# PROJECT TITLE

**Forecasting TTF Natural Gas Price**

## NON-TECHNICAL EXPLANATION OF YOUR PROJECT

Capstone Project on predicting TTF Natural Gas Prices using Machine Learning Models

The Title Transfer Facility, more commonly known as TTF, is a virtual trading point for natural gas in the Netherlands. This trading point provides facility for a number of traders in Netherlands to trade futures, physical and exchange trades.

Set up by Gasunie in 2003, it is almost identical to the National Balancing Point (NBP) in the United Kingdom and allows gas to be traded within the Dutch Gas network. The TTF is operated by an independent subsidiary of Gasunie, Gasunie Transport Services B.V.,[1] which is the Gas Transmission System Operator in the Netherlands. Wholesale gas trading at the TTF is predominantly conducted over-the-counter via interdealer brokers. Physical short-term gas and gas futures contracts are also traded and handled by the ICE-Endex Exchange (Amsterdam[2]) and via the PEGAS exchange. Gas at TTF trades in euros per megawatt hour.

In the two decades since its inception trades at the TTF have grown exponentially and exceeded domestic volumes in the Netherlands fourteen-fold. This increase, helped by the rise of liquefied natural gas (LNG), caused the TTF to overtake the UK's National Balancing Point (NBP) as Europe's biggest gas benchmark.[3]

As in any other free marketplace, prices on the Dutch hub are determined by the fundamental economic rules of supply and demand.

## DATA

For the purpose of this exercise we are going to query the data directly using Yahoo Fianance and using the data to predict the TTF Natural Gas daily prices for the next week.

The data queried will be since the begining of 2020 until 31st of March 2023 for trainnig various machine learning models and using past 5 months daily data to compare the model performances

## MODEL

Since this is a regression data problem where we are predicting numeric prices of TTF Natural Gas, I am compare some of the models best fitted to meet the requirement. Finally I am using Deep Learning Model like Long Short Term Memory (LSTM)model to predict forward prices

Linear Regression

Random Forest Regressor

Support Vector Machine Regression

Bayesian Ridge Regression

LSTM (Long Short Term Memory)

## HYPERPARAMETER OPTIMSATION

Since I am using different Models, the hyperparameters will be setup as per the respective model.

Broadly these are Gradient Descent and Hyperparameter Boosting

## RESULTS

Improvement based on each of the model

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Linear Regression

Improved by 0.362%

Base Accuracy : 99.32271143537098

Cross Validated Accuracy : 99.68262119124071

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Linear Regression

Improved by nan%

Base Accuracy : 99.32271143537098

Test Improved Accuracy : nan

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Linear Regression

Improved by nan%

Base Accuracy : 99.68262119124071

Cross Validated Test Improved Accuracy : nan

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Random Forest

Improved by -1.151%

Base Accuracy : 98.68564760171864

Cross Validated Accuracy : 97.54931056968233

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Random Forest

Improved by -0.246%

Base Accuracy : 98.68564760171864

Test Improved Accuracy : 98.44293188581312

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Random Forest

Improved by -0.812%

Base Accuracy : 97.54931056968233

Cross Validated Test Improved Accuracy : 96.75760495605316

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Support Vector

Improved by -3.697%

Base Accuracy : 85.11850978384804

Cross Validated Accuracy : 81.97158866138835

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Support Vector

Improved by 16.703%

Base Accuracy : 85.11850978384804

Test Improved Accuracy : 99.33608388479102

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Support Vector

Improved by 21.486%

Base Accuracy : 81.97158866138835

Cross Validated Test Improved Accuracy : 99.58366845614128

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Bayesian Ridge

Improved by 0.362%

Base Accuracy : 99.32259687374373

Cross Validated Accuracy : 99.6823887260662

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Bayesian Ridge

Improved by nan%

Base Accuracy : 99.32259687374373

Test Improved Accuracy : nan

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Bayesian Ridge

Improved by nan%

Base Accuracy : 99.6823887260662

Cross Validated Test Improved Accuracy : nan

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Best Model selected : SVM Forecast

Support VectorHyperparameter boosted Cross Validated model governing parameters

C : 10

cache\_size : 200

coef0 : 0.0

degree : 3

epsilon : 0.5

gamma : 1e-07

kernel : linear

max\_iter : -1

shrinking : True

tol : 0.001

verbose : False

Chart

Description automatically generated

LSTM Prediction

Chart, histogram

Description automatically generated

## (OPTIONAL: CONTACT DETAILS)

If you are planning on making your github repo public you may wish to include some contact information such as a link to your twitter or an email address.