}{Y_t}\right|$$

Metric	Value
MAE	3.1232
RMSE	4.7187
MAPE (%)	26.96

5.8 Baseline Models Comparison

Formula: Naive y_hat(t+1) = y_t, Moving Average y_hat(t+1) = mean(y_{t-w+1}..y_t).

$$\hat{y}_{t+1} = y_t \quad \text{(Naive)}$$

$$\hat{y}_{t+1} = \frac{1}{w}\sum_{i=t-w+1}^{t} y_i \quad \text{(Moving Average)}$$

Model	MAE	RMSE	MAPE (%)
Naive	2.2461	4.6217	18.45
Moving Average	4.3169	6.3159	37.68

5.9 Sensitivity Analysis

Formula: Delta MAPE = MAPE_FTS - MAPE_Baseline.

$$\Delta MAPE = MAPE_{FTS} - MAPE_{Baseline}$$

Case	MAPE (%)	Delta (%)
method = equal-frequency	27.18	0.22
n = 9	27.52	0.57
pad = 10%	29.35	2.39

7. Model Configuration

Model	Config Summary
FTS	n=7, method=Equal Width, pad=5%, split=80%
ANN	epoch=90, neuron=10, layers=1, lr=0.01
ARIMA	order=(1, 1, 1)

8. Performance Results

Model	MAE	RMSE	MAPE (%)	Rank
FTS	3.1232	4.7187	26.96	2
ANN	2.5885	4.4700	25.45	1
ARIMA	10.3864	12.2460	54.66	3

Best Model: ANN

9. Sensitivity Analysis

Case	MAPE (%)	Delta (%)
method = equal-frequency	27.18	0.22
n = 9	27.52	0.57
pad = 10%	29.35	2.39

Best Case: method = equal-frequency

10. Auto-Generated Caption

Analisis perbandingan FTS Cheng, ANN, dan ARIMA pada Unknown Device periode 26/12/2025 - 02/01/2026 dengan 1955 titik data. FTS parameter n=7, method=equal-width, pad=5% memberi MAPE=26.96%. Model terbaik: ANN (MAPE=25.45%). Konfigurasi saat ini sudah optimal.