

WIH2001 - GROUP 4

SDG 7 - AFFORDABLE & CLEAN ENERGY



From Data to Power: Predicting Renewable Energy Generation for a Sustainable Future

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Problem Statement

The advancement of technology, urbanisation, and growing population, has led to a surge in energy demand. Despite the potential for renewable energy to fulfill two-thirds of the overall energy consumption, many still rely on non-renewables as renewable energy remains unreliable due to the unpredictable weather.

Purpose



RESEARCH QUESTIONS

- What is the projected future energy demand and production pattern?
- What percentage of the total energy production is renewable energy by 2030?
- Which renewable energy type has the highest growth rate?

OBJECTIVES

- To analyze and forecast the energy demand and production pattern
- To determine and predict whether renewable energy can contribute 30% to total energy production by 2030
- To provide a solution for a smooth transition towards a renewable energy-powered future

SDG GOAL 7'S TARGET

- By 2030, increase substantially the share of renewable energy in the global energy mix
- By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries
- By 2030, reach a 30% renewable energy contribution to overall energy generation

Tools & Datasets

Suitability

- Simple to implement
- Interpretability
- Predicting continuous numeric values

LINEAR
REGRESSION

Suitability

- Univariate time series analysis
- Fast & easy to use
- Available in Python & R programming

PROPHET

Limitations

- Sensitive to outliers
- Prone to underfitting

Limitations

- Requires data in a specific format
- Limited multivariate support

1

Global Energy Consumption & Renewable Generation (Source: Kaggle)

- Continent_Consumption_TWH.csv
This dataset includes global consumption data for continental and international groups from 1990 to 2020, which helps identify the amount of energy needed and its changes over time.
- renewablePowerGeneration97-17.csv
The growth of the five major renewable energy sources—hydro, wind, biofuel, solar photovoltaic, and geothermal—is depicted in this dataset's 1990–2017 timeline.

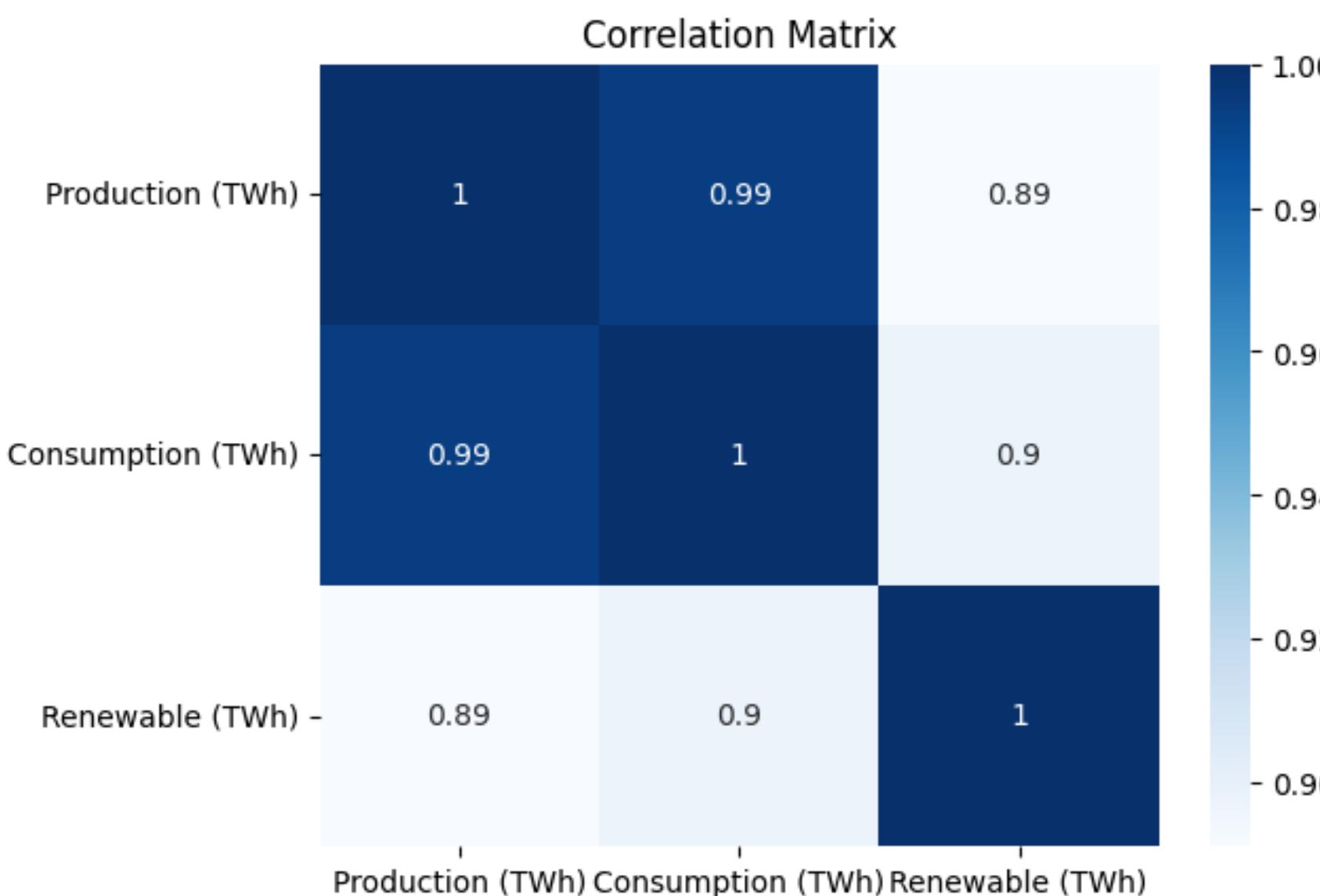
2

Predict Electricity Consumption (Source: Kaggle)

- Electric_Production.csv
This dataset shows the global production of electricity from 1985 - 2018.

Finding 1: Correlation

BETWEEN ENERGY DEMAND, OVERALL ENERGY & RENEWABLE ENERGY PRODUCTION



Electricity demand is strongly positively correlated to energy production with the correlation of:

0.99

Renewable energy production is positively correlated to the overall energy production with the correlation of:

0.89

Figure 1: Correlation between Global Total Energy Production, Global Total Energy Consumption and Global Total Renewable Energy Production

Finding 2

Projected Electricity Demand

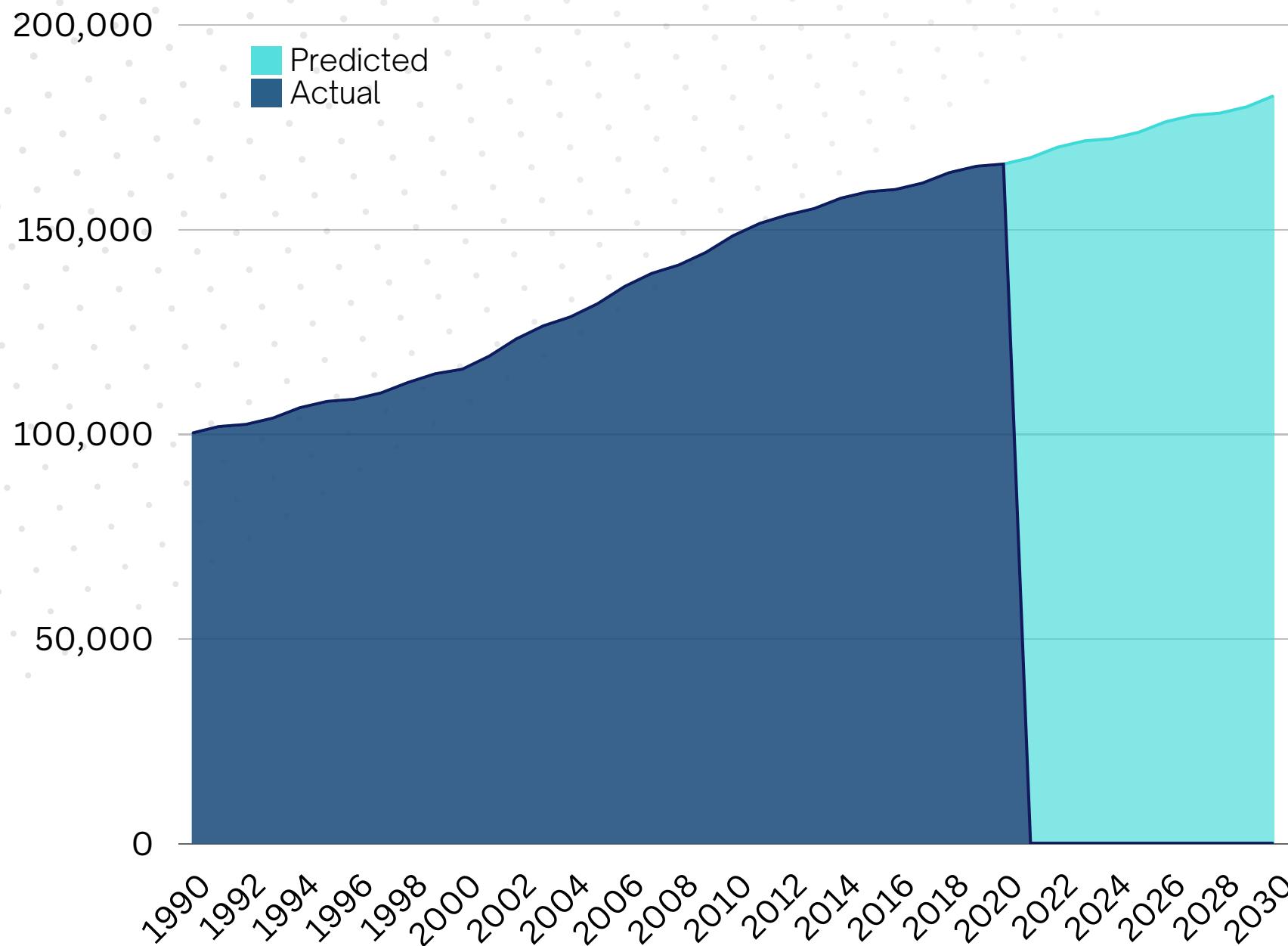


Figure 2: Electricity Demand Prediction

The projected energy demand by 2030 is
182,573.61 TWh.

Finding 3

Projected Energy Production

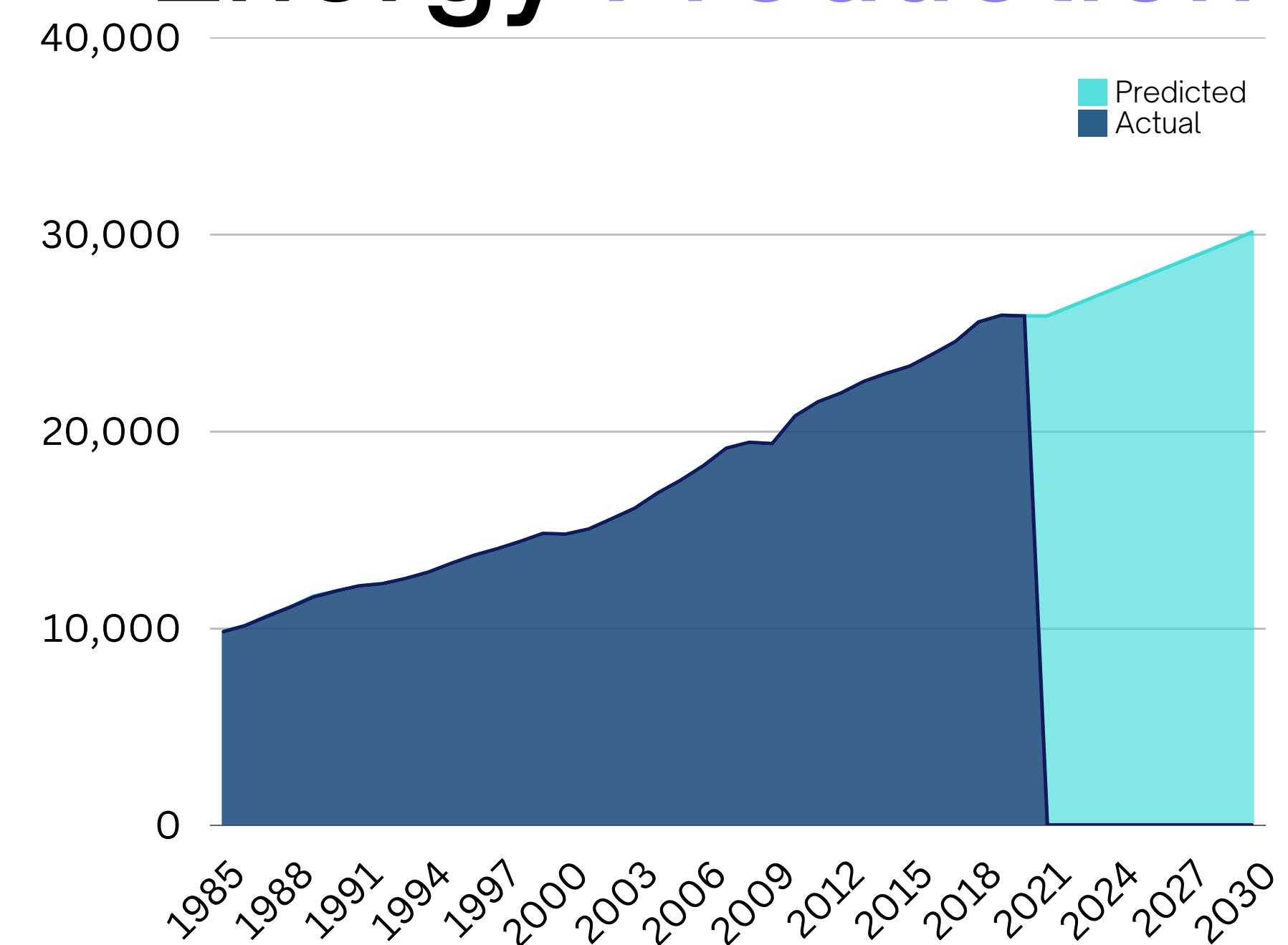


Figure 3: Electricity Production Prediction

The projected energy production by 2030 is
30,130.40 TWh.

Findings 4: Growth of Renewable Energy

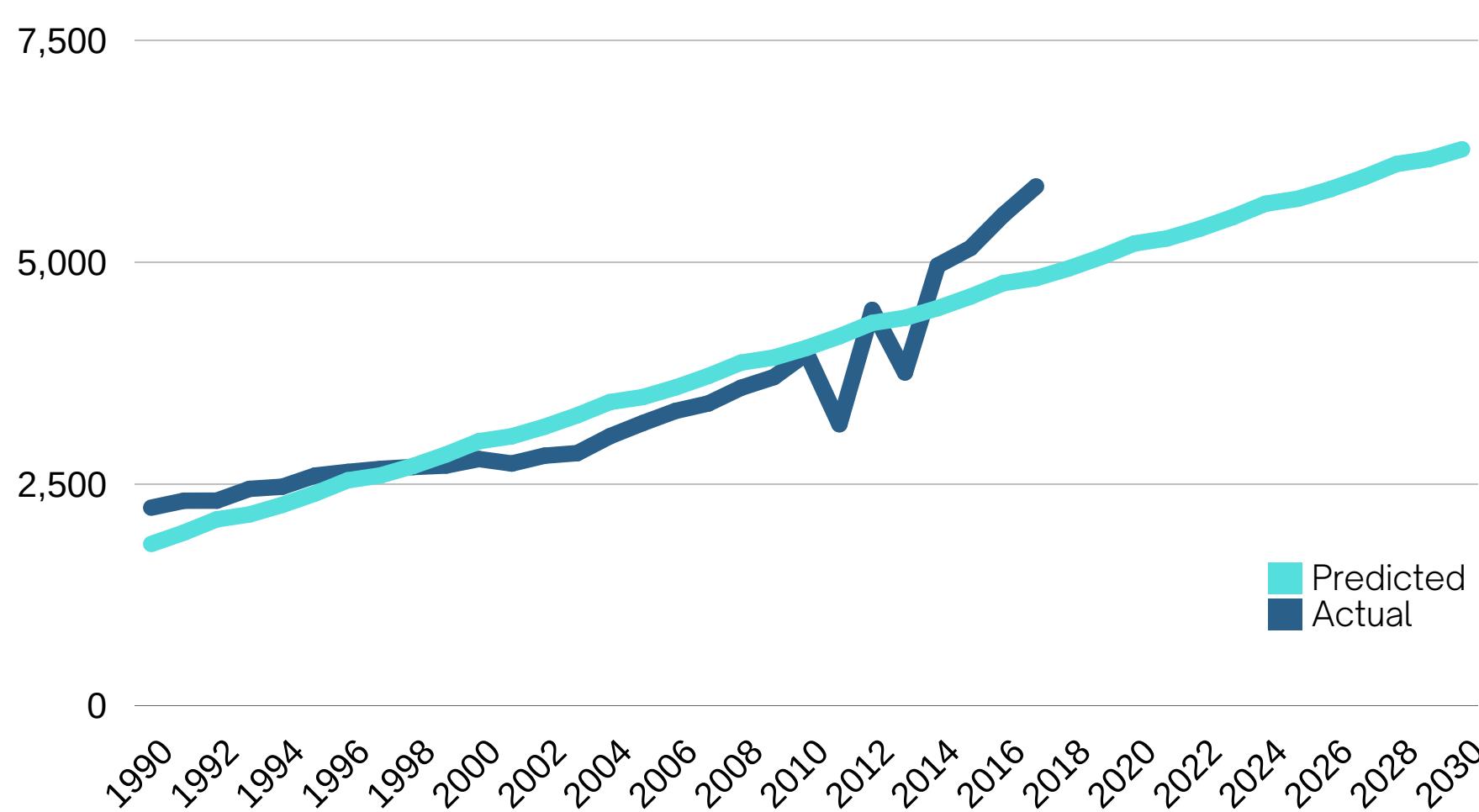


FIGURE 4: FORECASTED RENEWABLE ENERGY GENERATION, 1990 - 2030 (TWh)

It is forecasted that by 2030, total renewable energy generation is only [6,272.01 TWh](#) out of 30,130.40 TWh of total energy production.



Not aligning with the SDG Target to reach a 30% renewable energy contribution to overall energy generation (UNEP, 2023).

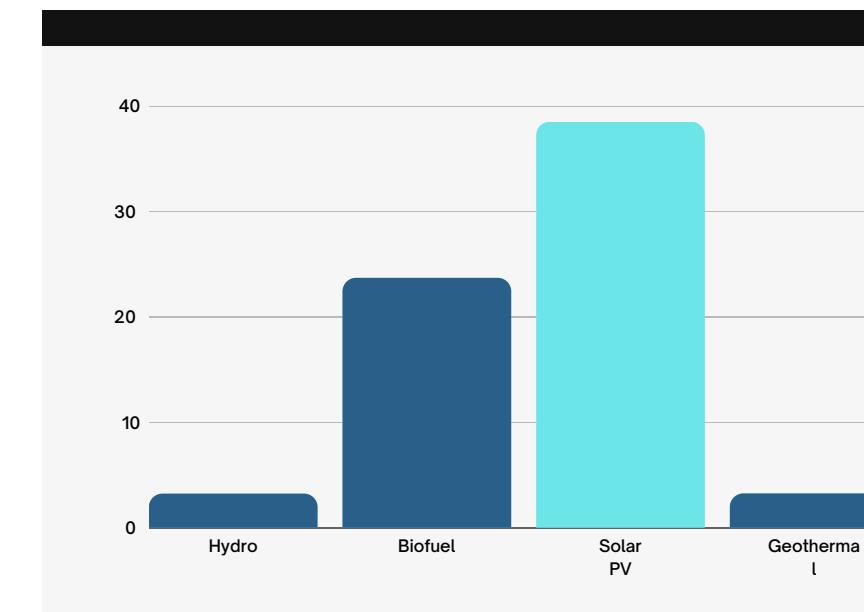


FIGURE 5: TYPES OF RENEWABLE ENERGY
• ANNUAL GROWTH MEAN, 1990 - 2017 (%)

[Solar](#) energy production has the **highest** annual growth rate of [38.5%](#).

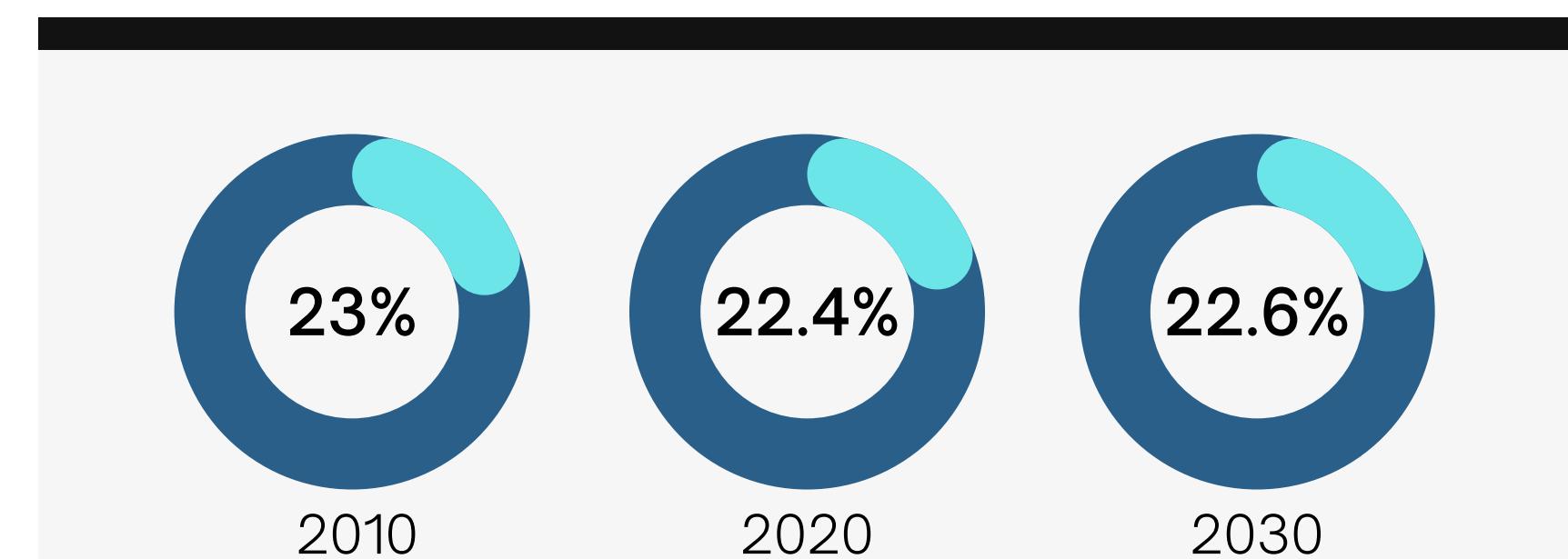


FIGURE 6: THE PERCENTAGE OF RENEWABLE ENERGY CONTRIBUTING TO THE OVERALL ENERGY PRODUCTION

Renewable energy generation is [increasing very slowly](#) from 2020-2030. In fact, there is a [drop](#) in percentage as compared to 2010.

Recommendation: Optimising & Utilising Smart Grids -- Part 1

What is smart grids?

- An electrical grid that allows a 2-way communication channel between the utility and its consumers
- Made up of controllers, computers, automation, new technologies, and equipment that work together with the electrical grid to respond digitally & in real-time to our rapidly changing electric demand

- Increasing the renewable energy contribution can only happen if more people are committed into producing renewable energy
- Smart grids aid in Renewable Energy Sources (RES) Integration

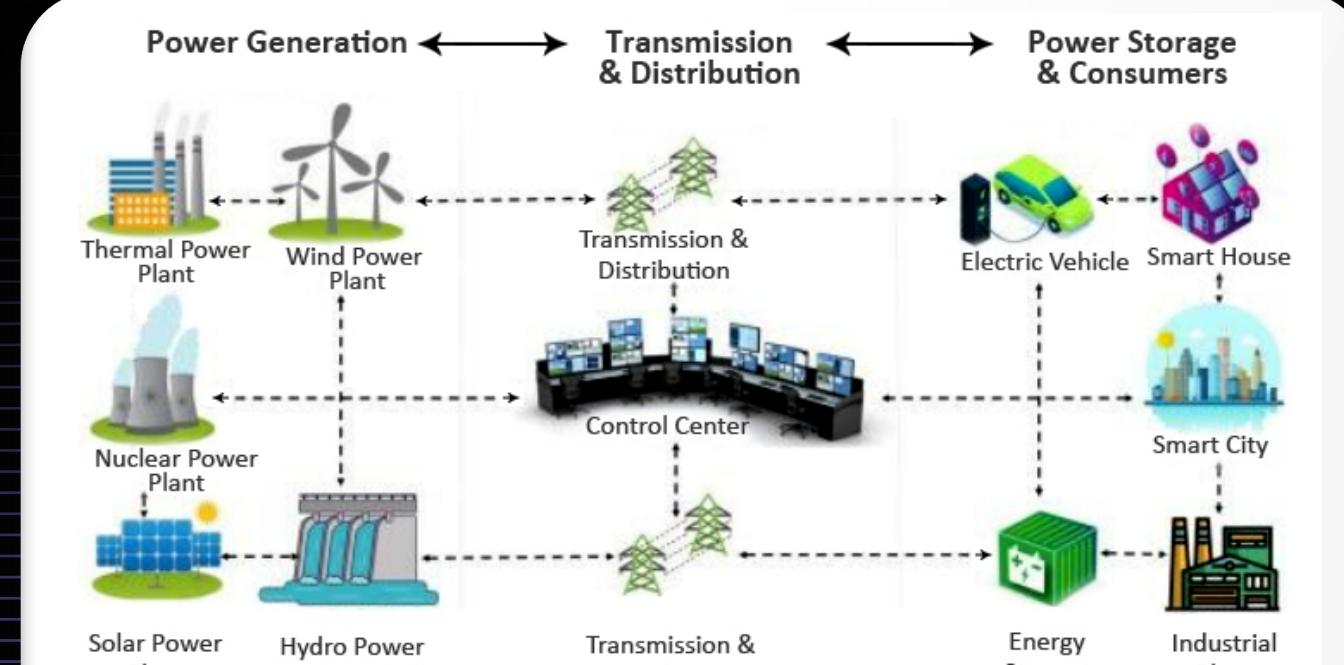
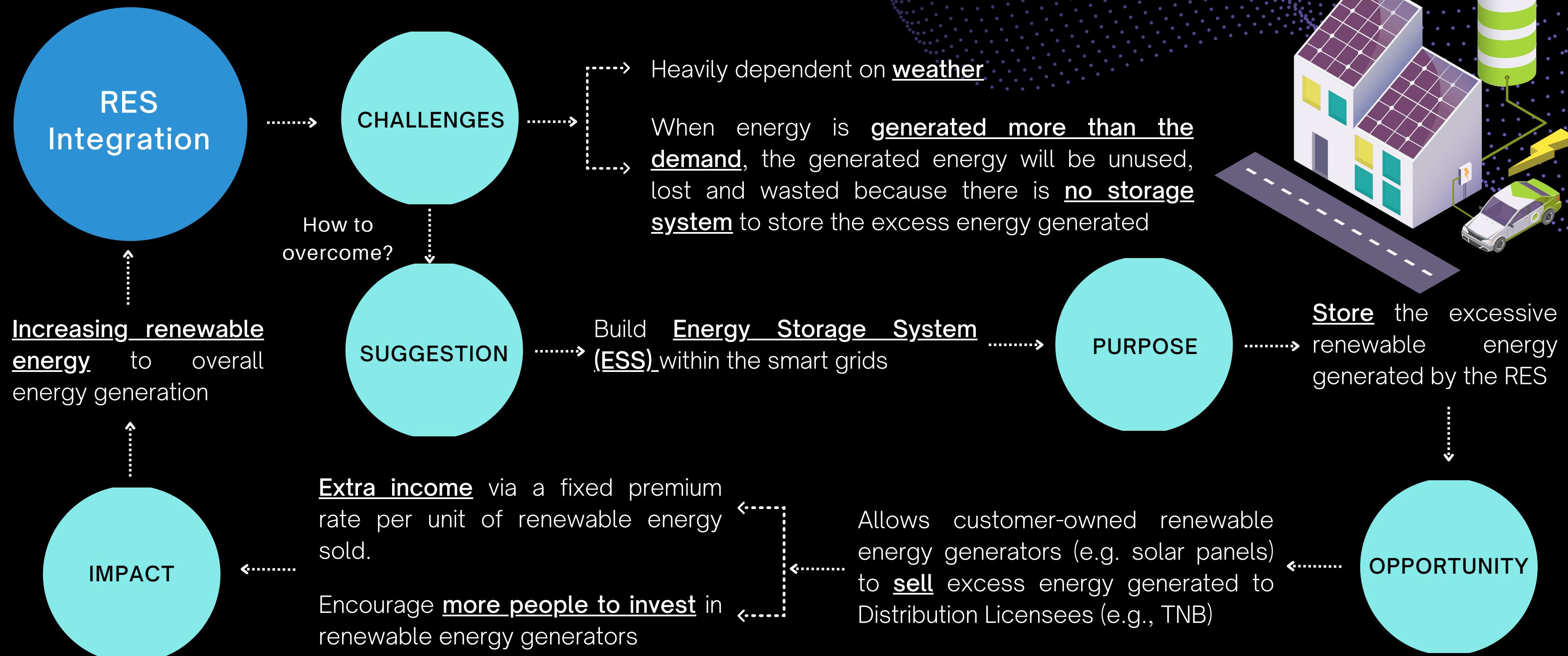


Figure 7: Smart Grid Technology

Recommendation: Optimising & Utilising Smart Grids - Part 2



Conclusion

1

Electricity demand is forecasted to exceed electricity production.

2

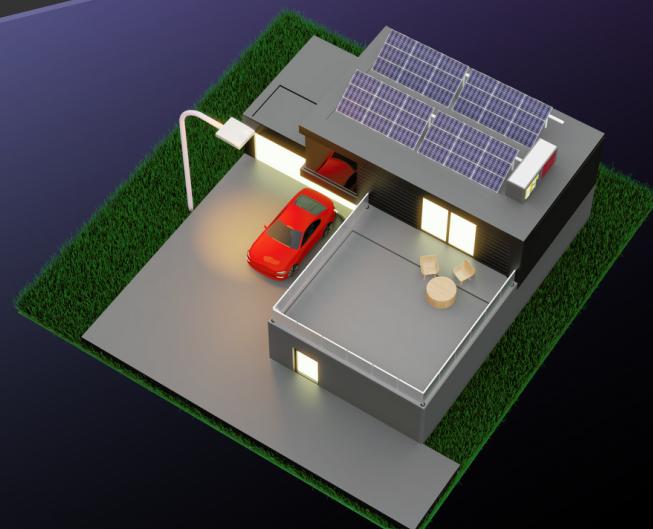
Renewable energy only contributes 22.6% to the overall energy production which is clearly against the SDG Goal **Target of 30%.**

3

Effective measures are needed to be taken to put us back on track to hit the 30% mark by 2030.

4

Our recommendation is to optimize and utilise **smart grids** through the implementation of **Energy Storage Systems (ESS)**.



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