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KEMENTERIAN EKONOMI
JABATAN PERANGKAAN MALAYSIA

UNIVERSITI TEKNOLOGI MARA

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UNDERSTANDING ENERGY INTENSITY: A PATH TO MALAYSIA'S SUSTAINABLE FUTURE

4CAST

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What is Energy Intensity ?

Indicator of **energy efficiency**

Measured in terms of **primary energy consumption** and **gross domestic product (GDP)**

Lower energy intensity, reflects **higher energy efficiency**

The Main Challenges

Greenhouse gas emissions **increased** by 3.47% from 2014 to 2021.

Malaysia’s energy intensity progress is **concerning** due to the growing energy consumption and energy demands in recent years.

Basis of the Analysis

From the **SDG 2024 report**, Malaysia's SDG 7: Affordable and clean energy **significant challenges remain with stagnating process**

Target 7.3:
By 2030, double the global rate of improvement in energy efficiency

SDG 7.3.1:
The improvement of energy efficiency by reducing the **energy intensity**

Objectives

To explore Malaysia’s potential to lower energy intensity by analyzing trends and correlations in energy intensity, renewable energy adoption, and industrial value added.

To analyze the relationship between energy intensity and the adoption of renewable energy and industrial value added to improve energy efficiency.

To look ahead and predict how Malaysia’s energy use will change over the next five years, helping to plan for a more sustainable future.

Datasets & Variables

Energy intensity

(kWh/$)

1990-2021

Measured by the **quantity of energy** required per unit output.

Renewable energy

(% of equivalent primary energy)

1990-2021

Percentage of total primary energy supply includes energy from all sources that are generated from renewable energy sources.

Industrial value added

(% of GDP)

1990-2021

Measures the **contribution of the industrial sector** to a country's Gross Domestic Product (GDP).

Objective 1

To explore Malaysia’s potential to lower energy intensity by analyzing trends and correlations in energy intensity, renewable energy adoption, and industrial value added.

Trends in Energy Intensity over the Years

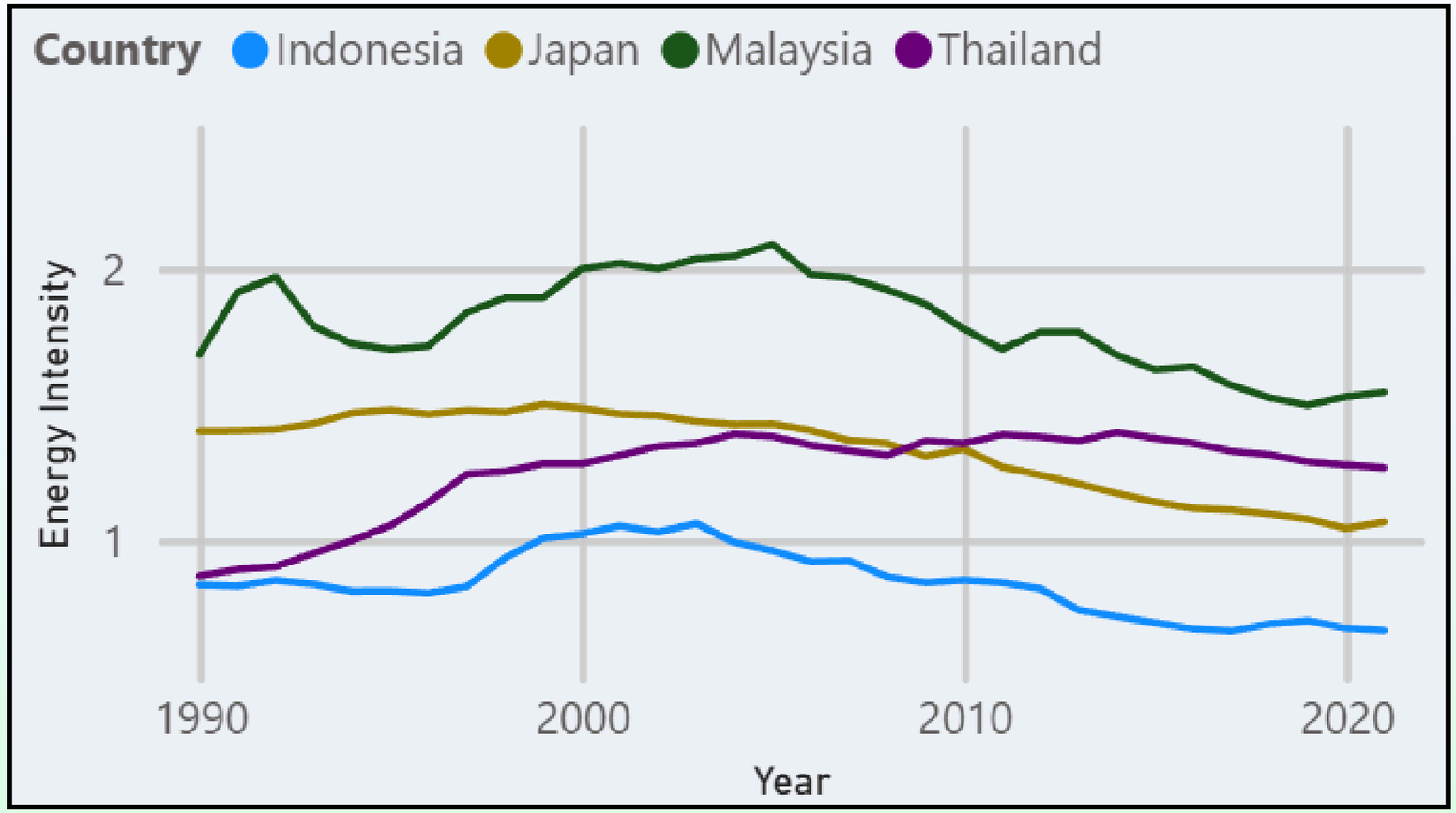


Figure 1

- **Japan:**
  Long-term **downward trend**
- **Malaysia and Indonesia:**
  Gradual declining starting in early 2000
- **Thailand:**
  Rising since 1990 and slowly **decreasing** in 2015

All 4 countries made a **significant stride** in renewable energy adoption

Trends in Renewable Energy over the Years

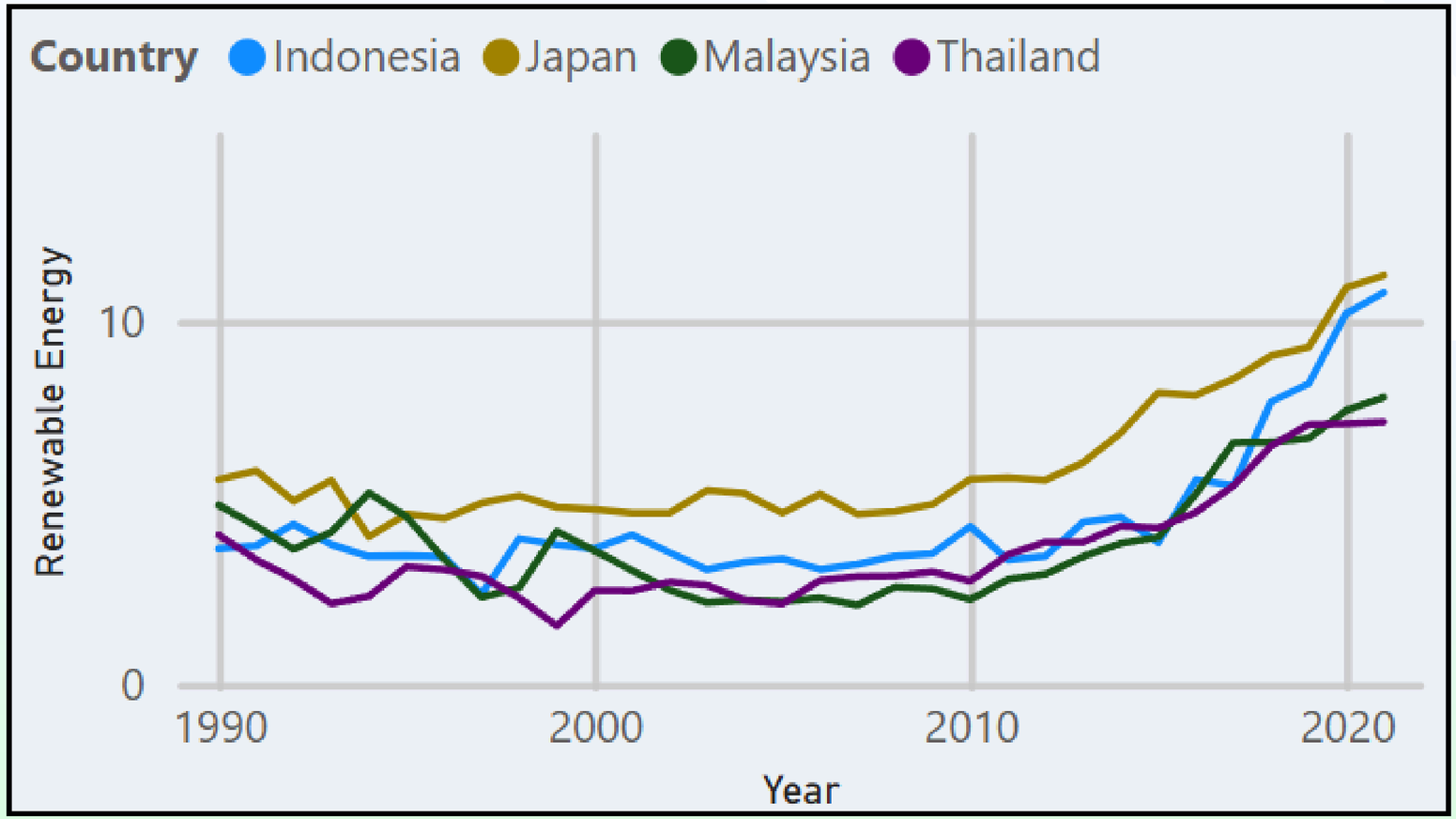
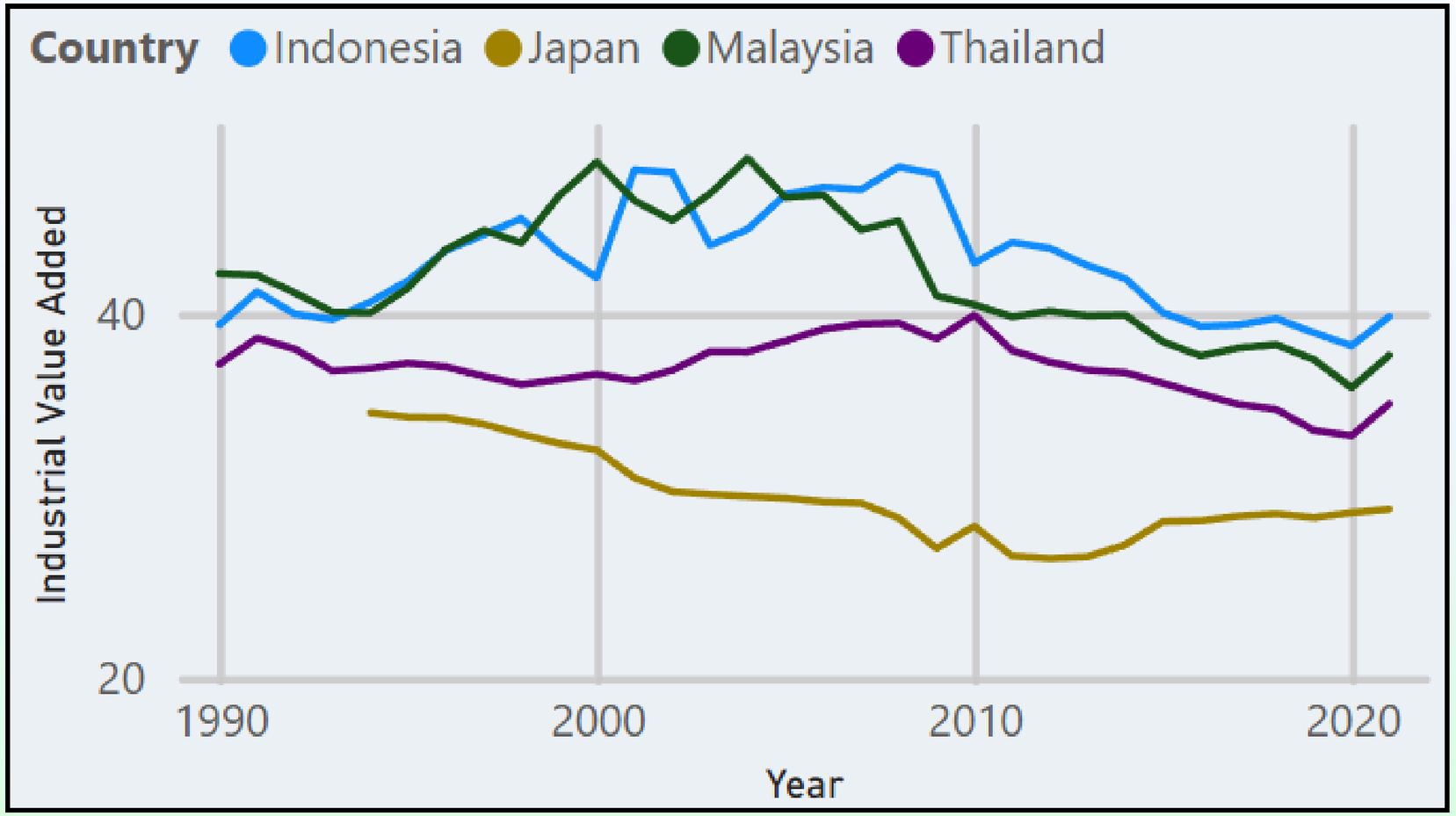


Figure 2

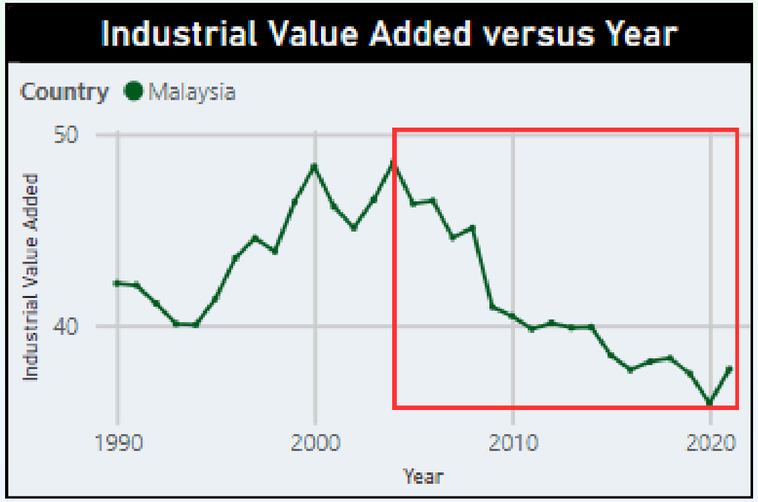
Trends in Industrial Value Added over the Years



- **Malaysia:**
  Decreasing trend starting around 2000.
- **Indonesia:**
  Steady growth with the slight decrease in 2010.
- **Japan:**
  Declining trend
- **Thailand:**
  Increasing trend

Figure 3

Malaysia's Variables against Time



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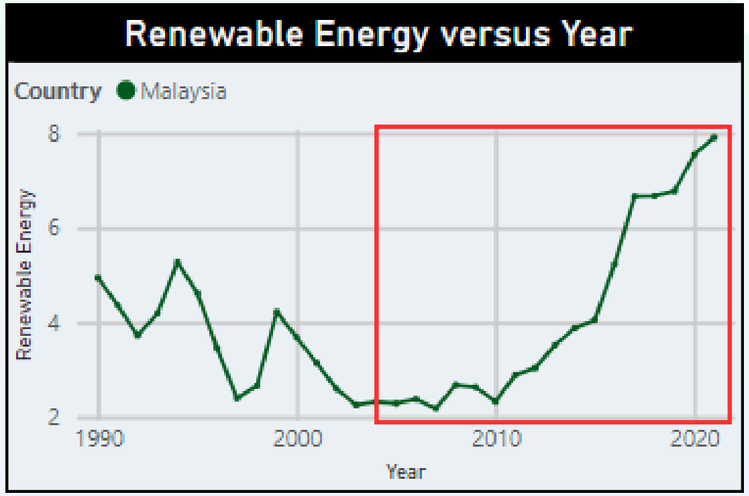
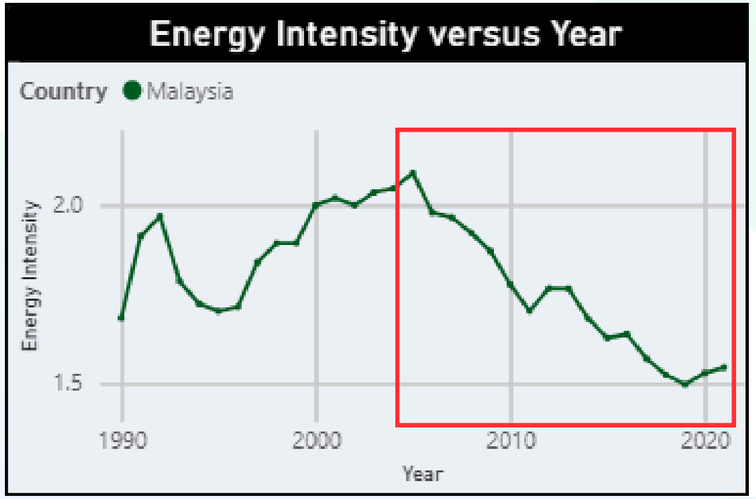


(b)



(c)

Figure 4

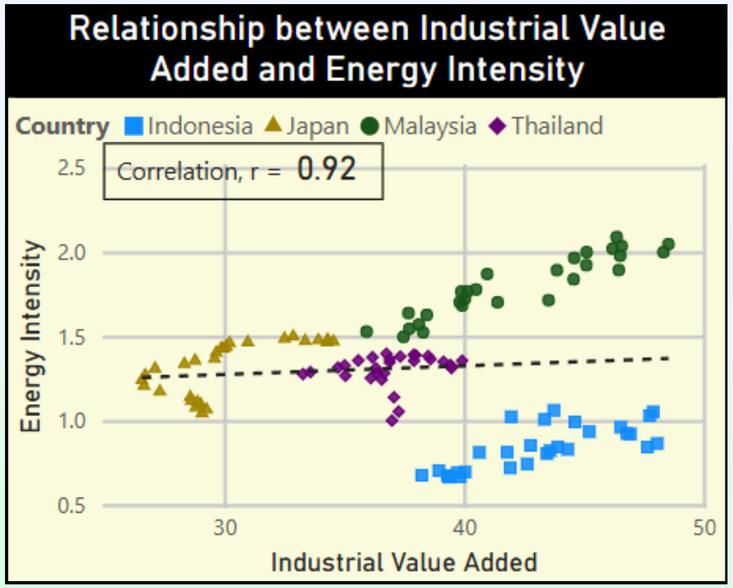
- In 2004, Malaysia **begun its transition** towards renewable energy under the framework **Fuel Diversification Policy.**
- Renewable energy as **"fifth fuel"** in the country's energy mix.
- **Reducing** energy intensity by encouraging renewable energy adoption.

Correlation Between the Variables

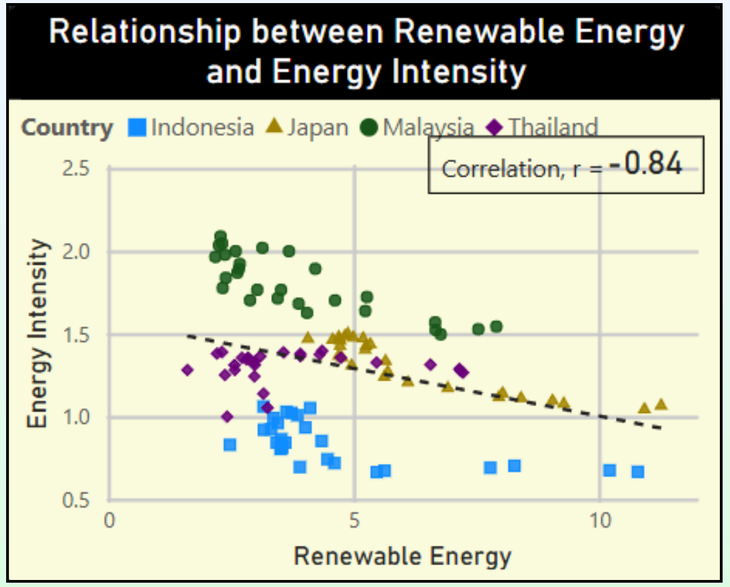
Positive correlation
Industrial sectors are consuming more energy per unit of economic output.

Negative correlation
As the adoption of renewable energy improves energy efficiency.

Negative correlation
Indicate a reliance on traditional energy sources for industrial growth.



(a)



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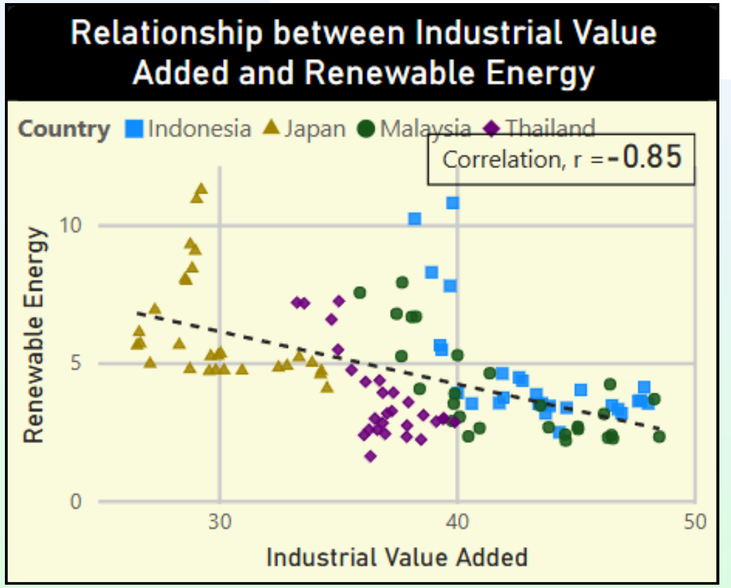


(c)

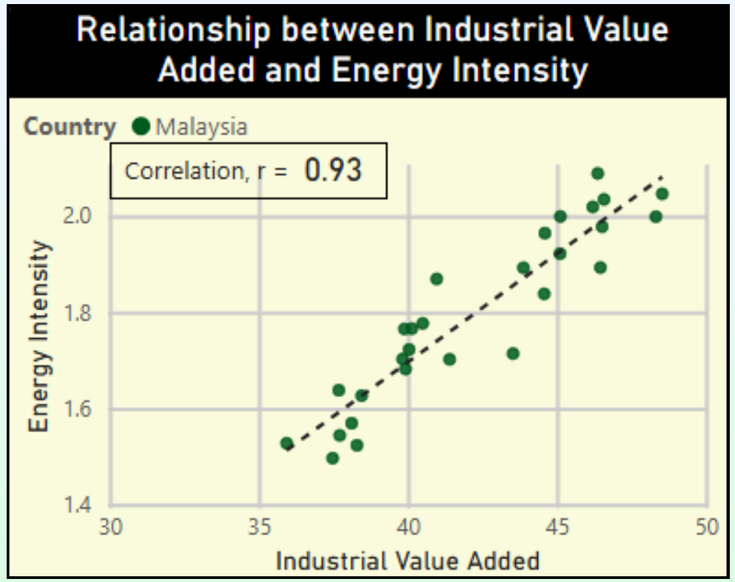
Figure 5

Correlation Between the Variables for Malaysia

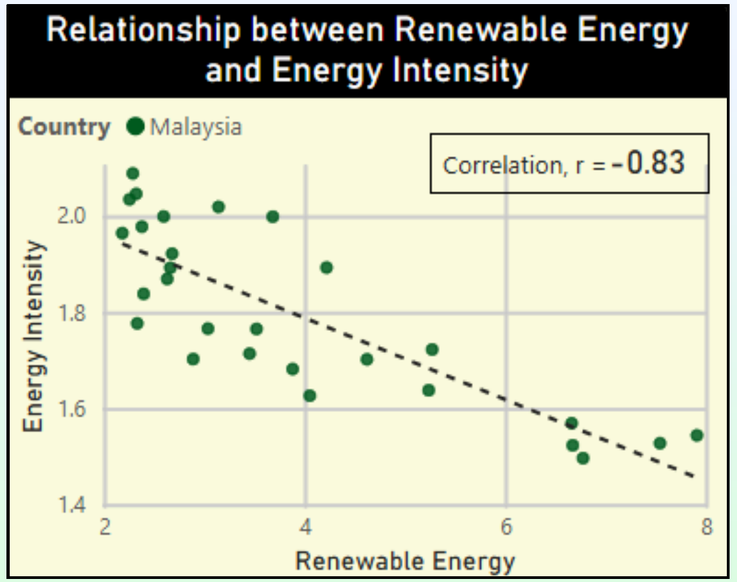
Positive correlation
Industrial sectors are consuming more energy per unit of economic output.

Negative correlation
As the adoption of renewable energy improves energy efficiency.

Negative correlation
Indicate a reliance on traditional energy sources for industrial growth.



(a)



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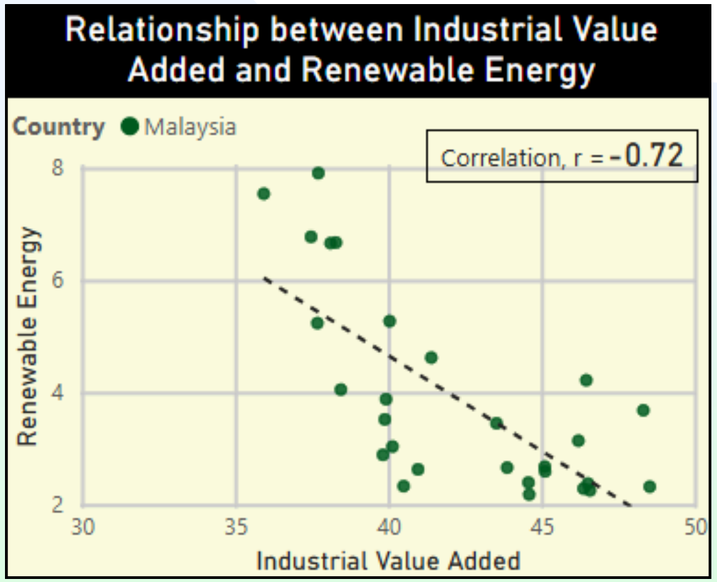


(c)

Figure 6

Objective 2

To analyze the relationship between energy intensity and the adoption of renewable energy and industrial value added to improve energy efficiency.

COMPARING PREDICTION MODEL ANALYSIS

The relationship between energy intensity and both renewable energy and industrial value added

Figure 7: 1990-2021 Model

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Industrial Value Added	0.03	0.01	6.20	0.00	2.03
Renewable Energy	-0.04	0.01	-3.45	0.00	2.03
Total					**4.06**

(a)

VIF < 10, no serious multicollinearity

Figure 8: 2004-2021 Model

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Industrial Value Added	0.04	0.00	7.44	0.00	2.41
Renewable Energy	-0.03	0.01	-3.67	0.00	2.41
Total					**4.82**

(a)

Both independent variables have a statistically significant effect ($p < 0.05$)

Model Summary

Metric	Value
R-sq	0.85
R-sq (adj)	0.84
R-sq (pred)	0.83
S	0.07
Total	**2.59**

Interpretation of R-sq (adj)

84% of the variability observed in the energy intensity is explained by the model when the number of predictors is considered.

(b)

Model Summary

Metric	Value
R-sq	0.95
R-sq (adj)	0.94
R-sq (pred)	0.92
S	0.05
Total	**2.85**

Interpretation of R-sq (adj)

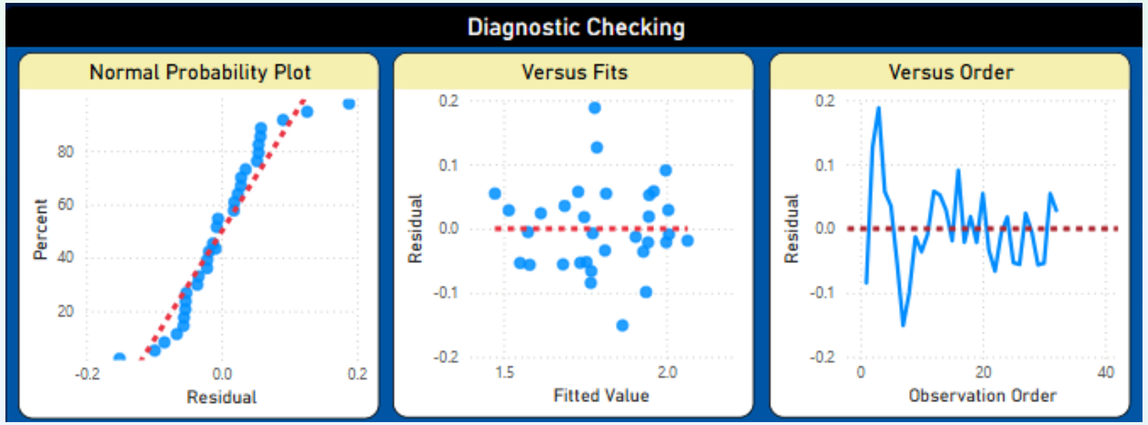
94% of the variability observed in the energy intensity is explained by the model when the number of predictors is considered.

(b)

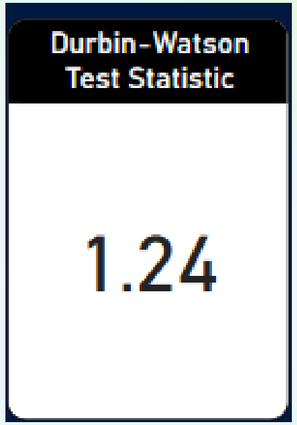
COMPARING PREDICTION MODEL ANALYSIS

Model diagnostic checking for the prediction model

Figure 9: 1990-2021 Model

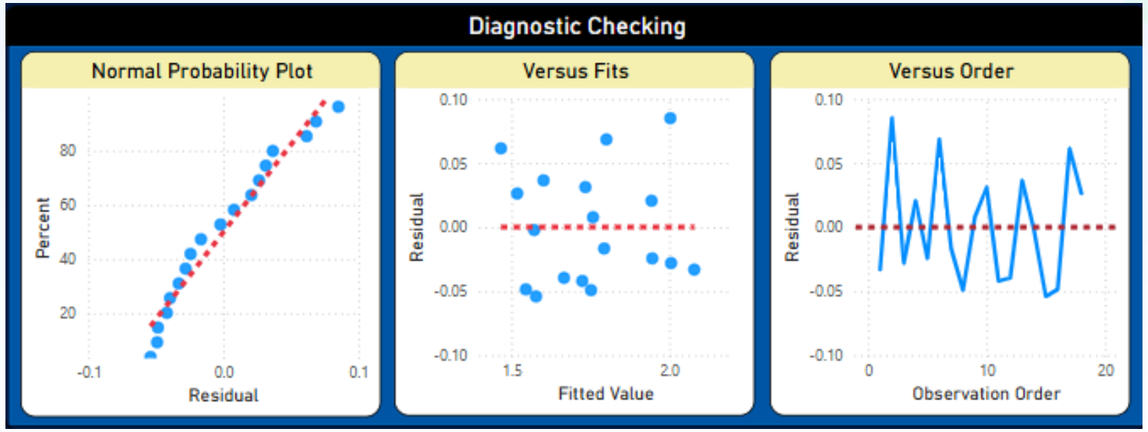


Normal distribution | Constant variances | Moderate autocorrelation

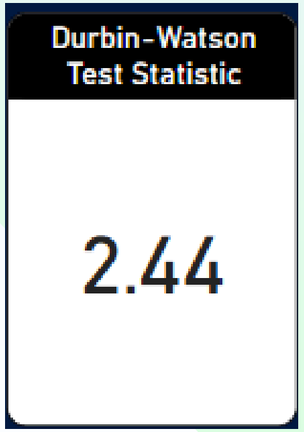


Moderate autocorrelation range: 1.0 to 1.5

Figure 10: 2004-2021 Model



Normal distribution | Constant variances | No autocorrelation

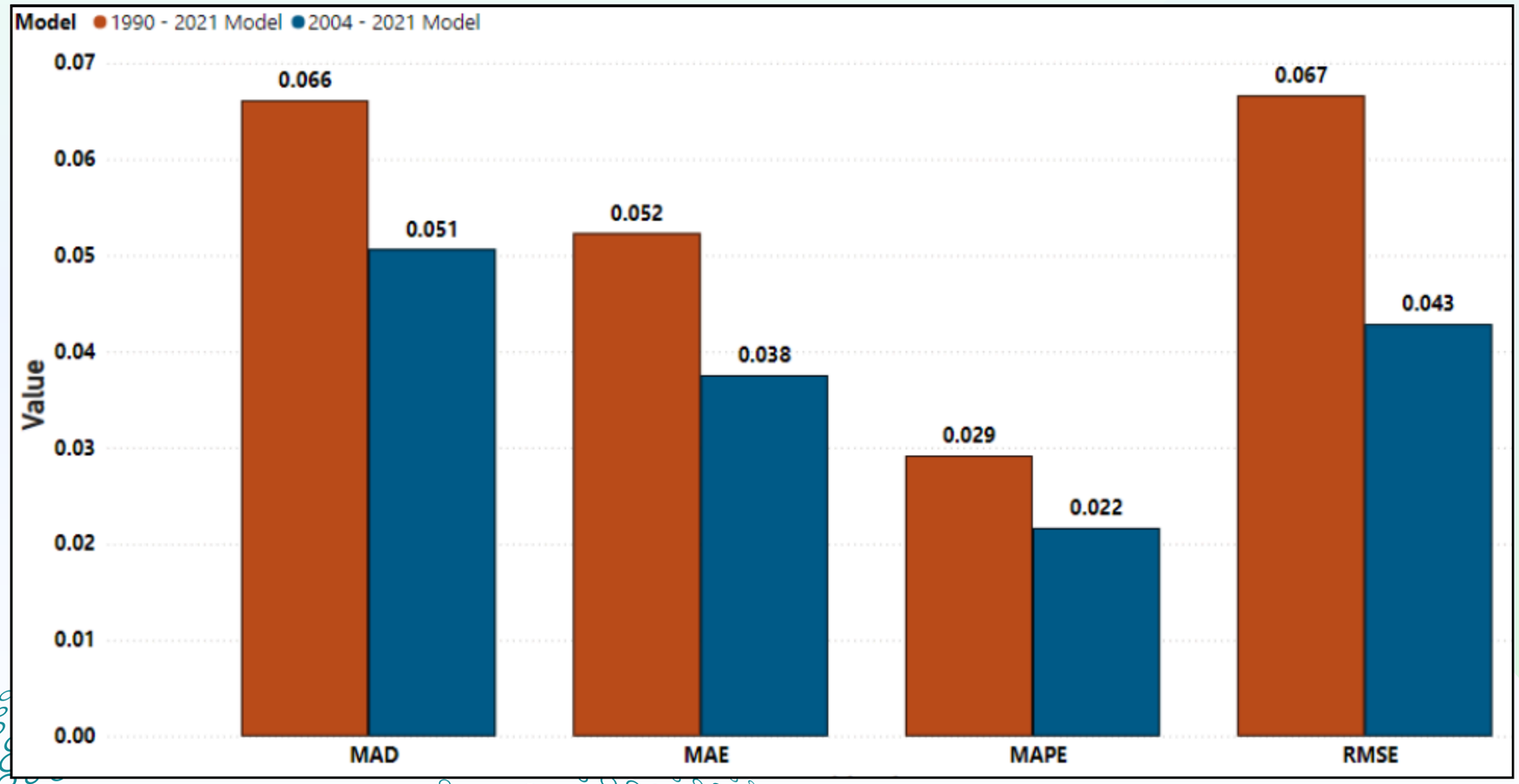


No autocorrelation range: 1.5 to 2.5

COMPARING PREDICTION MODEL ANALYSIS

Prediction model performance

Figure 11



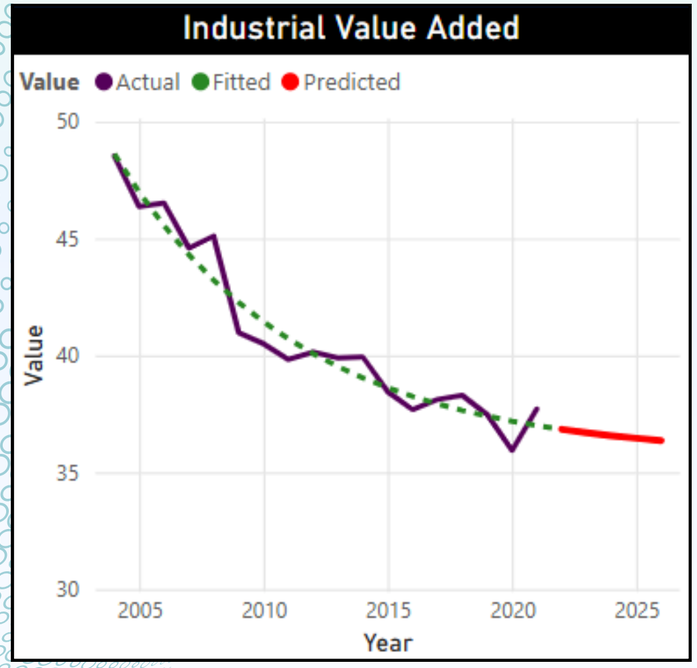
Lower metric values indicates **better** model performance

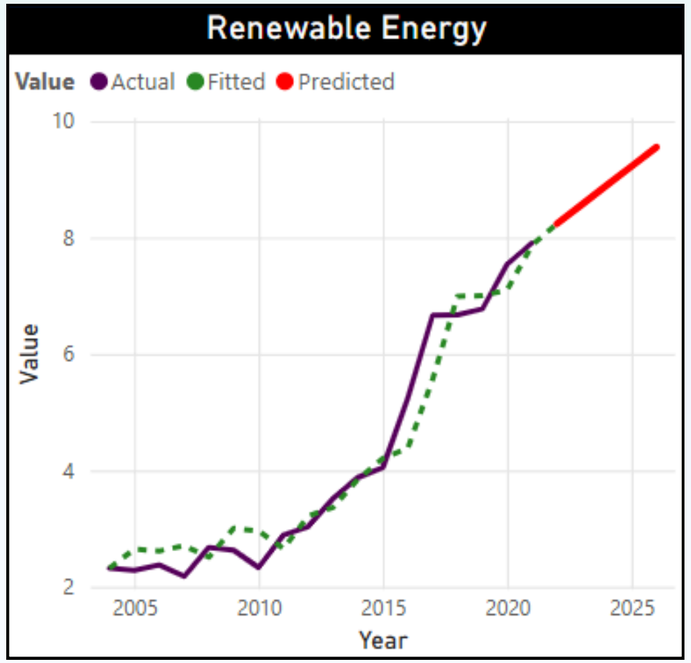
Objective 3

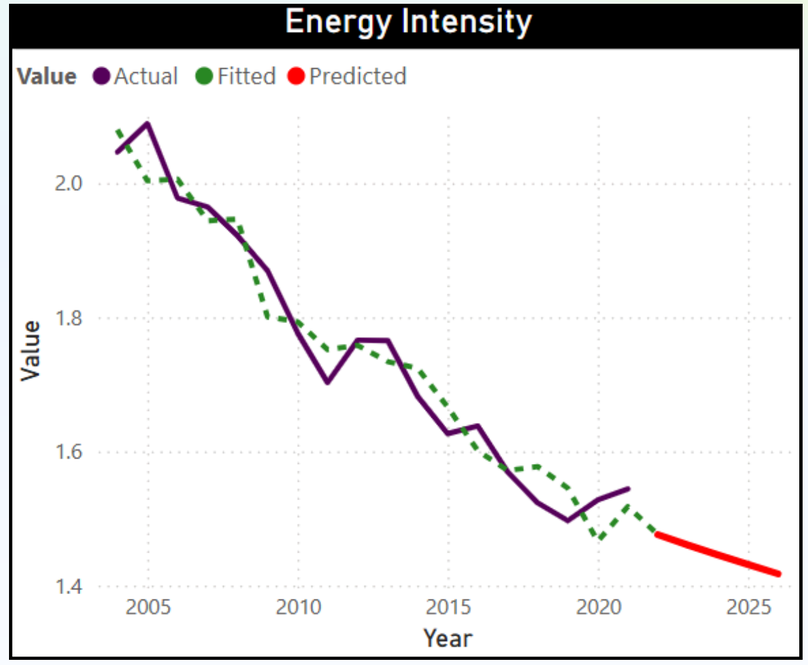
To look ahead and predict how Malaysia’s energy use will change over the next five years, helping to plan for a more sustainable future.

FORECASTING ANALYSIS

Predicting energy intensity with time series models of industrial value added and renewable energy







Exponential smoothing

ARIMA

Multiple linear regression

Figure 12: 2004-2021 Model

CONCLUSION

1. **Increase** energy efficiency to reduce reliance on volatile global energy prices.

2. **Expand** renewable energy to support growing industrial needs.

3. **Invest** in technology and research and development (R&D) for sustainable energy solutions.

CONCLUSION

4. **Policymakers:** Promote energy efficiency and expand local renewable sources.

5. **Industry:** Integrate more renewable energy into operations.

6. **Researchers:** Innovate solutions to enhance renewable energy and efficiency.

Thank You For Your Attention

Together, Let's Power a Sustainable Future!