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NEURAL NETWORK BASED MICROGRID VOLTAGE CONTROL

by

Chun-Ju Huang

A Thesis Submitted in

Partial Fulfillment of the

Requirements for the Degree of

Master of Science

in Engineering

at

The University of Wisconsin-Milwaukee

May 2013

ABSTRACT

NEURAL NETWORK BASED MICROGRID VOLTAGE CONTROL

by

Chun-Ju Huang

The University of Wisconsin-Milwaukee, 2013 Under the Supervision of Professor David Yu

The primary purpose of this study is to improve the voltage profile of Microgrid using the neural network algorithm. Neural networks have been successfully used for character recognition, image compression, and stock market prediction, but there is no directly application related to controlling distributed generations of Microgrid. For this reason the author decided to investigate further applications, with the aim of controlling dissel generator outputs.

Firstly, this thesis examines the neural network algorithm that can be utilized for alleviating voltage issues of Microgrid and presents the results. MATLAT and PSCAD are used for training neural network and simulating the Microgrid model respectively. The Feedforward Back-propagation algorithm is used in this study and the Microgrid consists of wind, solar, and diesel power generations, and battery storage. Neural network will indicate how much real and reactive power is needed from each generator. In the second stage, several scenarios are proposed to verify that the monitoring points are very

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important for training neural networks. Finally, the comparison of results is shown for further discussion of critical points.

In conclusion, the results of the study show that neural network algorithm is well suited for the application, and it was effectively certified for the purpose of improving the voltage profile of Microgrid. © Copyright by Chun-Ju Huang, 2013 All Rights Reserved

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LIST OF ABBREVIATIONS

PV	Photovoltaic
CSP	Concentrated solar power
MPPT	Maximum power point tracking
HAWT	Horizontal axis wind turbines
VAWT	Vertical axis wind turbines
AC	Alternating current
DC	Direct current
MSE	Mean Squared Error

CHAPTER I

INTRODOUCTION

Background

New energy technologies and scientific discoveries are being made every day. These extraordinary technologies and discoveries have improved and changed humans living conditions.

Most well known technologies are wind for sailing, insolation for grain drying and falling water for milling purposes. Electricity was the most important discovery of science. It is a basic feature of everything in the universe, and it brings convenience in many ways to humans' life. Fossil fuels are very old. Oil deposits are around 150 million years old. Although humans probably used it in ancient times, it was the industrial revolution that led to their wide-scale extraction. The industrial revolution was a key turning point in Earth's ecology and humans' relationship with their environment and the era of fossil fuels was the product of it. The most obvious evidence of the industrial revolution's impact on the world is human population growth that has rapidly increased energy consumption. Human beings have relied on finite sources over centuries and the CO2 production dramatically rising along with energy consumption. The results of major depletion of fossil fuel reserves cause global warming, financial instability, and political turmoil in the world. Scientists indicate that human will run out of fossil fuel reserves in the near future, world is facing an impending energy crisis. It is truly urgent to find energy alternatives that are reliable, sustainable and environment friendly.

Renewable energy sources will be a significant role to supply global energy demand in the future.

Renewable energy could supply for almost 80% of the world's energy demand within four decades and shift global dependence away from fossil fuels [1]. Renewable energy sources will also provide environmental benefits such as reduced pollution, land restoration, and slow down global warming. Renewable energy technologies development will excite global economy and it also offers more job opportunities.

Energy is one of the important needs for humans. The fundamental of global economic stability and growth are secure, reliable, and affordable energy. The world economic growth depends on global supply, and oil accounts for about 40% of the world energy consumption and almost all of the transportation fuels [2]. Humans have consumed an incredible amount of fossil fuels in a very short period of time since the industrial revolution. Crude oil reserves are vanishing at the rate of 4 billion tons a year. If humans carry on at this rate without any increase of our growing population, oil deposits will be gone by 2052. There still have gas and coal left but the increasing of gas production fills the energy gap left by oil, those reserves will only last an additional eight years. The coal will provide world energy till 2088 after oil and gas are vanished. Since the world's population is still rising, fossil fuels will run out earlier. Figure 1.1 shows that how many years the fossil fuels reserves will last.

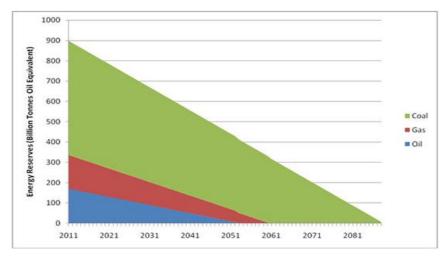


Figure 1.1: Years of production left for fossil fuels [3]

Literature review

Fossil fuel reserves are going to be vanished in the near future, so human beings will need to find alternative energy sources to avoid this disaster. The use of renewable energy sources is becoming popular along with fossil fuels depletion. Microgrid concept was quickly becoming a popular topic within the power community. It has been found that in terms of energy security, multiple small generators are more efficient than relying on a single large generator [4]. Microgrid systems can be integrated with renewable energy sources and meet the needs of a wide range of application in commercial, industrial and other critical applications such as running at hospitals and military bases. Microgrid will also be increasingly deployed in rural communities to meet their electricity needs. Independence is one of the advantages of Microgrid. It offers more reliability and stability over a traditional central generation. Faults and load imbalances are a reality within electrical distribution systems. There is a need of a controller to help maintain stability. The paper investigated a control strategy for distributed generation systems to mitigate imbalances due to load conditions [5]. It presented a controller that regulates the terminal voltage of sensitive loads in the island mode and real and reactive power flow in the gridconnected mode. The controller has multiple loops containing regulators for filter inductor current, filter capacitor voltage and real and reactive powers. Simulation results are presented in the paper to verify the performance of the controller. Frequency regulation was not investigated in the paper and the controller operates at a single frequency.

The analysis of droop based generation control schemes for distributed generation inverters comprising of active power-frequency and reactive power-voltage controllers are presented in [6]. The author built small-signal models for microgrids that consisting of several distributed generations in a chain topology. It is a radial network with several generators and an infinite bus at one end and loads connected at each distributed resource bus. Microgrid has a system matrix that is portioned into submatrices referring to the active and reactive power flows [7]. An eigenvalue analysis and sufficient conditions were developed to guarantee their small signal stability, and guidelines are provided for design of the active power-frequency and reactive power-voltage controllers. The authors also used IEEE 1547 standards in the design process in order to follow the established regulations. The droop-based controllers that allow decentralized operation of the Microgrid system without communication between the distributed generations.

Objective of Study

Microgrid deployments will increase significantly in decades. Power system planning is very important and voltage is one of the key objects of power systems. This thesis

pursues the same idea as the paper that was mentioned previously there is no communication system or central controller between generations, but this study provided a different method to accomplish it. The neural network algorithm is used for Microgrid voltage control. When the load demand changes significantly it might cause problems such as low and high voltage issues at the terminal of sensitive loads. The diesel generators should smooth these disturbances by controlling its real and reactive power. Microgrid has multiple power generations, and there is no central controller and no communication system between them in this study. It is difficult to solve the problems without a controller or by regulating only one generation's real and reactive power outputs. There are two diesel generators presented in this study, and their real and reactive powers are regulated. It will optimize Microgrid reliability. Diesel generators will sustain the load demand and renewable sources are mainly used for charging battery. Since there is no direct relationship between two generators, neural network is one of the best solutions to solve non-linear problems. There are many different types of neural networks; the abilities of different networks can be related to their structure, dynamics and learning methods. It offers improved performance over conventional technologies in areas which include: signal filtering, data segmentation, optimization and scheduling [8].

CHAPTER II

RENEWABLE ENERGY SYSTEMS INTEGRATION-MICROGRID

Overview

Renewable energy comes from sources that can be replaced or replenished. Nowadays, this type of energy is growing in popularity. It is a combination of various renewable energy sources such as solar, wind, biomass, and geothermal. These renewable energy sources are clean and have nominal environmental impacts. In contrast, fossil fuels are a finite resource. Eventually, it will become very expensive, and the world will run out of fossil fuels. However, renewable resources offer the alternative of fossil fuels; these are distributed all over the world and are available at no cost. Even the renewable energy demand is regularly increasing but the world still relies on fossil fuel energy the most. The percentage of annual energy consumption by source in the US and in the world is shown in the Table 2.1. Statistics has shown that there is an ongoing increase in the use of renewable energy. By the end of 2011, approximately 8% of the total global energy consumption came from renewable sources [9]. In the United States alone, 9% of the total energy production came from renewable energy sources [10]. The potential of renewable energy sources is enormous.

Source	World	US
petroleum	33%	36%
Natural Gas	24%	26%
Coal	30%	20%
Renewable Energy	8%	9%
Nuclear Electric Power	5%	8%

Table 2.1: Energy use in U.S and World in 2011

Even though the rapid growth of renewable sources, it has many challenges could affect wider deployment of these resources, for instance, intermittency, lack of large scale energy storage, and restriction of locations. These technical challenges must be overcome to make it growing maturity.

Components of Microgrid

There are some main components in a Microgrid power system such as protection, monitoring, immediate storage, local loads, and distributed generations. Distributed generations and energy storage will be introduced in this chapter.

Solar Energy

Solar power is considering an unlimited energy resource. One day of the insolation onto Earth is more than enough energy to satisfy global needs each day. The drawback of the solar energy is its intermittency. Solar power system needs to have a storage device such as a battery during the night. The cloudy weather would make the solar energy unreliable during the day.

Solar energy technologies are growing very fast in recent decades. The solar radiation can be used in many ways such as water heating-solar thermal, directly electricity generationsolar Photovoltaic (PV), and electricity generation-solar thermal power systems.

Photovoltaic Technology

Solar Photovoltaic devices convert sunlight into electrical energy and it is used very common in public. For instance, directly light traffic signs and providing house electricity. PV modules are wired in series and in parallel to meet voltage and current requirements. It can be applied to the grid or with storage for off-grid applications. It needs a power inverter to convert direct current (DC) to alternating current (AC). One of the advantages

of PV technology is its high reliability, and warranties of 20 years or more. Figure 2.1 show a photovoltaic cell structure.

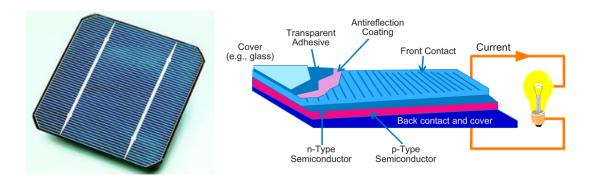


Figure 2.1: Photovoltaic cell structure [11]

The number of PV installations have a dramatically amount of growth in recent years. The growth is because of government supporting policies, cost reductions and technology improvements. For example, Solyndra was a manufacturer of photovoltaic (PV) systems and the company received a \$535million U.S. Energy Department loan guarantee [12]; the PV system price was \$9 per Watt-DC by system component for completed systems in 2009. The price dropped to \$5.9 per Watt-DC in 2012[13]. The world annual solar photovoltaic production is shown in Figure 2.2.

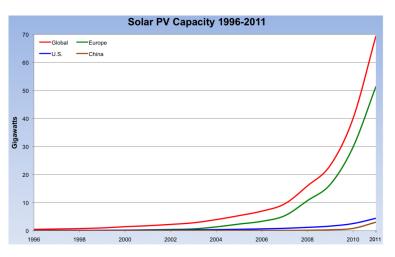


Figure 2.2: World annual solar photovoltaic production [9]

Photovoltaic cells have a complex relationship. The power delivered by a PV system is dependent on the temperature, solar irradiance, and incidence angle. As the operating conditions differ, the voltage and current that leads to maximum power vary. Maximum power tracking is widely used in a power electronic converter in order to produce as much power as possible from a PV system [14]. It also benefits some applications as putting power on the grid, charging batteries, and powering an electric motor. There are several methods such as constant voltage, open circuit voltage, short circuit current, and perturb and observe. Figure 2.3 shows the I-V and power characteristics of solar panel [14]. The certain resistance value at the maximum power point is called characteristic resistance of the cell; this value draws the maximum power from the device. If the resistance is lower or higher than this value, the system will not be used efficiently and drawn less power than the maximum available.

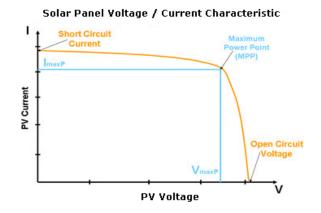


Figure 2.3: I-V curve [14]

Wind Energy

Wind energy comes from air current flowing across the earth's surface. A wind turbine is a device that converts wind energy from the wind into mechanical energy. The mechanical energy can be used to drive machinery such as for grinding grain or pumping water. Similarly, it can be used to produce electricity. The first known wind turbine for producing electricity was a battery charging machine in 1887. Wind generators for electricity were common on farms in the past. Nowadays, the wind energy is widely used for many applications such as telecom towers, offshore platforms, and rural schools.

Wind Technology

Wind turbines convert wind energy into usable power that can provide electricity for home, school or business applications on residential or utility scales. It can be horizontal axis wind turbines (HAWT) or vertical axis wind turbines (VAWT). The two wind turbines are shown in Figure 2.4 and Figure 2.5.



Figure 2.5: HAWT [16]

Figure 2.4: VAWT [15] Power from the wind can be calculated by the equation.

$$\mathbf{P} = 0.5 \rho \mathbf{A} \mathbf{v}^{3} C_{p}$$

Where P: power, watt, ρ : density of air, kg/ m^3 , v: wind speed, m/s, C_p : wind turbine power efficiency, A: πr^2 swept area of wind turbine. Figure 2.6 shows a sketch of how the power output from a wind turbine varies with steady wind speed [17].

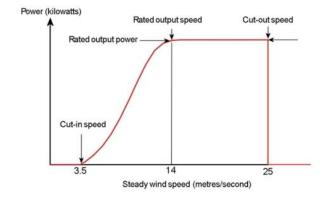


Figure 2.6: Wind turbine power output with steady wind speed [17]

The cut-in speed is at very low wind speeds. The wind turbines will begin to spin and generate electrical power when the wind speed is above 3.5 meters per second. Every turbine has a rated output power. When the wind speed reach the rated output speed the wind turbine will only generate rated output power. There is no further rise in the output power. If the wind speed is above the cut-out speed there is a risk of damage to the rotor. As a result, a braking system is employed to stop the wind turbine. There are several different technologies are used for wind turbine generators such as variable frequency synchronous generators, squirrel cage induction generators, and doubly fed induction generators. Most of modern wind turbines have two or three blades. A wind farm is numbers of wind turbines in the same area for production of electricity. The wind technologies have excellent environmental credential and avoidance of long distance transmission costs. Wind energy is one of the fastest growing markets in the world today. Figure 2.7 shows the world wind power capacity from 1997-2011.

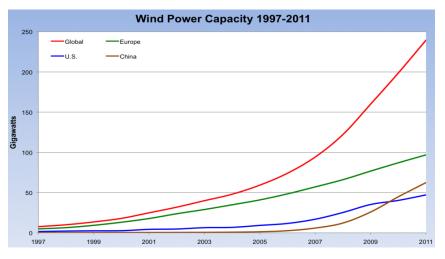


Figure 2.7: World annual wind energy production [9]

Energy Storage

Energy storage plays an important role in a utility disconnected power system. A conventional generation system is large enough not to be affected by load changes. Renewable energy must be stored in order to make power system reliable if it is not grid-connected. For example, energy storage is required to compensate for no wind periods; solar energy is not available on cloudy days and during the night time, so stored energy must be available to pick up the loads for the loss of sunlight. Storage batteries are generally used as energy backup. When the load voltages fluctuating along with load profile changing, energy storage has to have the ability of smoothing out load changes. There are several types of batteries such as Lithium ion, lead acid, and fuel cell. There are some other storage methods: for instance, thermal storage, mechanical storage, and biological storage. Figure 2.8 illustrates the emerging energy storage technologies. The storage battery is a bidirectional converter to the system. It is necessary to charge and discharge energy.

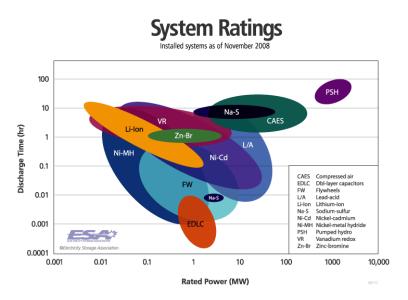


Figure 2.8: Energy storage rated power versus discharge time [18]

Diesel Generator

A diesel generator consists of a diesel engine with an electrical generator to generate electrical energy. Diesel generators are the most commonly used generators because of the diesel's unique features: powerful, portable, and highly dependable for a wide variety of uses. They also require minimal maintenance work and costs due to the absence of carburetors and spark plugs [19]. They are cheaper compared to gas generators because of the low fuel costs. Diesel has a higher energy density and more energy can be extracted from when compared to the same volume of gas. Despite the advantages of diesel generators, it could be way more expensive in terms of their setting up. However, the statistics shows that the savings derived from the investment in generators that run on diesel are worth on outweigh the disadvantages [20]. It is still the top rated choice among commercial users. Diesel generators are widely used in places where grid is not available or as emergency power source if the grid fails. One or more diesel generators could be supplying energy for residents, schools, and business buildings without a connection to

an electrical grid. It is one of the main components in Microgrid. Figure 2.9 shows a diesel generator.



Figure 2.9: Diesel generator [21]

Cost Optimization

Microgrid power system is a local version of a centralized electricity system that provides cheap and reliable power in remote areas. The capital cost of electric power transmission is very high to certain regions such as mountains and sparsely populated areas. The conventional power plant has a huge amount of power loss in a long distance transmission line. Power loss is a waste of energy. In addition, renewable energy resources are considered to be an unlimited power supply. Microgrid is the best solution to provide power to these areas.

Microgrid Power System

Microgrid power system is a small-scale power supply network that is designed to provide power for a small community. Microgrid technology has been in a research and development phase for the last decade. A major advantage of Microgrid is its ability to work alone during the utility grid disturbance or outage. The main components of Microgrid contain multiple distributed energy resources, local loads, and energy storages. These technologies are in different stages of maturity. The challenges are to integrate them all and to operate in a stable and reliable condition, and to manage the imbalance between loads and generations. Interconnection standards need to be developed to ensure consistency. For example, ANSI C84 is the American National Standard for Electric Power Systems and Equipment; the IEEE 1547 Standard for interconnecting distributed resources with electric power systems is proposed by the Institute of Electrical and Electronic Engineers. These standards include voltage, frequency, harmonics regulations, and synchronous interconnection requirements for distributed resources and utility grid. Figure 2.10 shows a typical Microgrid power system.

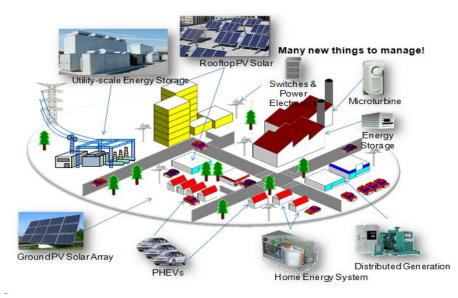


Figure 2.10: Microgrid [22]

There are two operating modes of a Microgrid power system. Grid Connected Mode: When it is connected to the utility grid, the static switch is closed. All the feeders are being supplied by the utility grid, and Microgrid can be sending excess power to the utility gird. Islanding Mode: The utility grid does not supply power when the static switch is open. Microgrid can be working alone preventing power outages when the utility grid is not available. Figures 2.11 and 2.12 illustrate the configurations of the two modes. The point of common coupling is the point where a Microgrid system is connected to the utility grid. Islanding mode includes two operating conditions: intentional islanding and unintentional islanding. The intentional islanding is expected to disconnect from the utility grid. The benefits of the intentional islanding mode is allowing for maintenance, resolving power quality issues, and relieving overload problems on the utility grid. The unintentional islanding is when the faults happen at the utility grid side, according to the ANSI C84 and IEEE 1547 Standards; Microgrid should be disconnected from the utility grid if its voltages or frequencies violate either the lower or upper bound limits.

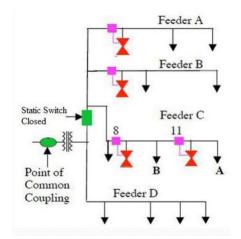


Figure 2.11: Grid connected mode [23]

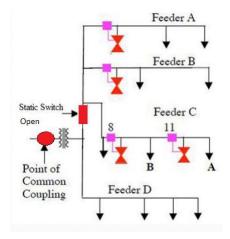


Figure 2.12: Islanding mode [23]

CHAPTER III

NEURAL NETWORK BASED MICROGRID VOLTAGE CONTROL

Microgrid Topology

A Microgrid system is presented on PSCAD. It represents a small community that consists of solar, wind, and diesel generations, battery storage and 10 variable loads. The system is a three phase balanced power system disconnected from the utility grid. As time progresses, the load demand changes. When the total load demand changes significantly, it might cause problems such as low and high voltage issues at the critical buses. The purpose of this study is to improve the voltage profile of Microgrid. The diesel generations should smooth out these disturbances by controlling their real and reactive power outputs using a neural network algorithm. Neural network will provide how much real and reactive power is needed from each generator supplying power to the system. This study included low voltage issue, high voltage issue, and low and high voltage issue at the same time at the terminal of sensitive loads. The lower bound and higher bound voltage are 0.978 and 1.027 per unit respectively. The power factors of diesel generators were also considered; the desired range was from 0.85 to 0.89 per unit. The system voltage is at a distribution level with rated line to line voltage-480 V. The locations of the power generation are given in this study. Figure 3.1 demonstrates the Microgrid topology.

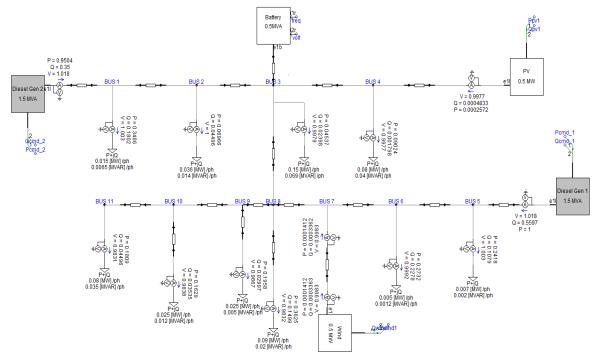


Figure 3.1: Microgrid topology

Table 3.1 shows the capacity of each power generation.

Power Generations	capacity
Wind Power	0.5MW
Solar Power	0.5MW
Diesel Generators	3.0MVA(PQ control)
Battery Storage	0.5MVA(voltage control)

Table 3.1: Electricity generating capacity

The transmission line parameters are the same but the distance may vary between bus to

bus. Table 3.2 shows the transmission line parameters.

Resistance	0.3418 ohm
Reactance	1.0335 ohm
Mutual resistance	0.1558 ohm
Mutual reactance	0.4367 ohm
Capacitance(A, B, C)	5.9990 uF
Capacitance(A-B, A-C, B-C)	-1.3300 uF

Table 3.2: Transmission line parameters

Table 3.3 illustrates the length of the transmission line between bus and bus in mile.

Bus	Bus	Length/mile	Bus	Bus	Length/mile
1	2	0.0035	1	Diesel 2	0.0090
2	3	0.0035	3	Battery	0.0070
3	4	0.0025	3	8	0.0070
5	6	0.0020	4	PV	0.0070
6	7	0.0010	5	Diesel 1	0.0070
7	8	0.0050	7	Wind	0.0010
8	9	0.0075	8	Load 8	0.0150
9	10	0.0064	9	Load 9	0.0055
10	11	0.0063	10	Load 10	0.0043

Table 3.3: Length of transmission line

The diesel generator model is shown in Figure 3.2. The diesel generator model consists of a synchronous generator, exciter, IC engine, and governor. The diesel generator model is P-Q controlled to provide desired output in order to sustain the system's voltage profile.

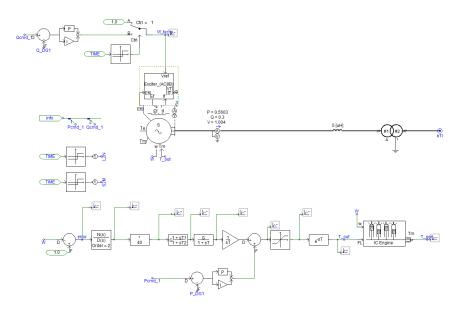


Figure 3.2: Diesel generator model

Figure 3.3 demonstrates the inverter average model for wind and solar power. Three current control current sources were used to model the inverter. It does not supply reactive power to the system, it only provides real power.

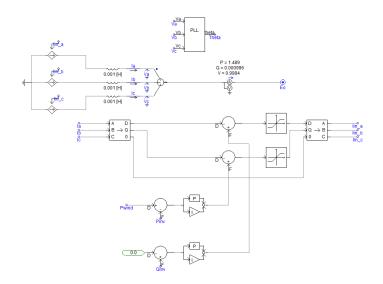


Figure 3.3: Inverter average model for wind and solar power

Artificial Neural Network

Neural network is a data processing system that is inspired by the biological neurons. It can be derived from the neurophysiologist Warren McCulloch and mathematician Walter Pitts; they modeled a simple neural network using electrical circuits in 1943 [24], but the technology was limited at that time. Neural network has significant progress that has been made since then. It has an outstanding ability to derive meaning from complicated data. It also can be used to detect data trends and patterns that are too complex to be classified by neither humans nor computer techniques. A trained neural network can analyze information that has been given and providing projections and answers to further problems. Neural networks take a different approach to problem solving than the conventional computers. Neural networks are like human beings' brain. They are suited to situations that have no clear algorithmic solutions and are able to manage imprecise

data. Neural networks are used in several applications that have irrelevant data such as robotics, signal processing, pattern recognition, and financial applications. This advantage allows neural networks to excel in some areas that conventional computers often find difficult [25]. In contrast to neural networks, conventional computers' instructions are fetched from memory. Its process is repeated the instructions are completed. This kind of process is suited to solving problems using an algorithm such as searching for an item on a database [25]. Conventional computers are not able to manage the variability of data obtained in the real word.

Architecture of Neural Networks

Mathematically, neural networks can be represented as weighted directed graphs. Feedforward network was the first type of neural network. The data moves in only one direction, there are no cycles or loops in the network. The two common neural network architectures are:

- Single Layer Feed-forward Neural Networks
- Multi Layer Feed-forward Neural Networks

The single layer feed-forward network consists of a single layer, where the inputs are directly connected to the outputs, via a series of weights. It is the simplest type of feedforward network and can only classify separable cases with a binary target [26]. Figure 3.4 shows the structure of single layer neural network.

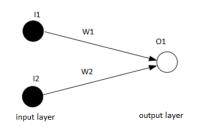


Figure 3.4: Single layer neural network

A multilayer feed-forward neural network has the same structure of a single layer network with one or more hidden layers. Network data and calculations flow in a single direction, from the input data to outputs [27]. The hidden layers sit in between the input and output layers. Figure 3.5 demonstrates the structure of multiple layers neural network

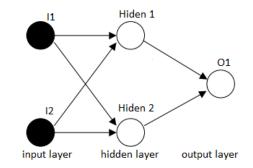


Figure 3.5: Multiple layers neural network

The Back-Propagation Algorithm

The back-propagation is used to learn the examples. Input data and output target are very important in the algorithm that needs to be given to train the network. When training is done, it will provide the required output for a particular input. The back-propagation networks are widely used for pattern recognition and mapping tasks. Figure 3.6 demonstrates the back-propagation algorithm.

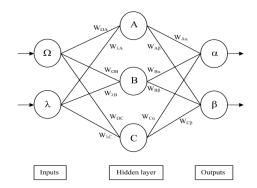


Figure 3.6: The back-propagation algorithm [28]

Activation Functions

The activation function translates the input signals to output signals. The sigmoid transfer function is commonly used in back-propagation networks, because it is differentiable. It can reduce the computation burden for training. Figure 3.7 shows the sigmoid transfer function.

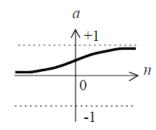


Figure 3.7: Sigmoid transfer function [29]

The calculation of the algorithm is shown below.

- 1. Calculate errors of output neurons $E_{\alpha} = out_{\alpha}(1 - out_{\alpha})(\text{Target }_{\alpha} - out_{\alpha})$ $E_{\beta} = out_{\beta}(1 - out_{\beta})(\text{Target }_{\beta} - out_{\beta})$
- 2. Change output layer weights

$W^{+}_{A\alpha} = W^{}_{A\alpha} + \eta E^{}_{\alpha}out^{}_{A}$	$\mathbf{W}^{+}{}_{\mathbf{A}\boldsymbol{\beta}} = \mathbf{W}_{\mathbf{A}\boldsymbol{\beta}} + \boldsymbol{\eta}\boldsymbol{E}_{\boldsymbol{\beta}}\boldsymbol{out}_{\mathbf{A}}$
$\mathbf{W}^{+}{}_{\mathbf{B}\alpha} = \mathbf{W}_{\mathbf{B}\alpha} + \eta E_{\alpha}out_{\mathbf{B}}$	$\mathbf{W}^{+}_{\mathbf{B}\beta} = \mathbf{W}_{\mathbf{B}\beta} + \eta E_{\beta}out_{\mathbf{B}}$
$W^+_{C\alpha} = W_{C\alpha} + \eta E_{\alpha}out_C$	$W^+_{C\beta} = W_{C\beta} + \eta E_{\beta}out_C$

3. Calculate errors of hidden layer neurons

$$E_{A} = out_{A}(1 - out_{A})(E_{\alpha}W_{A\alpha} + E_{\beta}W_{A\beta})$$
$$E_{B} = out_{B}(1 - out_{B})(E_{\alpha}W_{B\alpha} + E_{\beta}W_{B\beta})$$
$$E_{C} = out_{C}(1 - out_{C})(E_{\alpha}W_{C\alpha} + E_{\beta}W_{C\beta})$$

4. Change hidden layer weights

$$\begin{split} \mathbf{W}^{+}{}_{\lambda A} &= \mathbf{W}_{\lambda A} + \eta E_{A} \mathrm{in}_{\lambda} & \mathbf{W}^{+}{}_{\Omega A} &= \mathbf{W}_{\Omega A} + \eta E_{A} \mathrm{in}_{\Omega} \\ \mathbf{W}^{+}{}_{\lambda B} &= \mathbf{W}_{\lambda B} + \eta E_{B} \mathrm{in}_{\lambda} & \mathbf{W}^{+}{}_{\Omega B} &= \mathbf{W}_{\Omega B} + \eta E_{B} \mathrm{in}_{\Omega} \\ \mathbf{W}^{+}{}_{\lambda C} &= \mathbf{W}_{\lambda C} + \eta E_{C} \mathrm{in}_{\lambda} & \mathbf{W}^{+}{}_{\Omega C} &= \mathbf{W}_{\Omega C} + \eta E_{C} \mathrm{in}_{\Omega} \end{split}$$

Where η is the learning rate, *E* is the errors of neurons, *out* represents each neuron's output, W and W⁺ are the initial weight and adjusted weight respectively.

When the Mean Squared Error (MSE) ceases to decrease, the neural network training will stop.

MSE =
$$\frac{1}{n} \sum_{i=1}^{n} (Y_i - Y_i)^2$$

Where $Y_i^{'}$ is the neural network output, and Y_i is the output target value.

Neural Network Training

The input data cases with their corresponding output targets for training neural networks were generated on PSCAD. Possible circumstances were included, such as high and low voltages at critical buses. Table 3.4 illustrates 5 of the 112 training cases.

	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.9500	1.0200	0.4000	0.2600	0.8000
Diesel 1 Q	0.5600	0.5800	0.2200	0.1000	0.4500
Diesel 2 P	0.5160	0.7000	0.7000	1.2300	0.7800
Diesel 2 Q	0.3100	0.4000	0.4000	0.6400	0.4600
Wind P	0	0	0	0.1300	0
PV P	0.2000	0	0	0.0600	0
Vd1	1.0330	1.0350	0.9926	0.9760	1.0280
Vd2	1.0180	1.0270	1.0150	1.0310	1.0300
V load 1	1.0070	1.0120	1.0010	1.0080	1.0140
V load 2	1.0050	1.0080	0.9965	1.0010	1.0090
V load 3	1.0040	1.0040	0.9929	0.9943	1.0050
V load 4	1.0040	1.0030	0.9924	0.9941	1.0050
V load 5	1.0170	1.0190	0.9863	0.9726	1.0150
V load 6	1.0130	1.0150	0.9849	0.9732	1.0120
V load 8	1.0040	0.9979	0.9741	0.974	1.0020
V load 9	0.9976	0.9987	0.9757	0.9732	0.9961
V load 10	0.9933	0.9965	0.9737	0.9699	0.9922
V load 11	0.9931	0.9969	0.9703	0.9692	0.9912

Table 3.4: 5 of the 112 training cases

The output targets were determined by manually adjusting diesel generators' output power to alleviate voltage issues. The table 3.5 indicates the corresponding output target to the input cases. When each generator provides a certain amount of power, the issues will be eliminated.

	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.65	0.80	0.85	0.95	0.68
Diesel 1 Q	0.39	0.47	0.46	0.56	0.38
Diesel 2 P	0.65	0.65	0.65	0.65	0.60
Diesel 2 Q	0.39	0.36	0.38	0.38	0.34

	Table 3.5:	5 of the	112 output	targets
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Table 3.6 shows the test cases for verifying the neural network performance after training

was finished. These test cases were different from the input training cases.

	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.3200	0.5000	0.9800	0.8500	0.6500
Diesel 1 Q	0.1900	0.2800	0.5824	0.5000	0.3500
Diesel 2 P	1.0500	1.1000	0.2000	0.3000	0.6500
Diesel 2 Q	0.6500	0.6100	0.1188	0.1600	0.3500
Wind P	0.0500	0	0.1000	0	0
PV P	0.0100	0	0.0600	0	0
Vd1	1.0020	1.0010	1.0350	1.0130	1.0130
Vd2	1.0370	1.0280	1.0040	1.0040	1.0220
V load 1	1.0150	1.0070	1.0000	0.9977	1.0090
V load 2	1.0070	1.0010	0.9993	0.9956	1.0040
V load 3	1.0000	0.9965	0.9997	0.9937	0.9999
V load 4	0.9994	0.9962	0.9996	0.9933	0.9997
V load 5	0.9966	0.9930	1.0200	0.9994	1.0030
V load 6	0.9953	0.9916	1.0160	0.9963	0.9999
V load 8	0.9869	0.9817	1.0010	0.9754	0.9803
V load 9	0.9819	0.9774	0.9986	0.9762	0.9807
V load 10	0.9744	0.9719	0.9958	0.9705	0.9753
V load 11	0.9760	0.9719	0.9957	0.9696	0.9745

 Table 3.6: 5 of the 16 test cases

System Optimization Scenarios

There are seven scenarios to alleviate voltage issues in this thesis. The monitoring points are different in each scenario so there were seven neural networks. Their results are presented in this chapter respectively.

- 1. Monitor all the loads
- 2. Monitor four critical loads
- 3. Monitor three critical loads
- 4. Monitor two critical loads
- 5. Monitor one critical load
- 6. Monitor four irrelevant loads
- 7. Monitor one critical load and one irrelevant load

First Scenario – Monitoring All the Loads

The first scenario was to monitor 10 loads. The goal of this scenario was to determine that the neural network could be used for improving the voltage profile of Microgrid. There were 15 neurons in the hidden layer. Figure 3.8 demonstrates that the network training stopped at epoch 6 because it had the best vaildation performace. Regression values measure the correlation between neural outputs and output targets. An R value 1 means a close relationship, and 0 means a random relationship.

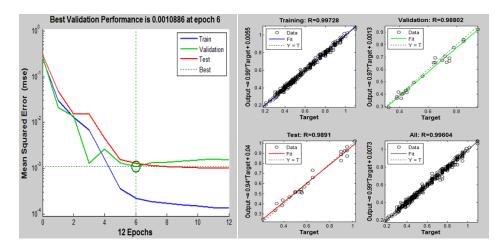


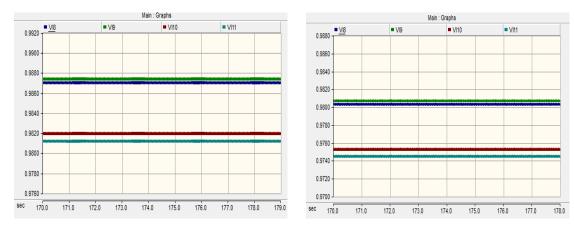
Figure 3.8: First scenario training information

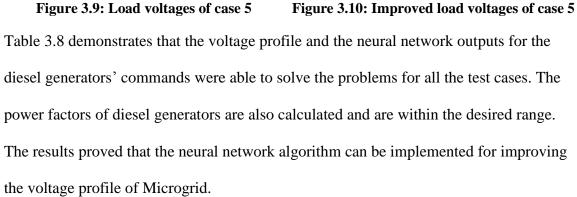
First Scenario Simulation Result

	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.6922	0.9130	0.6844	0.9748	0.8097
Diesel 1 Q	0.3806	0.5304	0.3366	0.5586	0.4731
Diesel 2 P	0.6833	0.8839	0.5286	0.6803	0.6591
Diesel 2 Q	0.3506	0.4909	0.2914	0.3977	0.3887

 Table 3.7: Neural network output of first network

Figure 3.9 shows the simulation plot of voltages at bus 8,9,10, and 11 before adjusting the diesel generators' power commands of case 5. Figure 3.10 shows the improved load voltages using the neural network outputs on diesel generators of case 5. The simulation results indicated that low voltage issues at critical buses were eliminated in case 5.





	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.6922	0.91303	0.6844	0.9748	0.8097
Diesel 1 Q	0.3806	0.5304	0.3366	0.5586	0.4731
Diesel 2 P	0.6833	0.8839	0.5286	0.6803	0.6591
Diesel 2 Q	0.3506	0.4909	0.2914	0.3977	0.3887
Wind P	0.0500	0	0.1000	0	0
PV P	0.0100	0	0.0600	0	0
Vd1	1.0200	1.0250	1.0160	1.026	1.0260
Vd 2	1.0210	1.0250	1.0150	1.026	1.0260
V load 1	1.0080	1.0070	1.0040	1.012	1.0130
V load 2	1.0030	1.0030	1.0010	1.0070	1.0080
V load 3	1.0000	1.0000	0.9990	1.0020	1.0040
V load 4	0.9991	0.9998	0.9988	1.0010	1.0030
V load 5	1.0090	1.0110	1.0060	1.0110	1.0130
V load 6	1.0060	1.0080	1.0050	1.0070	1.0090
V load 8	0.9933	0.9920	0.9941	0.9851	0.9870
V load 9	0.9894	0.9879	0.9922	0.9859	0.9874
V load 10	0.9847	0.9823	0.9892	0.9803	0.9820
V load 11	0.9840	0.9823	0.9892	0.9796	0.9813
PF D1	0.8762	0.8646	0.8973	0.8676	0.8634
PF D2	0.8896	0.8742	0.8757	0.8632	0.8613

Table 3.8: Simulation results for the first scenario

Second Scenario – Monitoring Four Critical Loads

In this scenario, the four critical buses were selected as monitoring points. The four buses were far away from the power generations. The lowest load voltages always happened on these buses, so they could be considered the most critical buses. They were bus 8, 9, 10, and 11. There were 10 Neurons in the hidden layer. The simulation results of voltage profile are shown in table 3.9. This scenario successfully resolved the voltage issues by monitoring four critical loads. The monitoring points narrowed down to four loads.

	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.8289	0.9097	0.7177	1.0248	0.8241
Diesel 1 Q	0.4587	0.5147	0.3686	0.5866	0.4802
Diesel 2 P	0.6146	0.8329	0.4750	0.600	0.5765
Diesel 2 Q	0.3482	0.45965	0.2756	0.3315	0.3213
Wind P	0.0500	0	0.1000	0	0
PV P	0.0100	0	0.0600	0	0
Vd1	1.0260	1.0230	1.0190	1.0260	1.0250
Vd2	1.0210	1.0220	1.0140	1.0210	1.0220
V load 1	1.0090	1.0050	1.0040	1.0090	1.0110
V load 2	1.0050	1.0020	1.0010	1.0050	1.0070
V load 3	1.0020	0.9991	0.9991	1.0010	1.0020
V load 4	1.0010	0.9989	0.9990	1.0000	1.0020
V load 5	1.0150	1.0090	1.0080	1.0110	1.0120
V load 6	1.0110	1.0060	1.0060	1.0080	1.0080
V load 8	0.9970	0.9906	0.9951	0.9850	0.9860
V load 9	0.9931	0.9866	0.9930	0.9857	0.9864
V load 10	0.9882	0.9809	0.9902	0.9802	0.9810
V load 11	0.9877	0.9810	0.9903	0.9793	0.9802
PF D1	0.8749	0.8703	0.8895	0.8678	0.8640
PF D2	0.8700	0.8755	0.8649	0.8753	0.8734

Table 3.9: Simulation results for the second scenario

Third Scenario – Monitoring Three Critical loads

The three monitoring points were bus 9, 10, and 11 in this scenario. There were 7 neurons in the hidden layer. Table 3.10 shows the voltage profile of the simulation results. This scenario also successfully resolved the voltage issues. In the next scenario, the number of monitoring points could be reduced to examine if the neural network would still perform its function.

	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.6922	0.91303	0.6470	0.9748	0.8097
Diesel 1 Q	0.3806	0.5304	0.3577	0.5586	0.4731
Diesel 2 P	0.6833	0.8839	0.5879	0.6803	0.6591
Diesel 2 Q	0.3506	0.4909	0.3192	0.3977	0.3887
Wind P	0.0500	0	0.1000	0	0
PV P	0.0100	0	0.0600	0	0
Vd1	1.0240	1.024	1.0180	1.0240	1.0230
Vd 2	1.0250	1.025	1.0180	1.0230	1.0250
V load 1	1.0110	1.0070	1.0060	1.0100	1.0120
V load 2	1.0060	1.0030	1.0020	1.0050	1.0070
V load 3	1.0020	0.9999	1.0000	1.001	1.0030
V load 4	1.0010	0.9995	0.9998	1.0000	1.0020
V load 5	1.0130	1.0100	1.0080	1.0090	1.0100
V load 6	1.0100	1.0070	1.0060	1.0060	1.0070
V load 8	0.9961	0.9915	0.9953	0.9840	0.9856
V load 9	0.9922	0.9872	0.9933	0.9848	0.9860
V load 10	0.9874	0.9816	0.9904	0.9792	0.9804
V load 11	0.9868	0.9817	0.9905	0.9783	0.9797
PF D1	0.8762	0.8646	0.8751	0.8676	0.8634
PF D2	0.8897	0.8742	0.8788	0.8633	0.8613

 Table 3.10: Simulation Results for the third scenario

Fourth Scenario – Monitoring Two Critical Loads

The monitoring points could be gradually reduced since the previous scenario effectively resolved the voltage issues of the test cases. Based on the observation, bus 10 and 11 were the most critical points due to it always had the lowest voltages at these two buses. There were 10 neurons in the hidden layer. Table 3.11 shows the results. The issues could be resolved by monitoring only two critical loads.

	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.7282	0.8962	0.6966	0.8470	0.8068
Diesel 1 Q	0.4170	0.5191	0.3805	0.4946	0.4555
Diesel 2 P	0.6211	0.8203	0.5164	0.7405	0.5923
Diesel 2 Q	0.3466	0.4652	0.2834	0.4327	0.3303
Wind P	0.0500	0	0.1000	0	0
PV P	0.0100	0	0.0600	0	0
Vd1	1.0220	1.0230	1.0190	1.0200	1.0230
Vd2	1.0200	1.0220	1.0150	1.0260	1.0220
V load 1	1.0070	1.0050	1.0040	1.0120	1.0100
V load 2	1.0030	1.0020	1.0010	1.0060	1.0060
V load 3	1.0000	0.9990	0.9995	1.0010	1.0020
V load 4	0.9995	0.9987	0.9993	1.0000	1.0020
V load 5	1.0110	1.0090	1.0090	1.0060	1.0100
V load 6	1.0080	1.0060	1.0070	1.0030	1.0070
V load 8	0.9944	0.9907	0.9954	0.9826	0.9850
V load 9	0.9906	0.9864	0.9935	0.9831	0.9854
V load 10	0.9858	0.9811	0.9906	0.9786	0.9800
V load 11	0.9853	0.9812	0.9908	0.9780	0.9792
PF D1	0.8677	0.8653	0.8776	0.8635	0.8708
PF D2	0.8732	0.8698	0.8766	0.8634	0.8733

Table 3.11: Simulation Results for the fourth scenario

Fifth Scenario – Monitoring One Critical Load

The intention of reducing monitoring points was to find the most critical buses that need to be monitored for the purpose of training neural network. Bus 11 was monitored in this scenario. There were 6 neurons in the hidden layer. In this scenario, some of the cases were resolved but case 5 still has the low voltage issue. The neural network was not able to provide precise outputs for the two generators.

	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.6678	0.8931	0.6209	0.9545	0.7187
Diesel 1 Q	0.4031	0.5065	0.3512	0.5559	0.4230
Diesel 2 P	0.6627	0.7949	0.5525	0.6397	0.5656
Diesel 2 Q	0.3823	0.4551	0.3047	0.3731	0.3244
Wind P	0.0500	0	0.1000	0	0
PV P	0.0100	0	0.0600	0	0
Vd1	1.0210	1.0210	1.0160	1.0250	1.0180
Vd 2	1.0220	1.0220	1.0160	1.0230	1.0200
V load 1	1.0090	1.0090	1.0050	1.0100	1.0090
V load 2	1.0040	1.0040	1.0010	1.0050	1.0050
V load 3	1.0010	1.0010	0.9993	1.0010	1.0010
V load 4	0.9999	0.9999	0.9991	1.0000	1.0000
V load 5	1.0100	1.0100	1.0070	1.0100	1.0070
V load 6	1.0070	1.0070	1.0050	1.0060	1.0040
V load 8	0.9943	0.9943	0.9944	0.9841	0.9828
V load 9	0.9904	0.9904	0.9923	0.9850	0.9832
V load 10	0.9857	0.9857	0.9895	0.9793	0.9777
V load 11	0.9850	0.9850	0.9896	0.9786	0.9768
PF D1	0.8561	0.8698	0.8704	0.8641	0.8618
PF D2	0.8662	0.8678	0.8756	0.8638	0.8674

 Table 3.12: Simulation Results for the fifth scenario

Sixth Scenario – Monitoring Four Irrelevant Loads

The four irrelevant loads were bus 1, 2, 3, and 6. The low and high voltage issues would not happen at these buses. The objective of this scenario was to indicate that monitoring point is very important. There were 8 neurons in the hidden layer. Since the critical loads were not included in the training cases, the low voltage issues still exist in cases 4 and 5. This network failed to resolve the problems. Table 3.13 shows the results.

	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.6593	0.8538	0.6555	0.9484	0.6774
Diesel 1 Q	0.3968	0.5004	0.3542	0.5271	0.3956
Diesel 2 P	0.6041	0.8253	0.5578	0.5993	0.4831
Diesel 2 Q	0.3652	0.4858	0.3120	0.3352	0.2752
Wind P	0.05	0	0.1000	0	0
PV P	0.01	0	0.0600	0	0
Vd1	1.02	1.022	1.0180	1.022	1.014
Vd 2	1.02	1.023	1.0170	1.02	1.016
V load 1	1.007	1.006	1.0050	1.008	1.006
V load 2	1.003	1.002	1.0020	1.004	1.002
V load 3	1	0.9989	0.9997	0.9993	0.9986
V load 4	0.9991	0.9986	0.9994	0.9991	0.9986
V load 5	1.009	1.008	1.0080	1.007	1.003
V load 6	1.006	1.005	1.0060	1.004	1
V load 8	0.9933	0.9901	0.9949	0.9822	0.9801
V load 9	0.9894	0.9857	0.9930	0.983	0.9805
V load 10	0.9848	0.9802	0.9901	0.9774	0.975
V load 11	0.9841	0.9804	0.9901	0.9766	0.9742
PF D1	0.856793	0.862744	0.8797	0.874075	0.863529
PF D2	0.855776	0.861784	0.8727	0.872759	0.868906

Table 3.13: Simulation results for the sixth scenario

Seventh Scenario – Monitoring One Critical Load and One Irrelevant Load

The monitoring buses were bus 9, and 10 in this scenario. In view of the fact that the fourth scenario was successful, bus 9 could be considered as an irrelevant load. There were 8 neurons in the hidden layer. According to the simulation results, some cases still have low or high voltage issues, and this neural network was not able to accomplish the task.

	Case 1	Case 2	Case 3	Case 4	Case 5
Diesel 1 P	0.6843	0.9333	0.5832	0.9450	0.8058
Diesel 1 Q	0.4039	0.5360	0.3481	0.5486	0.4249
Diesel 2 P	0.6946	0.8592	0.6203	0.6992	0.5759
Diesel 2 Q	0.3974	0.4735	0.3583	0.4182	0.3238
Wind P	0.0500	0	0.1000	0	0
PV P	0.0100	0	0.0600	0	0
Vd1	1.0270	1.0260	1.0170	1.0250	1.0200
Vd 2	1.0260	1.0240	1.0200	1.0270	1.0210
V load 1	1.0120	1.0060	1.0070	1.0120	1.0090
V load 2	1.0080	1.0030	1.0030	1.0070	1.0050
V load 3	1.0040	0.9999	1.0000	1.0020	1.0010
V load 4	1.0030	0.9996	1.0000	1.0010	1.0010
V load 5	1.0170	1.0110	1.0070	1.0100	1.0080
V load 6	1.0140	1.0080	1.0050	1.0070	1.0050
V load 8	1.0000	0.9921	0.9950	0.9849	0.9836
V load 9	0.9997	0.9879	0.9931	0.9856	0.9838
V load 10	0.9985	0.9824	0.9901	0.9800	0.9782
V load 11	0.9978	0.9825	0.9903	0.9794	0.9774
PF D1	0.8611	0.8671	0.8586	0.8648	0.8845
PF D2	0.8679	0.8758	0.8659	0.8582	0.8716

Table 3.14: Simulation results for the seventh scenario

Comparison of the Results

The results show that the first four scenarios have met the request to balance the load demand and generations to sustain the voltage profile at a certain range in case 5 and some other test cases. Figure 3.11 is shown the voltages at bus 10 and 11 of test case 5. In contrast the last three scenarios violated the lower bound and it could not deal with all the test cases. Evidently, the first four networks can provide accurate information compared to the last three networks. According to the simulation results, when the most critical points are included in the training cases, the neural network outputs will be able to improve the voltage profile. Consequently, this study also indicates that the critical points are very important when using the neural network algorithm. The monitoring points were reduced in the second scenario, the voltage issues were solved in every case. If the majority critical points can be determined it will be easier to alleviate the voltage issues for Microgrid.

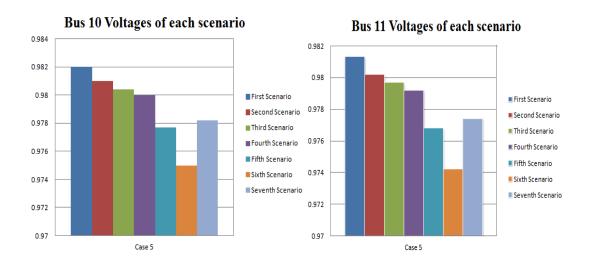


Figure 3.11: Bus 10 and 11 voltages of test case 5

CHATPER IV

CONCLUSIONS

Microgrid is very flexible in applications to different geographic conditions with several distributed generations. Management of imbalance between loads and generations is one of the Microgrid challenges. On the basis of the results of this research, it can be concluded that neural network is an effective and efficient tool that can be employed for Microgrid protection. Thus, neural network chip could be implemented in diesel generators to optimize Microgrid reliability. In addition, this study also indicates that the monitoring point is very important. Once monitoring points are determined, it allows neural network to perform its function. Furthermore, the neural network algorithm can be used for power systems planning and design due to its predictive ability. It is a very trustworthy approach in terms of power systems security. However, the neural network output and the system simulation are performed separately in this thesis. The work can be done in real time with simulation-interfacing of MATLAB and PSCAD software. When the voltage issues are detected on MATLAB, neural network will give new power outputs for diesel generators and the data will be transmitted from MATLAB to PSCAD immediately. The Microgrid topology for a small community with 10 loads is presented in this study. Ultimately, the neural network algorithm can even be implemented on a larger system, such as IEEE 34 bus, to maintain its voltage profile.

REFERENCES

- [1] Intergovernmental Panel on Climate Change (IPCC), "Renewable energy can power the world," [online], Available http://www.ipcc.ch/
- [2] J. Burn,"Has the global economy become less vulnerable to oil price shocks?" Utah, USA, 2012
- [3] A. Gore, "The End of Fossil Fuels," Ecotricity [online], Available http://www.ecotricity.co.uk/our-green-energy/energy-independence/the-end-offossil-fuels
- [4] C. Marnay and O. Bailey, "The CERTS Microgrid and the Future of the Macrogrid," Lawrence Berkeley National Laboratory, Berkeley, California, August 2004
- [5] M. Illindala and G. Venkataramanan, "Control of distributed generation systems to mitigate load and line imbalances," in *Power Electronics Specialists Conference*, vol.4, pp.2013-2018, Feb.2002
- [6] G. Venkataramanan and M. Illindala, "Small Signal Dynamics of Inverter Interfaced Distributed Generation in a Chain-Microgrid," in *Power Engineering Society General Meeting*," pp.1-6, June 2007
- [7] A. Bollman, "An Experimental Study of Frequency Droop Control in a Low-Inertia Microgrid," M.S. thesis, Dept. of ECEN, University of Illinois at Urbana-Champaign, 2009
- [8] Neural Network Applications [online], Available http://tralvex.com/pub/nap/#Introduction
- [9] R. Rapier, "Renewable Energy Facts and Figures," Jul.2012 [online], Available http://www.energytrendsinsider.com/2012/07/09/renewable-energy-facts-andfigures/
- [10] B. Stevens, "Natural Gas: The Logical Alternative," Jul.2012 [online], Available http://www.dailyenergyreport.com/natural-gas-the-logical-alternative/
- [11] National Training and Education Resource [online], Available https://www.nterlearning.org/
- [12] Wikipedia,"Solyndra," [online], Available http://en.wikipedia.org/wiki/Solyndra

- [13] M. Liffmann, "Top trends to watch in 2013: solar soft cost reduction," Clean Power Research, Jan.2013
- [14] B. Buckley, "Maximum power point tracking photovoltaic system," [online], Available http://bama.ua.edu/~bwbuckley/projects/mppt.html
- [15] Design Applause, "Ten Wind Turbines," [online] Jan 2009, Available http://designapplause.com/2009/ten-wind-turbines/2283/
- [16] Powered by Mother Nature," What is wind Energy and How Does it Work?" [online], Available http://www.poweredbymothernature.com/what-is-wind-energy
- [17] Wind Power Program, "Wind turbine power output variation with steady wind speed," [online], Available http://www.wind-power-program.com/turbine_characteristics.htm#top
- [18] Electricity Storage Association, "Technology comparison," [online], Available http://www.electricitystorage.org/technology/storage_technologies/technology_co mparison
- [19] D. Hopkins, "Introduction to the Diesel Generator," [online], Available http://ezinearticles.com/?Introduction-to-the-Diesel-Generator&id=4584220
- [20] Leda Greenpower Trading & Engineering [online], Available http://www.china-power-contractor.cn/index.html
- [21] Cat® Power Generators [online], Available http://powergeneratorssrilanka.blogspot.com/2012/11/cat-diesel-generators-forendless-power.html#.UYWg9LXvvg1
- [22] Horizon Energy Group," Horizon Microgrid Solutions," [online], Available http://www.horizonenergygroup.com/page.asp?p=Horizon%20Microgrid%20Solu tions
- [23] S. Khan, R. Ali, and S. Hussain, "Introduction to Microgrid," Aug.2010 [online], Available http://fgamedia.org/faculty/afirouzi/ENGR600/lesson04/reading/Introduction%20 to%20Microgrid-%202010.pdf
- [24] C. Stergiou and D. Siganos," Neural Networks," [online], Available http://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/cs11/report.html
- [25] Neural Network Solutions, "Neural Network versus Conventional Computing," [online], Available http://www.neuralnetworksolutions.com/nn/intro3.php

- [26] S. Sayad, "Artificial Neural Network," [online], Available http://www.saedsayad.com/artificial_neural_network_bkp.htm
- [27] Visual Numerics, "Multilayer Feed forward Neural Networks," IMSL® C Numerical Stat Library, [online], Available http://www.roguewave.com/portals/0/products/imsl-numerical-libraries/clibrary/docs/7.0/html/cstat/default.htm?turl=multilayerfeedforwardneuralnetworks .htm
- [28] Robert Gordon University Aberdeen, [online], Available http://www.rgu.ac.uk/
- [29] H. Demuth, M. Beale, and M. Hagan, "Neural Network Toolbox 6 User's Guide." The Math Works, Mar. 2008

T · · · A		2	2	4	_		-	0	0	10
Training Cases	case 1	case 2	case 3	case 4	case 5	case 6	case 7	case 8	case 9	case 10
Diesel 1 P	0.9500	0.6500	0.3000	0.3000	0.5500	0.8000	1.0000	0.7500	1.2000	0.6000
Diesel 1 Q	0.5600	0.3856	0.1800	0.1800	0.3263	0.4742	0.5900	0.4450	0.7200	0.3559
Diesel 2 P	0.5160	0.6500	1.0000	0.3000	0.4000	0.7000	0.2000	0.3000	0.2000	0.8300
Diesel 2 Q	0.3062	0.3856	0.5900	0.1800	0.2371	0.4154	0.1188	0.1800	0.1188	0.4925
Wind P	0.0000	0.2000	0.1200	0.2000	0.2000	0.0000	0.1200	0.2500	0.1000	0.0000
PV P	0.2000	0.2000	0.0000	0.1000	0.2000	0.3000	0.1500	0.0000	0.1000	0.1000
Vd1	1.0330	1.0090	0.9990	0.9952	1.0030	1.0170	1.0290	1.0120	1.0310	1.0050
Vd2	1.0180	1.0160	1.0300	1.0020	1.0010	1.0180	1.0000	1.0010	0.9936	1.0170
V 1	1.0070	1.0020	1.0100	0.9956	0.9927	1.0030	0.9959	0.9948	0.9892	0.9998
V 2	1.0050	0.9989	1.0040	0.9939	0.9919	0.9990	0.9949	0.9928	0.9902	0.9961
V 3	1.0040	0.9962	0.9984	0.9925	0.9914	0.9964	0.9956	0.9923	0.9924	0.9939
V 4	1.0040	0.9963	0.9981	0.9926	0.9907	0.9959	0.9948	0.9911	0.9913	0.9931
V 5	1.0170	0.9981	0.9940	0.9902	0.9937	1.0040	1.0130	0.9999	1.0110	0.9947
V 6	1.0130	0.9952	0.9927	0.9888	0.9919	1.0000	1.0090	0.9971	1.0070	0.9928
V 8	1.0040	0.9797	0.9859	0.9817	0.9824	0.9877	0.9934	0.9869	0.9910	0.9855
V 9	0.9976	0.9822	0.9815	0.9784	0.9780	0.9792	0.9903	0.9796	0.9803	0.9795
V 10	0.9933	0.9779	0.9761	0.9742	0.9732	0.9756	0.9843	0.9764	0.9786	0.9757
V 11	0.9931	0.9777	0.9749	0.9737	0.9736	0.9754	0.9843	0.9759	0.9781	0.9751
Training Cases	case 11	case 12	case 13	case 14	case 15	case 16	case 17	case 18	case 19	case 20
Diesel 1 P	0.2800	0.6500	0.4000	1.1500	0.3000	1.1500	0.7000	0.3000	0.6500	0.9000
Diesel 1 Q	0.1662	0.3856	0.2371	0.6824	0.1800	0.6824	0.4154	0.1800	0.3856	0.5340
Diesel 2 P	1.1500	0.8200	1.2000	0.4000	0.5500	0.2000	0.5500	1.2000	0.7000	0.6500
Diesel 2 Q	0.6824	0.4866	0.7200	0.2371	0.3263	0.1188	0.3263	0.7200	0.4450	0.3856
Wind P	0.1100	0.0000	0.0300	0.1500	0.0500	0.1000	0.2500	0.3000	0.1900	0.3000
PV P	0.1300	0.0000	0.4000	0.2000	0.0500	0.2000	0.2000	0.0000	0.2600	0.2600
Vd1	0.9898	1.0090	0.9961	1.0300	0.9920	1.0290	1.0060	0.9858	1.0020	1.0170
Vd2	1.0290	1.0190	1.0340	1.0070	1.0120	0.9956	1.0070	1.0320	1.0140	1.0140
V 1	1.0050	1.0020	1.0090	0.9986	1.0000	0.9914	0.9953	1.0070	0.9988	1.0000
V 2	0.9990	0.9978	1.0020	0.9961	0.9963	0.9914	0.9924	0.9991	0.9946	0.9968
V 3	0.9943	0.9952	0.9965	0.9952	0.9929	0.9927	0.9910	0.9926	0.9920	0.9949
V 4	0.9930	0.9940	0.9962	0.9945	0.9920	0.9920	0.9903	0.9916	0.9913	0.9946
V 5	0.9850	0.9984	0.9894	1.0110	0.9870	1.0100	0.9942	0.9808	0.9915	1.0020
V 6	0.9844	0.9960	0.9884	1.0070	0.9866	1.0060	0.9918	0.9804	0.9896	0.9989
V 8	0.9811	0.9874	0.9837	0.9847	0.9856	0.9878	0.9766	0.9712	0.9761	0.9820
V 9	0.9750	0.9804	0.9762	0.9840	0.9786	0.9840	0.9748	0.9694	0.9742	0.9802
V 10	0.9712	0.9753	0.9707	0.9783	0.9777	0.9793	0.9698	0.9643	0.9705	0.9770
V 11	0.9707	0.9754	0.9703	0.9779	0.9755	0.9785	0.9690	0.9635	0.9700	0.9764

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V 40.99411.00700.99451.00300.99351.00300.99510.99480.99501.0130V 50.99041.02000.9541.02400.98591.01501.01010.99770.98531.0150V 60.98871.01700.92721.02100.98491.01300.97770.99530.98631.0150V 80.97941.00200.97841.01200.97551.00300.98860.98740.97591.0101V 90.97661.00300.97541.01000.97510.97510.97540.97660.99700.97610.97610.9793V 100.97331.00100.96691.01000.97650.99710.97640.97700.97120.9788Training Casescase 31case 32case 33case 34case 35case 35case 37case 38case 39case 40Disel 1 P0.66001.20000.20001.09000.35000.20000.40000.50000.20000.5000Disel 2 Q0.44000.20000.63000.64000.87000.51000.12000.80000.1000Disel 2 Q0.44000.00000.15000.16000.80000.20000.10000.1000Disel 2 Q0.44000.00000.16000.9730.99151.00300.90000.20000.1000Disel 2 Q0.44000.00000.16000.16000.82000.90000.20000.1000<	V 2	0.9999	1.0130	1.0020	1.0050	0.9955	1.0090	0.9970	0.9991	0.9992	1.0030
V 50.99041.02000.99541.02400.98591.01501.00100.99760.98761.0180V 60.98871.01700.99271.02100.98491.01300.97770.99530.98631.0150V 80.97941.00000.97841.01200.97561.00300.98860.98740.97591.0101V 90.97661.00300.97541.01100.97911.00000.98270.97880.97241.0101V 100.97331.01010.97081.01000.97550.99110.97540.97060.97010.97120.9788V 110.97151.01010.96981.01000.97450.97010.97130.97120.9718Training Casescase 31case 32case 33case 34case 35case 37case 38case 38case 40Disel 1 P0.66001.20000.20000.50000.23000.70001.00000.50000.20000.5000Disel 2 Q0.44000.20000.63000.64000.87000.51000.12000.60000.1000Disel 2 Q0.44000.20000.15000.16000.87000.20000.12000.10000.1000Disel 2 Q0.44000.00000.16000.16000.9730.99151.00800.2000.10000.1000V 110.00000.10000.15000.98740.98751.00000.10000.10000.10000.	V 3	0.9948	1.0070	0.9961	1.0050	0.9932	1.0040	0.9953	0.9956	0.9947	1.0030
V 60.98871.01700.99271.02100.98491.01300.99770.99530.98631.0150V 80.97941.00200.97841.01200.97561.00300.98860.98740.97591.0010V 90.97661.00300.97541.01100.97911.00000.98270.97800.97800.9791V 100.97331.00100.96961.01000.97550.99510.97540.97600.97000.9998V 110.97151.00100.96961.01000.97450.99700.97400.9780.97120.9978Training Casescase 31case 32case 33case 33case 35case 36case 37case 38case 39case 30Disel 1 P0.66001.20000.29001.09000.35000.23000.70000.50000.25000.1000Disel 2 P0.82000.39000.65000.40000.51000.51000.50000.25000.1000Disel 2 Q0.44000.20000.63000.50000.23000.05000.20000.1000Disel 2 Q0.44000.20000.10000.15000.32000.00000.20000.2000Disel 2 Q0.44000.00000.10000.15000.32000.00000.20000.2000V 110.00000.10000.10000.10000.30000.20000.20000.2000V 10.00000.10000.10000.0	V 4	0.9941	1.0070	0.9945	1.0030	0.9935	1.0030	0.9951	0.9948	0.9950	1.0030
V 80.97941.00200.97841.01200.97561.00300.98860.98740.97591.0101V 90.97661.00300.97541.01100.97911.00000.98270.97890.97241.0010V 100.97331.00100.97081.01000.97550.99710.97540.97660.97000.97890.97150.97160.97010.97150.97120.9978Training Casescase 31case 32case 33case 34case 35case 35case 37case 38case 32case 31Disel 1 P0.66001.20000.29001.09000.35000.23000.70001.00000.50000.2600Disel 2 P0.36000.68000.13000.65000.44000.60000.12000.64000.12000.64000.23000.60000.23000.10000.12000.64000.23000.10000.12000.48000.4400Disel 2 Q0.44000.20000.50000.51000.12000.63000.51000.23000.00000.12000.63000.23000.60000.23000.00000.12000.60000.2600Wind P0.66000.10000.05000.18000.98710.98751.08000.90200.99120.99120.99120.9913Wind P0.66000.10001.02000.90000.10000.00000.23000.00000.23000.00000.23000.00000.2000.000	V 5	0.9904	1.0200	0.9954	1.0240	0.9859	1.0150	1.0010	0.9976	0.9876	1.0180
V 90.97661.00300.97541.01100.97911.00000.98270.97890.97241.0101V 100.97331.00100.97081.01000.97550.99510.97540.97660.97000.9988V 110.97151.00100.96961.01000.97450.97010.97400.97780.97120.9978Training Casecase 31case 32case 33case 34case 35case 36case 37case 38case 39case 30Diesel 1 P0.66001.20000.20001.00000.35000.23000.70001.00000.50000.2500Diesel 2 P0.82000.39000.96000.26000.64000.87000.51000.12000.6400Diesel 2 Q0.44000.20000.63000.15000.32000.60000.23000.05000.48000.4800Wind P0.06000.10000.00000.15000.32000.00000.12000.00000.1000Wind P0.21000.05000.18000.99730.98751.00300.90911.01011.010V 111.00001.03400.99861.02000.99730.99731.0930.99930.99930.99121.0101V 111.00500.99671.00600.99730.99131.00300.99930.99930.99131.0101.010V 111.00500.99671.00600.99730.99130.99330.9933 <td< td=""><td>V 6</td><td>0.9887</td><td>1.0170</td><td>0.9927</td><td>1.0210</td><td>0.9849</td><td>1.0130</td><td>0.9977</td><td>0.9953</td><td>0.9863</td><td>1.0150</td></td<>	V 6	0.9887	1.0170	0.9927	1.0210	0.9849	1.0130	0.9977	0.9953	0.9863	1.0150
V 100.97331.00100.97081.01000.97650.99510.97540.97660.97000.97780.97120.9978Training Casescase 31case 32case 33case 33case 35case 36case 37case 38case 39case 39Diesel 1 P0.66001.20000.29001.09000.35000.23000.70001.00000.50000.2500Diesel 1 Q0.36000.68000.13000.65000.14000.87000.51000.10000.50000.2500Diesel 2 P0.82000.99000.63000.64000.87000.51000.12000.86001.2300Diesel 2 Q0.44000.20000.63000.5000.32000.60000.12000.48000.4800Wind P0.06000.10000.00000.15000.32000.00000.23000.00000.12000.0000Wind P0.21000.05000.18000.19000.32000.00000.23000.00000.12000.0000W 111.00001.03400.9861.03200.98740.98751.00800.20000.00000.0000V 111.00001.03400.9861.03200.98740.99751.00801.03101.01101.0180V 111.00500.99751.00600.99730.99711.02301.09011.01011.01801.0110V 111.00500.99671.00600.99730.99711.030	V 8	0.9794	1.0020	0.9784	1.0120	0.9756	1.0030	0.9886	0.9874	0.9759	1.0010
V 11 0.9715 1.0010 0.9696 1.0100 0.9745 0.9970 0.9740 0.9778 0.9712 0.9978 Training Cases case 31 case 32 case 33 case 34 case 35 case 36 case 37 case 38 case 39 case 39 case 39 case 30 case 30 <td>V 9</td> <td>0.9766</td> <td>1.0030</td> <td>0.9754</td> <td>1.0110</td> <td>0.9791</td> <td>1.0000</td> <td>0.9827</td> <td>0.9789</td> <td>0.9724</td> <td>1.0010</td>	V 9	0.9766	1.0030	0.9754	1.0110	0.9791	1.0000	0.9827	0.9789	0.9724	1.0010
Training Casescase 31case 32case 33case 33case 34case 35case 36case 37case 38case 38case 39case 40Diesel 1 P0.66001.20000.29001.09000.35000.23000.70001.00000.50000.2600Diesel 1 Q0.36000.68000.13000.65000.14000.80000.44000.60000.25000.1000Diesel 2 P0.82000.39000.96000.26000.64000.87000.51000.12000.86001.2300Diesel 2 Q0.44000.20000.63000.05000.32000.60000.25000.48000.48000.48000.4800Wind P0.06000.10000.00000.15000.19000.30000.00000.12000.00000.1300PV P0.21000.05000.18000.05000.32000.05000.00000.22000.00000.0600Vd11.00001.03400.98661.03200.98751.00801.03101.03101.03101.0310V11.00500.99671.00001.00701.0231.09901.00101.01011.0310V11.00500.99480.99880.99730.99830.99730.99730.99130.99430.99430.9913V20.99840.99450.99250.99260.99730.99130.99330.99340.99350.99340.99350.9934V30.9964<	V 10	0.9733	1.0010	0.9708	1.0100	0.9765	0.9951	0.9754	0.9766	0.9700	0.9998
Diesel 1 P0.66001.20000.29001.09000.35000.23000.70001.00000.50000.2600Diesel 1 Q0.36000.68000.13000.65000.14000.80000.44000.60000.25000.1000Diesel 2 P0.82000.39000.96000.26000.64000.87000.51000.12000.86001.2300Diesel 2 Q0.44000.20000.63000.05000.32000.60000.21000.86000.40000.12000.86000.4000Wind P0.06000.10000.00000.15000.19000.32000.60000.22000.00000.1300PV P0.21000.05000.18000.05000.32000.05000.00000.22000.00000.0000Vd11.00001.03400.98661.03200.98740.98751.08001.03200.99120.9101V20.99980.99671.00001.02001.00001.00001.00001.00101.01001.01001.0100V11.00500.99671.00600.99730.99131.03000.99730.99130.99430.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.991	V 11	0.9715	1.0010	0.9696	1.0100	0.9745	0.9970	0.9740	0.9778	0.9712	0.9978
Diesel 1 Q0.36000.68000.13000.65000.14000.08000.44000.60000.25000.1000Diesel 2 P0.82000.39000.96000.26000.64000.87000.51000.12000.86001.2300Diesel 2 Q0.44000.20000.63000.05000.32000.60000.23000.05000.48000.6400Wind P0.06000.10000.00000.15000.19000.03000.00000.12000.00000.1300PV P0.21000.05000.18000.05000.32000.05000.00000.22000.00000.0600Vd11.00001.03400.98661.03200.98740.98751.00801.03200.99120.9703V11.00500.99671.00600.99730.99511.00300.99970.99911.00101.01001.0080V20.99980.99480.99800.99780.99130.99330.99730.99930.99730.9913V11.00500.99450.99230.99130.99430.99480.99350.99430.99430.99350.99350.9943V20.99940.99450.99250.99230.99130.99330.99380.99350.99350.9943V30.99460.99450.99250.99230.99130.99330.99340.99350.99350.9945V51.00001.01100.98251.01500.9848 <t< td=""><td>Training Cases</td><td>case 31</td><td>case 32</td><td>case 33</td><td>case 34</td><td>case 35</td><td>case 36</td><td>case 37</td><td>case 38</td><td>case 39</td><td>case 40</td></t<>	Training Cases	case 31	case 32	case 33	case 34	case 35	case 36	case 37	case 38	case 39	case 40
Diesel 2 P0.82000.39000.96000.26000.64000.87000.51000.12000.86001.2300Diesel 2 Q0.44000.20000.63000.05000.32000.60000.23000.05000.48000.6400Wind P0.06000.10000.00000.15000.19000.03000.00000.12000.00000.1300PV P0.21000.05000.18000.05000.32000.05000.00000.22000.00000.00000.1600Vd11.00001.03400.98661.03200.98740.98751.00801.03200.99120.9760Vd21.02101.00401.02701.00001.00701.02301.09001.01011.01001.0301V 11.00500.99671.00600.99730.99511.00300.99770.99911.00101.0080V 20.99980.99480.99800.99680.99230.99830.99730.99930.99730.99930.99731.0010V 30.99640.99450.99250.99280.99780.99110.99330.99380.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99340.99330.97410.97320.97310.97430.99530.97310.97430.99530.97310.97330.97430.97430.97430.97430.97430.97430.	Diesel 1 P	0.6600	1.2000	0.2900	1.0900	0.3500	0.2300	0.7000	1.0000	0.5000	0.2600
Diesel 2 Q 0.4400 0.2000 0.6300 0.0500 0.3200 0.6000 0.2300 0.0500 0.4800 0.6400 Wind P 0.0600 0.1000 0.0000 0.1500 0.1900 0.0300 0.0000 0.1200 0.0000 0.1300 PV P 0.2100 0.0500 0.1800 0.0500 0.3200 0.0500 0.0000 0.2200 0.0000 0.0600 Vd1 1.0000 1.0340 0.9866 1.0320 0.9874 0.9875 1.0080 1.0320 0.9912 0.9760 Vd2 1.0210 1.0040 1.0270 1.0000 1.0230 1.0990 1.0101 1.0180 1.0310 Vd2 1.0210 1.0040 1.0270 1.0000 1.0030 0.9997 0.9911 1.0101 1.0101 1.0800 V1 1.0550 0.9967 1.0060 0.9973 0.9923 0.9973 0.9973 0.9973 0.9993 0.9913 0.9973 0.9993 0.9913 0.9973	Diesel 1 Q	0.3600	0.6800	0.1300	0.6500	0.1400	0.0800	0.4400	0.6000	0.2500	0.1000
Wind P0.06000.10000.00000.15000.19000.03000.00000.12000.00000.1300PV P0.21000.05000.18000.05000.32000.05000.00000.22000.00000.0600Vd11.00001.03400.98661.03200.98740.98751.00801.03200.99120.9760Vd21.02101.00401.02701.00001.02701.00701.02301.00901.00101.01801.0310V 11.00500.99671.00600.99730.99511.00300.99730.99910.99131.00101.01001.0080V 20.99980.99480.99800.99680.99230.99830.99730.99930.99721.0010V 30.99640.99450.99230.99780.99110.99430.99480.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.99330.97330.9733 <t< td=""><td>Diesel 2 P</td><td>0.8200</td><td>0.3900</td><td>0.9600</td><td>0.2600</td><td>0.6400</td><td>0.8700</td><td>0.5100</td><td>0.1200</td><td>0.8600</td><td>1.2300</td></t<>	Diesel 2 P	0.8200	0.3900	0.9600	0.2600	0.6400	0.8700	0.5100	0.1200	0.8600	1.2300
PV P0.21000.05000.18000.05000.32000.05000.00000.22000.00000.0600Vd11.00001.03400.98661.03200.98740.98751.00801.03200.99120.9760Vd21.02101.00401.02701.00001.00701.02301.00901.01001.01801.0310V11.00500.99671.00600.99730.99511.00300.99970.99911.00101.0080V20.99980.99480.99800.99680.99230.99830.99730.99930.99721.0010V30.99640.99450.99230.99710.99430.99480.99830.99430.99430.99430.99450.9943V40.99450.99250.99230.99700.99130.99330.99330.99830.99350.9941V51.00001.01600.98251.01500.98190.98430.99431.01200.98250.9732V60.99791.01100.98211.01100.98190.98430.99341.01200.98250.9732V80.98690.99340.97650.99360.97310.97560.98040.99700.97690.9732V90.98250.98900.97040.99620.97030.97560.98040.99700.97690.9732V100.97570.98240.96670.99450.96920.97310.97310.9779 <td>Diesel 2 Q</td> <td>0.4400</td> <td>0.2000</td> <td>0.6300</td> <td>0.0500</td> <td>0.3200</td> <td>0.6000</td> <td>0.2300</td> <td>0.0500</td> <td>0.4800</td> <td>0.6400</td>	Diesel 2 Q	0.4400	0.2000	0.6300	0.0500	0.3200	0.6000	0.2300	0.0500	0.4800	0.6400
Vd1 1.0000 1.0340 0.9866 1.0320 0.9874 0.9875 1.0080 1.0320 0.9912 0.9760 Vd2 1.0210 1.0040 1.0270 1.0000 1.0070 1.0230 1.0090 1.0100 1.0310 V1 1.0050 0.9967 1.0060 0.9973 0.9951 1.0030 0.9997 0.9991 1.0100 1.0080 V2 0.9998 0.9948 0.9980 0.9968 0.9923 0.9943 0.9993 0.9972 1.0010 1.0080 V3 0.9964 0.9945 0.9928 0.9973 0.9948 0.9993 0.9973 0.9993 0.9972 1.0101 V3 0.9964 0.9945 0.9928 0.9971 0.9943 0.9993 0.9973 0.9993 0.9973 0.9933 0.9933 0.9933 0.9933 0.9933 0.9933 0.9933 0.9933 0.9933 0.9933 0.9934 0.9353 0.9943 V4 0.9945 1.0100 0.9825	Wind P	0.0600	0.1000	0.0000	0.1500	0.1900	0.0300	0.0000	0.1200	0.0000	0.1300
Vd2 1.0210 1.0040 1.0270 1.0000 1.0070 1.0230 1.0090 1.0010 1.0110 1.0180 1.0310 V 1 1.0050 0.9967 1.0060 0.9973 0.9951 1.0030 0.9997 0.9991 1.0010 1.0080 V 2 0.9998 0.9948 0.9980 0.9968 0.9923 0.9983 0.9973 0.9993 0.9993 0.9972 1.0010 1.0080 V 2 0.9998 0.9948 0.9980 0.9968 0.9923 0.9983 0.9973 0.9993 0.9993 0.9972 1.0010 V 3 0.9964 0.9945 0.9928 0.9970 0.9913 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9943 0.9746 0.9943 0.9743 0.9743	PV P	0.2100	0.0500	0.1800	0.0500	0.3200	0.0500	0.0000	0.2200	0.0000	0.0600
V 1 1.0050 0.9967 1.0060 0.9973 0.9951 1.0030 0.9997 0.9991 1.0010 1.0080 V 2 0.9998 0.9948 0.9980 0.9968 0.9923 0.9983 0.9973 0.9993 0.9973 0.9993 0.9973 0.9993 0.9973 1.0010 V 3 0.9964 0.9945 0.9928 0.9978 0.9911 0.9943 0.9948 0.9933 0.9973 0.9933 0.9933 0.9933 0.9933 0.9935 0.9938 0.9938 0.9938 0.9935 0.9938 0.9935 0.9938 0.9935 0.9933 0.9935 0.9933 0.9938 0.9935 0.9943 0.9948 0.9935 0.9941 V 4 0.9945 0.9925 0.9923 0.9970 0.9933 0.9933 0.9938 0.9935 0.9934 0.9935 0.9941 V 5 1.0000 1.0160 0.9825 1.0110 0.9819 0.9843 0.9934 1.0120 0.9825 0.9732 <td< td=""><td>Vd1</td><td>1.0000</td><td>1.0340</td><td>0.9866</td><td>1.0320</td><td>0.9874</td><td>0.9875</td><td>1.0080</td><td>1.0320</td><td>0.9912</td><td>0.9760</td></td<>	Vd1	1.0000	1.0340	0.9866	1.0320	0.9874	0.9875	1.0080	1.0320	0.9912	0.9760
V 2 0.9998 0.9948 0.9980 0.9968 0.9923 0.9983 0.9973 0.9993 0.9972 1.0010 V 3 0.9964 0.9945 0.9928 0.9978 0.9911 0.9943 0.9948 0.9993 0.9973 0.9993 0.9972 1.0010 V 4 0.9945 0.9925 0.9923 0.9970 0.9913 0.9933 0.9938 0.9995 0.9938 0.9945 V 4 0.9945 0.9925 0.9923 0.9970 0.9913 0.9933 0.9938 0.9938 0.9935 0.9938 0.9945 0.9934 0.9945 0.9941 V 5 1.0000 1.0160 0.9825 1.0150 0.9828 0.9847 0.9963 1.0160 0.9825 0.9726 V 6 0.9979 1.0110 0.9821 1.0110 0.9843 0.9934 1.0120 0.9825 0.9732 V 8 0.9869 0.9934 0.9765 0.9936 0.9731 0.9726 0.9959 0.9769 0.9732 <td>Vd2</td> <td>1.0210</td> <td>1.0040</td> <td>1.0270</td> <td>1.0000</td> <td>1.0070</td> <td>1.0230</td> <td>1.0090</td> <td>1.0010</td> <td>1.0180</td> <td>1.0310</td>	Vd2	1.0210	1.0040	1.0270	1.0000	1.0070	1.0230	1.0090	1.0010	1.0180	1.0310
V 3 0.9964 0.9945 0.9928 0.9978 0.9911 0.9943 0.9948 0.9995 0.9938 0.9943 V 4 0.9945 0.9925 0.9923 0.9970 0.9913 0.9933 0.9938 0.9989 0.9935 0.9941 V 5 1.0000 1.0160 0.9825 1.0150 0.9828 0.9847 0.9963 1.0160 0.9837 0.9726 V 6 0.9979 1.0110 0.9821 1.0110 0.9819 0.9843 0.9934 1.0120 0.9825 0.9732 V 8 0.9869 0.9934 0.9765 0.9936 0.9731 0.9722 0.9823 0.9959 0.9736 0.9740 V 9 0.9825 0.9800 0.9704 0.9962 0.9731 0.9779 0.9971 0.9739 0.9739 V 10 0.9757 0.9824 0.9667 0.9945 0.9692 0.9731 0.9779 0.9971 0.9739 0.9739	V 1	1.0050	0.9967	1.0060	0.9973	0.9951	1.0030	0.9997	0.9991	1.0010	1.0080
V 4 0.9945 0.9925 0.9923 0.9970 0.9913 0.9933 0.9938 0.9989 0.9935 0.9945 V 5 1.0000 1.0160 0.9825 1.0150 0.9828 0.9847 0.9963 1.0160 0.9837 0.9726 V 6 0.9979 1.0110 0.9821 1.0110 0.9819 0.9843 0.9934 1.0120 0.9825 0.9732 V 8 0.9869 0.9934 0.9765 0.9936 0.9731 0.9722 0.9823 0.9959 0.9786 0.9740 V 9 0.9825 0.9890 0.9704 0.9962 0.9731 0.9756 0.9960 0.9736 0.9740 0.9970 0.9769 0.9732 V 9 0.9825 0.9800 0.9704 0.9962 0.9731 0.9776 0.9804 0.9769 0.9732 V 10 0.9757 0.9824 0.9667 0.9945 0.9692 0.9731 0.9779 0.9971 0.9739 0.9971 0.9739 0.9974 0.9699 <td>V 2</td> <td>0.9998</td> <td>0.9948</td> <td>0.9980</td> <td>0.9968</td> <td>0.9923</td> <td>0.9983</td> <td>0.9973</td> <td>0.9993</td> <td>0.9972</td> <td>1.0010</td>	V 2	0.9998	0.9948	0.9980	0.9968	0.9923	0.9983	0.9973	0.9993	0.9972	1.0010
V 5 1.0000 1.0160 0.9825 1.0150 0.9828 0.9847 0.9963 1.0160 0.9837 0.9726 V 6 0.9979 1.0110 0.9821 1.0110 0.9819 0.9843 0.9934 1.0120 0.9825 0.9732 V 8 0.9869 0.9934 0.9765 0.9936 0.9731 0.9722 0.9823 0.9959 0.9766 0.9740 V 9 0.9825 0.9800 0.9704 0.9962 0.9703 0.9756 0.9804 0.9970 0.9769 0.9732 V 10 0.9757 0.9824 0.9667 0.9945 0.9692 0.9731 0.9779 0.9971 0.9739 0.9699	V 3	0.9964	0.9945	0.9928	0.9978	0.9911	0.9943	0.9948	0.9995	0.9938	0.9943
V 6 0.9979 1.0110 0.9821 1.0110 0.9819 0.9843 0.9934 1.0120 0.9825 0.9732 V 8 0.9869 0.9934 0.9765 0.9936 0.9731 0.9792 0.9823 0.9959 0.9786 0.9740 V 9 0.9825 0.9800 0.9704 0.9962 0.9703 0.9756 0.9804 0.9970 0.9769 0.9732 V 10 0.9757 0.9824 0.9667 0.9945 0.9692 0.9731 0.9779 0.9971 0.9739 0.9779	V 4	0.9945	0.9925	0.9923	0.9970	0.9913	0.9933	0.9938	0.9989	0.9935	0.9941
V 8 0.9869 0.9934 0.9765 0.9936 0.9731 0.9792 0.9823 0.9959 0.9786 0.9740 V 9 0.9825 0.9800 0.9704 0.9962 0.9703 0.9756 0.9804 0.9970 0.9769 0.9732 V 10 0.9757 0.9824 0.9667 0.9945 0.9692 0.9731 0.9779 0.9971 0.9739 0.9699	V 5	1.0000	1.0160	0.9825	1.0150	0.9828	0.9847	0.9963	1.0160	0.9837	0.9726
V 8 0.9869 0.9934 0.9765 0.9936 0.9731 0.9792 0.9823 0.9959 0.9786 0.9740 V 9 0.9825 0.9800 0.9704 0.9962 0.9703 0.9756 0.9804 0.9970 0.9769 0.9732 V 10 0.9757 0.9824 0.9667 0.9945 0.9692 0.9731 0.9779 0.9971 0.9739 0.9699	V 6	0.9979	1.0110	0.9821	1.0110	0.9819	0.9843	0.9934	1.0120	0.9825	0.9732
V 10 0.9757 0.9824 0.9667 0.9945 0.9692 0.9731 0.9779 0.9971 0.9739 0.9699	V 8	0.9869		0.9765	0.9936	0.9731	0.9792	0.9823	0.9959	0.9786	0.9740
	V 9	0.9825	0.9890	0.9704	0.9962	0.9703	0.9756	0.9804	0.9970	0.9769	0.9732
V 11 0.9745 0.9811 0.9653 0.9940 0.9676 0.9709 0.9758 0.9974 0.9732 0.9692	V 10	0.9757	0.9824	0.9667	0.9945	0.9692	0.9731	0.9779	0.9971	0.9739	0.9699
	V 11	0.9745	0.9811	0.9653	0.9940	0.9676	0.9709	0.9758	0.9974	0.9732	0.9692

Training Cases case 41 case 42 case 43 case 44 case 45				1				[[
Diesel 1 Q0.20000.14000.21000.36000.56001.26000.33000.50000.21000.3600Diesel 2 Q0.38000.40000.12000.32000.35000.20000.10000.30000.10000.3000Wind P0.20700.08000.08000.10000.00000.00000.10000.10000.10000.10000.1000VP P0.20700.09550.99591.00701.0200.99391.00700.99311.03030.99431.03031.0400V10.99571.01500.99570.99551.01011.00600.99470.99360.99740.9966V20.99571.01600.99700.99510.99710.99150.99320.99260.99460.99740.9966V10.99570.99680.99090.99710.99100.99320.99260.99460.99740.9966V20.99570.99680.99090.99710.99700.99320.99260.99640.99760.9976V30.99710.99720.99860.99920.99810.99320.99250.99600.99690.99760.99130.99350.99260.99840.9976V50.94660.99720.98310.99710.98330.99710.99330.99210.99300.99300.99300.99300.99300.99300.99300.99300.99300.99300.99300.99300.99300.99300.9											
Diesel 2 P 0.6800 1.200 0.4800 0.6600 0.5600 1.2600 0.3300 0.5000 0.1200 0.3300 Wind P 0.0800 0.450 0.1200 0.2000 0.0000 0.0000 0.000 0.100 0.1000 0.0000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.00		0.3800								0.9500	
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Wind P0.08000.04500.12000.22000.10000.00000.00000.10000.10000.1000PV P0.27000.06900.08000.12000.00000.00000.13000.00000.13000.0000Vd10.99050.99450.03011.03001.01001.02021.01001.02021.0101Vd21.01201.03800.09450.99550.09060.99550.99060.99170.99350.99360.99240.99360.9970V 20.99550.99600.99700.99070.99700.99700.99350.99320.99220.99240.99860.9971V 40.99300.99720.99860.99070.99170.99350.99220.99250.99860.9927V 50.98460.99070.99080.99171.01000.98300.99220.99250.99840.9936V 40.93300.99270.99860.99071.01000.98351.00000.99250.99350.99240.98600.9972V 50.98460.99070.98020.98030.99170.91810.91610.91730.98230.9620.91841.01000.9925V 60.98360.98290.98020.98030.96020.98040.91690.91760.91320.9220.9220.9250.98040.9160V 10.96360.97500.98030.99610.93530.9620.91610.9169 <td>Diesel 2 P</td> <td>0.6800</td> <td>1.2200</td> <td>0.4800</td> <td>0.6600</td> <td>0.5600</td> <td>1.2600</td> <td>0.3300</td> <td>0.5000</td> <td>0.2100</td> <td>0.6800</td>	Diesel 2 P	0.6800	1.2200	0.4800	0.6600	0.5600	1.2600	0.3300	0.5000	0.2100	0.6800
PVP0.27000.06690.08000.12000.00000.30000.01000.10300.1000Vd10.99050.99451.03301.00301.00301.01201.01201.01201.01011.00001.0101V10.99871.01500.99450.99450.99551.00600.99700.99250.99860.99700.99260.99710.9960V20.99551.00600.99700.99270.99860.99700.99370.99360.99270.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99720.99360.99730.99360.99720.99360.99730.99360.99720.99360.99730.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.99360.99740.9936<	Diesel 2 Q	0.3800	0.6400	0.2100	0.3200	0.3500	0.6200	0.1800	0.2800	0.1200	0.3800
VdI0.99050.99440.99541.0301.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03041.03040.99350.99350.99350.99350.99360.99360.99370.99360.99370.99360.99370.99360.99370.99360.99360.99370.99360.99360.99360.99370.99360.99360.99360.99360.99360.99360.99370.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.9936 <td>Wind P</td> <td>0.0800</td> <td>0.0450</td> <td>0.1200</td> <td>0.2200</td> <td>0.1000</td> <td>0.0000</td> <td>0.0000</td> <td>0.1000</td> <td>0.1100</td> <td>0.1300</td>	Wind P	0.0800	0.0450	0.1200	0.2200	0.1000	0.0000	0.0000	0.1000	0.1100	0.1300
Vd21.01201.03001.00301.01401.01401.02011.01001.00011.0001V 10.99871.01000.99450.99551.00101.00600.99470.99630.99740.9960V 20.99551.00000.99700.99700.99710.99700.99350.99360.99220.99340.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.93650.9365	PV P	0.2700	0.0690	0.0800	0.1200	0.0000	0.3000	0.0000	0.1300	0.1600	0.0900
V10.99871.01500.99480.99551.00001.00600.99470.99630.99740.9060V20.99551.00000.99700.99250.99860.99920.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99350.99250.99350.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99250.99260.98230.98230.98230.98230.98230.98260.97610.98260.97690.99260.98260.97610.98260.97690.99260.98060.97050.99260.98060.97050.98630.97260.98630.97260.98630.97260.98630.97260.98630.97260.98630.97260.98630.97260.98630.97260.98630.97600.97600.98630.97600.98630.97650.98630.97650.98630.97650.98630.97650.98630.97650.98630.97650.98630.97650.98630.97650.98630.97650.98630.97650.98630.97650.98	Vd1	0.9905	0.9945	0.9959	1.0070	1.0320	0.9939	1.0290	0.9943	1.0330	1.0040
V20.99551.00600.99700.99260.99860.99920.99340.99340.99360.99340.99360.99340.99360.99340.99360.99340.99360.99340.99340.99340.99340.99340.99340.99340.99320.99220.99250.99360.99240.99360.99240.99350.99250.99250.99250.99260.99360.99270.99360.99230.99230.99230.99230.99230.99230.99230.99230.99331.01000.99331.01000.99331.01000.99331.01000.99331.01030.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.99360.9361 <td>Vd2</td> <td>1.0120</td> <td>1.0380</td> <td>1.0030</td> <td>1.0080</td> <td>1.0140</td> <td>1.0290</td> <td>1.0010</td> <td>1.0070</td> <td>1.0020</td> <td>1.0140</td>	Vd2	1.0120	1.0380	1.0030	1.0080	1.0140	1.0290	1.0010	1.0070	1.0020	1.0140
V 30.99270.99860.99090.99170.99700.99330.99230.99240.99840.9936V 40.93000.97720.99800.99011.01000.99320.99220.99220.99860.9971V 50.98460.99000.98800.99611.01000.98331.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99031.01000.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.99030.9903	V 1	0.9987	1.0150	0.9945	0.9955	1.0010	1.0060	0.9947	0.9963	0.9979	1.0000
V 40.99300.99720.99080.99080.99610.99220.99220.99250.99860.9927V 50.98460.99000.98800.99671.01400.98451.01000.99031.01800.9936V 60.93360.98220.98230.98530.96770.91310.92800.98800.9804V 90.97420.97660.97760.98110.98670.97220.98620.97690.99260.9802V 100.97050.97250.97460.97810.98130.96920.91610.97220.99040.9716V 110.96820.97110.97250.97430.97780.98230.96920.91610.97160.91910.9716Training Casescase 51case 52case 53case 53case 54case 55case 55case 56case 57case 58case 60Discel 1 P0.98000.50001.10001.30000.60000.40000.40000.40000.40000.40000.40000.4000Discel 2 Q0.30000.45000.50000.50000.60000.45000.25000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.1000<	V 2	0.9955	1.0060	0.9970	0.9925	0.9986	0.9992	0.9934	0.9936	0.9974	0.9960
V 50.98460.99000.98960.99671.01400.98451.01000.99031.01800.9956V 60.98360.98220.98230.98530.96530.96500.98140.0560.98941.0130.9366V 80.97050.98220.98200.98230.98530.96770.9130.98200.98020.9804V 90.97420.97660.97760.97110.96760.97120.97610.97160.97160.97120.97610.9716V 100.97050.97250.97430.97780.98230.96220.98160.97220.90400.9716V 110.96820.97110.97330.97730.97810.96220.98160.97220.99040.9716Training Casecase 51case 52case 53case 54case 55case 55case 57case 58case 50Disel 1 Q0.43000.50001.10001.30000.60000.40000.60000.40000.40000.4000Disel 2 Q0.40000.40000.50000.45000.60000.60000.45000.20000.10000.10000.1000Disel 2 Q0.20000.10000.10000.30000.60000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.1000 </td <td>V 3</td> <td>0.9927</td> <td>0.9986</td> <td>0.9909</td> <td>0.9917</td> <td>0.9970</td> <td>0.9935</td> <td>0.9936</td> <td>0.9924</td> <td>0.9984</td> <td>0.9936</td>	V 3	0.9927	0.9986	0.9909	0.9917	0.9970	0.9935	0.9936	0.9924	0.9984	0.9936
V 60.98360.98820.98830.99451.00900.98301.00500.98941.01300.9936V 80.97050.97260.98020.98230.98530.96770.91310.98200.98020.9802V 90.97420.97660.97760.98110.98670.97220.98620.97090.99260.9802V 100.97050.97250.97460.97810.98310.96920.98100.97160.99190.9711Training Casescase 51case 52case 53case 53case 55case 55case 56case 57case 58case 59case 50Disel 1 P0.98000.65001.0001.30000.60000.72000.50000.40000.30000.3000Disel 2 P0.35000.29000.45000.50000.50000.60000.20000.45000.29001.2000Disel 2 Q0.20000.18000.32000.60000.20000.45000.20000.45000.2000Disel 2 Q0.20000.10000.10000.30000.60000.20000.12000.60000.2000Wind P0.36000.10000.10000.30000.00000.20000.10000.12000.1200V111.01501.00701.0201.03101.03001.00201.00201.01010.99411.0130Wind P0.36000.10000.10000.10000.20000.10000.10000.1000	V 4	0.9930	0.9972	0.9908	0.9908	0.9961	0.9932	0.9922	0.9925	0.9986	0.9927
V 80.97050.98290.98200.98230.98530.96970.99130.98200.99800.9980V 90.97420.97660.97760.98110.98670.97220.98620.97690.99260.9802V 100.97050.97250.97460.97810.98310.96920.98160.97220.99040.9711Training Casecase 51case 52case 53case 53case 55case 55case 57case 58case 59case 50Diesel 1 P0.98000.65001.10001.30000.60000.72000.50000.60000.30000.3000Diesel 2 P0.35000.29000.45000.59000.30000.60000.45000.45000.29001.2000Diesel 2 Q0.20000.18000.20000.60000.45000.20000.60000.45000.29001.2000Diesel 2 Q0.20000.18000.20000.30000.60000.20000.10000.20000.60000.10000.2000Diesel 2 Q0.20000.18000.30000.30000.60000.20000.10000.20000.20000.10000.2000Diesel 2 Q0.20000.18000.10000.30000.60000.20000.10000.20000.2000Diesel 2 Q0.20000.10000.10000.30000.60000.20000.10000.20000.2000Diesel 2 Q0.20000.10000.10000.3000	V 5	0.9846	0.9900	0.9896	0.9967	1.0140	0.9845	1.0100	0.9903	1.0180	0.9956
V 90.97420.97660.97760.98110.98670.97220.98620.97690.99260.99040.9811V 100.97050.97250.97460.97810.98310.96220.98160.97220.99040.9713V 110.96820.97310.97430.9780.98230.96920.98100.97160.99190.9711Training Casescase 51case 52case 53case 54case 55case 55case 56case 57case 58case 59case 50Diesel 1 P0.98000.65001.10001.30000.60000.72000.50000.93000.80000.3000Diesel 2 P0.35000.29000.45000.50000.65000.60000.45000.29001.2000Diesel 2 Q0.20000.18000.30000.03000.60000.20000.12000.60000.2000Diesel 2 Q0.20000.18000.10000.30000.03000.60000.20000.12000.20000.2000Wind P0.36000.10000.13000.05000.05000.00000.10000.12000.05000.12000.12000.1200V 110.99211.01001.01001.01011.01001.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01011.01	V 6	0.9836	0.9892	0.9883	0.9945	1.0090	0.9830	1.0050	0.9894	1.0130	0.9936
V 100.97050.97250.97460.97810.98310.96920.98160.97220.99040.9781V 110.96820.97310.97330.97780.97830.96920.98100.97160.99190.9716Training Casescase 51case 52case 53case 54case 55case 55case 57case 58case 59case 50Dissel 1 P0.98000.65001.10001.30000.60000.72000.50000.93000.80000.3000Dissel 2 P0.35000.29000.54000.59000.65000.66000.45000.45000.20000.4500Dissel 2 Q0.20000.18000.32000.60000.60000.45000.20000.60000.20000.12000.6000Dissel 2 Q0.20000.18000.32000.30000.60000.20000.12000.60000.20000.12000.6000Dissel 2 Q0.20000.10000.10000.30000.00000.20000.13000.60000.20000.12000.20000.1200Dissel 2 Q0.20000.10000.10000.30000.00000.00000.10000.12000.12000.12000.1200Wind P0.36000.10000.10000.50000.05000.00000.10000.10000.9011.01000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.10000.1000<	V 8	0.9705	0.9829	0.9802	0.9823	0.9853	0.9697	0.9913	0.9820	0.9980	0.9804
V 110.96820.97310.97430.97780.98230.96920.98100.97160.99190.9761Training Casescase 51case 52case 53case 54case 55case 56case 57case 58case 59case 60Diesel 1 P0.98000.65001.10001.30000.60000.72000.50000.93000.80000.3000Diesel 1 Q0.43000.38000.54000.59000.45000.45000.60000.45000.40000.1800Diesel 2 P0.35000.29000.45000.29000.65000.90000.60000.45000.29001.2000Diesel 2 Q0.20000.18000.32000.09000.60000.45000.29000.60000.21000.45000.6000Diesel 2 Q0.20000.18000.10000.30000.30000.60000.20000.12000.60000.25000.12000.6000Diesel 2 Q0.20000.10000.10000.30000.00000.10000.12000.60000.12000.12000.6000Diesel 2 Q0.20000.10000.10000.30000.00000.10000.12000.60000.20000.12000.6000Wind P0.36000.10000.10000.30000.00000.10000.12000.50000.10000.12000.5000Vd11.01201.00201.01001.01001.01001.01001.01001.01000.99131.0100 <td>V 9</td> <td>0.9742</td> <td>0.9766</td> <td>0.9776</td> <td>0.9811</td> <td>0.9867</td> <td>0.9722</td> <td>0.9862</td> <td>0.9769</td> <td>0.9926</td> <td>0.9802</td>	V 9	0.9742	0.9766	0.9776	0.9811	0.9867	0.9722	0.9862	0.9769	0.9926	0.9802
Training Casescase 51case 52case 53case 54case 55case 56case 57case 58case 58case 59case 59case 50Diesel 1 P0.98000.65001.10001.30000.60000.72000.50000.93000.80000.3000Diesel 1 Q0.43000.38000.54000.59000.55000.45000.20000.60000.45000.40000.1800Diesel 2 P0.35000.29000.45000.26000.65000.90000.60000.45000.29001.2000Diesel 2 Q0.20000.18000.32000.90000.60000.60000.45000.29000.60000.2000Diesel 2 Q0.20000.18000.30000.30000.60000.20000.13000.60000.20000.13000.6000Wind P0.36000.10000.10000.30000.05000.00000.10000.13000.20000.13000.2000Vd11.01501.00701.02901.03401.00901.02201.00101.01100.99131.01300.9973Vd20.99130.99141.00200.99731.01011.01900.99130.99140.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99130.99	V 10	0.9705	0.9725	0.9746	0.9781	0.9831	0.9692	0.9816	0.9722	0.9904	0.9781
Diesel 1 P0.98000.65001.10001.30000.60000.72000.50000.93000.80000.3000Diesel 1 Q0.43000.38000.54000.59000.35000.45000.45000.60000.60000.40000.40000.1800Diesel 2 P0.35000.29000.45000.26000.65000.90000.60000.45000.29000.12000.1200Diesel 2 Q0.20000.18000.32000.09000.30000.60000.24000.25000.12000.6400Wind P0.36000.10000.13000.30000.30000.00000.20000.13000.60000.12000.12000.6000Wind P0.36000.10000.10000.30000.05000.00000.10000.12000.05000.2000V10.12000.10001.01001.03001.03001.02001.03001.03001.03001.03000.99331.09041.0904V10.99120.99531.00201.01001.01701.01501.01601.01501.01500.99151.01600.99210.99220.99140.9933V20.99130.99411.01020.99750.99541.00500.99731.01000.99130.99170.99140.99150.99140.99150.99150.99150.99150.99150.99150.99150.99150.99150.99150.99150.99150.99150.99150.99150.99	V 11	0.9682	0.9731	0.9743	0.9778	0.9823	0.9692	0.9810	0.9716	0.9919	0.9761
Diesel 1 Q0.43000.38000.54000.59000.35000.45000.20000.60000.60000.40000.40000.1800Diesel 2 P0.35000.29000.45000.20000.60000.60000.60000.45000.29001.2000Diesel 2 Q0.20000.18000.32000.09000.30000.60000.24000.25000.12000.6400Wind P0.36000.10000.10000.30000.03000.00000.20000.13000.05000.2000PV P0.12000.10000.13000.05000.05000.00000.10000.12000.05000.1300Vd11.01501.00701.02901.03401.03901.02001.01001.03901.00501.01100.99541.0290Vd20.99551.00201.01601.01101.01301.01901.05011.01100.99441.0050V 10.99220.99541.00200.99751.00101.01200.99330.99410.99430.9943V 30.99190.99330.99810.99551.00500.99300.99150.99150.99150.99150.9915V 40.99080.99471.01401.01700.99751.01000.99511.01801.00200.9851V 40.99080.99441.01001.01300.99781.00800.99300.99150.99810.99810.99810.99810.9851V 4<	Training Cases	case 51	case 52	case 53	case 54	case 55	case 56	case 57	case 58	case 59	case 60
Diesel 2 P0.35000.29000.45000.26000.65000.90000.60000.45000.29001.2000Diesel 2 Q0.20000.18000.32000.09000.30000.60000.24000.25000.12000.6400Wind P0.36000.10000.10000.30000.03000.00000.20000.13000.06000.2000PV P0.12000.10000.13000.05000.05000.00000.10000.12000.05000.1300Vd11.01501.00701.0291.03401.00901.02021.00201.03401.01901.02031.01001.0304Vd20.99551.00201.01601.01011.01301.03901.00501.01100.99541.0290V 10.99220.99541.00500.99751.01011.01200.99330.99440.99750.99541.01200.99330.9945V 30.99190.99330.99140.99750.99541.01000.99511.01800.99750.9954V 40.99080.99671.01401.01700.99751.01000.99511.01801.00200.9859V 40.99030.99441.01001.01300.99781.01000.99511.01801.00200.9851V 51.00200.99671.01401.01700.99781.01000.99730.99100.99130.98180.98380.98380.99330.9841<	Diesel 1 P	0.9800	0.6500	1.1000	1.3000	0.6000	0.7200	0.5000	0.9300	0.8000	0.3000
Diesel 2 Q0.20000.18000.32000.09000.30000.60000.24000.25000.12000.6400Wind P0.36000.10000.10000.30000.03000.00000.20000.13000.06000.2000PV P0.12000.10000.10000.13000.05000.05000.00000.10000.12000.05000.1300Vd11.01501.00701.02901.03401.00901.02201.00201.03401.01300.9903Vd20.99551.00201.01601.01001.01301.01900.99531.00100.99041.0200V 10.99220.99541.00200.99730.99811.01200.99330.99940.99330.99930.99730.99811.01200.99330.99040.9944V 20.99130.99411.00200.99730.99541.00500.99330.99730.99330.99330.99430.9943V 30.99190.99330.99430.99730.99541.00500.99330.99541.00200.99530.99650.99330.99650.99330.99650.99330.99430.99430.99430.99530.99530.99430.99430.99430.99530.99530.99530.99530.99650.99630.99650.99630.99650.99650.99650.99650.99650.99530.99550.99530.99550.99530.99530.99530.9953	Diesel 1 Q	0.4300	0.3800	0.5400	0.5900	0.3500	0.4500	0.2000	0.6000	0.4000	0.1800
Wind P0.36000.10000.10000.30000.03000.00000.20000.13000.06000.2000PV P0.12000.10000.13000.05000.05000.00000.10000.12000.05000.1300Vd11.01501.00701.02901.03401.00901.02201.00201.03401.01300.9995Vd20.99951.00201.01601.01011.01301.03901.00501.01100.99541.0290V10.99220.99541.00200.99751.00101.01900.99531.00100.99940.9994V20.99130.99411.00200.99730.99811.01200.99330.99940.99551.00600.99210.99920.99140.9944V30.99190.99330.99910.99750.99541.00500.99180.99760.99360.99770.99160.9936V40.99080.99671.01401.01700.99771.01000.99511.01801.00200.9859V51.00200.99671.01401.01700.99781.00800.99371.01500.99890.9851V60.99930.99441.01001.01300.99781.00800.99370.99800.98720.9781V51.00200.99770.99430.99530.99550.99331.00000.98700.99300.98720.9871V60.99980.97770.9943	Diesel 2 P	0.3500	0.2900	0.4500	0.2600	0.6500	0.9000	0.6000	0.4500	0.2900	1.2000
PV P0.12000.10000.13000.05000.05000.00000.10000.12000.05000.1300Vd11.01501.00701.02901.03401.00901.02201.00201.03401.01300.9909Vd20.99951.00201.01601.0101.01301.03901.00501.01100.99541.0290V10.99220.99541.00500.99751.00101.01900.99331.00100.99041.0060V 20.99130.99411.00200.99730.99811.01200.99300.99970.99040.9994V 30.99190.99330.99980.99790.99591.00600.99210.99220.99150.9944V 40.99080.99320.99910.99750.99541.00500.99080.99200.99150.9936V 40.99080.99320.99910.99750.99541.00500.99080.99860.99070.9936V 51.00200.99671.01401.01700.99771.01000.99511.01801.02000.9851V 60.99930.99441.01001.01300.99781.00800.99370.99800.98720.9781V 80.99080.97490.99530.99530.99031.00000.98700.99380.98330.9746V 90.98180.97770.99430.99440.98280.99480.98380.99380.93330.9	Diesel 2 Q	0.2000	0.1800	0.3200	0.0900	0.3000	0.6000	0.2400	0.2500	0.1200	0.6400
Vd11.01501.00701.02901.03401.00901.02201.00201.03401.01300.9909Vd20.99951.00201.01601.01001.01301.03901.00501.01100.99541.0290V10.99220.99541.00500.99751.00101.01900.99531.00100.99030.99041.0060V20.99130.99411.00200.99730.99811.01200.99300.99770.99040.9994V30.99190.99330.99880.99790.99541.00500.99210.99220.99150.9943V40.99080.99320.99110.99750.99541.00500.99230.99660.99370.9943V40.99080.99671.01001.01700.99771.01000.99511.01801.01200.99860.9907V51.00200.99671.01001.01300.99781.00800.99371.01500.98890.9851V60.99930.99441.01001.01300.99781.00800.99371.01500.98890.9851V80.99080.97790.99430.99440.98280.99480.98380.99380.98330.9746V90.98180.97770.99430.99270.97560.98870.98880.99110.97880.9686V100.97730.97180.98920.99270.97560.98870.97900.9911	Wind P	0.3600	0.1000	0.1000	0.3000	0.0300	0.0000	0.2000	0.1300	0.0600	0.2000
Vd20.99951.00201.01601.00101.01301.03901.00501.01100.99541.0290V10.99220.99541.00500.99751.00101.01900.99531.00100.99041.0060V20.99130.99411.00200.99730.99811.01200.99300.99970.99040.9994V30.99190.99330.99980.99790.99591.00600.99210.99220.99150.9943V40.99080.99320.99910.99750.99541.00500.99080.99860.99070.9943V40.99080.99320.99910.99750.99541.00500.99080.99860.99070.9943V51.00200.99671.01401.01700.99971.01000.99511.01801.00200.9859V60.99930.99441.01001.01300.99781.00800.99371.01500.99890.9851V80.99080.97490.99530.99650.99031.00000.98700.99900.98720.9781V90.98180.97770.99430.99440.98280.99480.98380.99380.99330.9746V100.97730.97180.98920.99270.97560.98870.97900.99110.97880.9686	PV P	0.1200	0.1000	0.1300	0.0500	0.0500	0.0000	0.1000	0.1200	0.0500	0.1300
V1 0.9922 0.9954 1.0050 0.9975 1.0010 1.0190 0.9953 1.0010 0.9904 1.0060 V2 0.9913 0.9941 1.0020 0.9973 0.9981 1.0120 0.9930 0.9930 0.9997 0.9904 0.9994 V3 0.9919 0.9933 0.9998 0.9979 0.9959 1.0060 0.9921 0.9992 0.9915 0.9943 V4 0.9908 0.9932 0.9991 0.9975 0.9954 1.0050 0.9908 0.9907 0.9933 V4 0.9908 0.9932 0.9991 0.9975 0.9954 1.0050 0.9908 0.9907 0.9933 V5 1.0020 0.9967 1.0140 1.0170 0.9977 1.0100 0.9953 1.0050 0.9953 1.0180 1.0020 0.9859 V6 0.9993 0.9944 1.0100 1.0130 0.9978 1.0080 0.9937 1.0150 0.9989 0.9851 V8 0.9908 0.	Vd1	1.0150	1.0070	1.0290	1.0340	1.0090	1.0220	1.0020	1.0340	1.0130	0.9909
V 2 0.9913 0.9941 1.0020 0.9973 0.9981 1.0120 0.9930 0.9930 0.9997 0.9904 0.9994 V 3 0.9919 0.9933 0.9998 0.9979 0.9959 1.0060 0.9921 0.9992 0.9915 0.9943 V 4 0.9908 0.9932 0.9991 0.9975 0.9954 1.0050 0.9908 0.9907 0.9936 V 5 1.0020 0.9967 1.0140 1.0170 0.9997 1.0100 0.9951 1.0180 1.0020 0.9859 V 6 0.9993 0.9944 1.0100 1.0130 0.9978 1.0080 0.9937 1.0150 0.9989 0.9851 V 6 0.9908 0.9749 0.9953 0.9965 0.9903 1.0000 0.9937 1.0150 0.9989 0.9851 V 8 0.9908 0.9749 0.9953 0.9965 0.9903 1.0000 0.9870 0.9981 0.9872 0.9781 V 9 0.9818 0.9777	Vd2	0.9995	1.0020	1.0160	1.0010	1.0130	1.0390	1.0050	1.0110	0.9954	1.0290
V 3 0.9919 0.9933 0.9998 0.9979 0.9959 1.0060 0.9921 0.9992 0.9915 0.9943 V 4 0.9908 0.9932 0.9991 0.9975 0.9954 1.0050 0.9908 0.9986 0.9907 0.9954 V 4 0.9908 0.9932 0.9991 0.9975 0.9954 1.0050 0.9908 0.9986 0.9907 0.9938 V 5 1.0020 0.9967 1.0140 1.0170 0.9997 1.0100 0.9951 1.0180 1.0020 0.9859 V 6 0.9993 0.9944 1.0100 1.0130 0.9978 1.0080 0.9937 1.0150 0.9989 0.9851 V 8 0.9908 0.9749 0.9953 0.9965 0.9903 1.0000 0.9870 0.9980 0.9872 0.9781 V 9 0.9818 0.9777 0.9943 0.9924 0.9887 0.9938 0.9938 0.9938 0.9938 0.9788 0.9784 0.9788 0.9948 0.99790 <td>V 1</td> <td>0.9922</td> <td>0.9954</td> <td>1.0050</td> <td>0.9975</td> <td>1.0010</td> <td>1.0190</td> <td>0.9953</td> <td>1.0010</td> <td>0.9904</td> <td>1.0060</td>	V 1	0.9922	0.9954	1.0050	0.9975	1.0010	1.0190	0.9953	1.0010	0.9904	1.0060
V 4 0.9908 0.9932 0.9991 0.9975 0.9954 1.0050 0.9908 0.9986 0.9907 0.9936 V 5 1.0020 0.9967 1.0140 1.0170 0.9997 1.0100 0.9951 1.0180 1.0020 0.9859 V 6 0.9993 0.9944 1.0100 1.0130 0.9978 1.0080 0.9937 1.0150 0.9989 0.9859 V 6 0.9908 0.9914 1.0100 1.0130 0.9978 1.0080 0.9937 1.0150 0.9989 0.9851 V 8 0.9908 0.9749 0.9953 0.9965 0.9903 1.0000 0.9870 0.9980 0.9872 0.9781 V 9 0.9818 0.9777 0.9943 0.9924 0.9828 0.9948 0.9938 0.9938 0.9833 0.9746 V 10 0.9773 0.9718 0.9822 0.9927 0.9756 0.9887 0.9911 0.9788 0.9686	V 2	0.9913	0.9941	1.0020	0.9973	0.9981	1.0120	0.9930	0.9997	0.9904	0.9994
V 5 1.0020 0.9967 1.0140 1.0170 0.9997 1.0100 0.9951 1.0180 1.0020 0.9859 V 6 0.9993 0.9944 1.0100 1.0130 0.9978 1.0080 0.9937 1.0150 0.9989 0.9859 V 8 0.9908 0.9749 0.9953 0.9965 0.9903 1.0000 0.9870 0.9990 0.9872 0.9781 V 9 0.9818 0.9777 0.9943 0.9927 0.9756 0.9948 0.9838 0.9938 0.9933 0.9746 V 10 0.9773 0.9718 0.9822 0.9927 0.9756 0.9887 0.9790 0.9911 0.9788 0.9686	V 3	0.9919	0.9933	0.9998	0.9979	0.9959	1.0060	0.9921	0.9992	0.9915	0.9943
V 6 0.9993 0.9944 1.0100 1.0130 0.9978 1.0080 0.9937 1.0150 0.9989 0.9851 V 8 0.9908 0.9749 0.9953 0.9965 0.9903 1.0000 0.9870 0.9990 0.9872 0.9781 V 9 0.9818 0.9777 0.9943 0.9944 0.9828 0.9948 0.9838 0.9933 0.9833 0.9746 V 10 0.9773 0.9718 0.9892 0.9927 0.9756 0.9887 0.9911 0.9788 0.9686	V 4	0.9908	0.9932	0.9991	0.9975	0.9954	1.0050	0.9908	0.9986	0.9907	0.9936
V 8 0.9908 0.9749 0.9953 0.9965 0.9903 1.0000 0.9870 0.9990 0.9872 0.9781 V 9 0.9818 0.9777 0.9943 0.9944 0.9828 0.9948 0.9838 0.9938 0.9938 0.9833 0.9746 V 10 0.9773 0.9718 0.9892 0.9927 0.9756 0.9887 0.9790 0.9911 0.9788 0.9686	V 5	1.0020	0.9967	1.0140	1.0170	0.9997	1.0100	0.9951	1.0180	1.0020	0.9859
V 9 0.9818 0.9777 0.9943 0.9944 0.9828 0.9948 0.9838 0.9938 0.9833 0.9746 V 10 0.9773 0.9718 0.9892 0.9927 0.9756 0.9887 0.9790 0.9911 0.9788 0.9686	V 6	0.9993	0.9944	1.0100	1.0130	0.9978	1.0080	0.9937	1.0150	0.9989	0.9851
V 10 0.9773 0.9718 0.9892 0.9927 0.9756 0.9887 0.9790 0.9911 0.9788 0.9686	V 8	0.9908	0.9749	0.9953	0.9965	0.9903	1.0000	0.9870	0.9990	0.9872	0.9781
	V 9	0.9818	0.9777	0.9943	0.9944	0.9828	0.9948	0.9838	0.9938	0.9833	0.9746
V 11 0.9766 0.9707 0.9895 0.9917 0.9741 0.9882 0.9808 0.9909 0.9780 0.9675	V 10	0.9773	0.9718	0.9892	0.9927	0.9756	0.9887	0.9790	0.9911	0.9788	0.9686
	V 11	0.9766	0.9707	0.9895	0.9917	0.9741	0.9882	0.9808	0.9909	0.9780	0.9675

Training Cases case 63 case 64 case 65 case 67 case 68 case 69											
Diesel I Q 0.1800 0.1188 0.1500 0.2371 0.6824 0.1800 0.4385 Diesel 2 P 0.9200 1.1500 1.0500 1.2000 0.4000 0.5500 0.2000 0.5500 1.2000 0.4450 Diesel 2 Q 0.5460 0.6824 0.6230 0.1300 0.1300 0.1300 0.2500 0.3000 0.4450 Wind P 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000	Training Cases	case 61	case 62	case 63	case 64	case 65	case 66	case 67	case 68	case 69	case 70
Diesel 2 P 0.9200 1.1500 1.0500 1.2000 0.4000 0.5500 0.2000 0.5500 1.2000 0.7000 Diesel 2 Q 0.5460 0.6824 0.6230 0.7200 0.2371 0.3263 0.1188 0.3263 0.7200 0.4450 Wind P 0.0000 0.0000 0.000 0.000 0.0000 0.000 0.2000 0.0000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.200 0.2000		0.3000								0.3000	
Diesel 2 Q 0.5460 0.6824 0.6230 0.7200 0.2371 0.3263 0.1188 0.3265 0.7200 0.4450 Wind P 0.0000 0.0000 0.0500 0.4000 0.0500 0.500 0.1000 0.2500 0.3000 0.2000 PV P 0.0000 0.0000 0.0500 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300 1.0300	Diesel 1 Q	0.1800	0.1188	0.1500	0.2371	0.6824	0.1800	0.6824	0.4154	0.1800	0.3856
Wind P 0.0000 0.0000 0.2000 0.0300 0.1500 0.0000 0.2000 0.0000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000<	Diesel 2 P	0.9200	1.1500	1.0500	1.2000	0.4000	0.5500	0.2000	0.5500	1.2000	0.7000
PV P 0.000 0.0000 0.0500 0.4000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 <td>Diesel 2 Q</td> <td>0.5460</td> <td>0.6824</td> <td>0.6230</td> <td>0.7200</td> <td>0.2371</td> <td>0.3263</td> <td>0.1188</td> <td>0.3263</td> <td>0.7200</td> <td>0.4450</td>	Diesel 2 Q	0.5460	0.6824	0.6230	0.7200	0.2371	0.3263	0.1188	0.3263	0.7200	0.4450
Vd1 1.0140 0.9895 0.9944 0.9961 1.0300 0.9920 1.020 1.0060 0.9858 1.0020 Vd2 1.0370 1.0330 1.0300 1.0400 1.0070 1.0120 0.9956 1.0070 1.0120 0.9953 1.0070 0.9988 V 2 1.0110 1.0010 1.0010 1.0020 0.9961 0.9963 0.9914 0.9924 0.9911 0.9926 0.9920 V 3 1.0050 0.9956 0.9925 0.9920 0.9920 0.9920 0.9921 0.9926 0.9926 0.9920 V 4 1.0040 0.9935 0.9984 1.0110 0.9701 0.9920 0.9920 0.9920 0.9921 0.9761 0.9915 V 6 1.0080 0.9855 0.9884 0.9847 0.9847 0.9866 1.0060 0.9918 0.9804 0.9761 V 6 1.0080 0.9770 0.9723 0.9762 0.9840 0.9785 0.9783 0.9765 0.9763 0.9775	Wind P	0.0000	0.0000	0.2000	0.0300	0.1500	0.0500	0.1000	0.2500	0.3000	0.1900
Vd2 1.0370 1.0300 1.0340 1.0070 1.0120 0.9956 1.0070 1.0320 1.0140 V 1 1.0180 1.0090 1.0080 1.0090 0.9986 1.0000 0.9914 0.9953 1.0070 0.9988 V 2 1.0110 1.0010 1.0010 1.0020 0.9961 0.9920 0.9914 0.9924 0.9910 0.9926 0.9920 V 3 1.0000 0.9956 0.9952 0.9920 0.9920 0.9903 0.9916 0.9913 V 5 1.0000 0.9861 0.9906 0.9844 1.0100 0.9866 1.0000 0.9913 0.9916 0.9913 V 6 1.0080 0.9855 0.9894 0.9817 0.9866 1.0060 0.9913 0.9761 0.9712 0.9761 V 6 1.0080 0.9855 0.9897 0.9847 0.9866 0.9848 0.9753 0.9763 0.9775 0.9753 0.9763 0.9775 0.9753 0.9760 0.9763 0.9764 <td>PV P</td> <td>0.0000</td> <td>0.0000</td> <td>0.0500</td> <td>0.4000</td> <td>0.2000</td> <td>0.0500</td> <td>0.2000</td> <td>0.2000</td> <td>0.0000</td> <td>0.2600</td>	PV P	0.0000	0.0000	0.0500	0.4000	0.2000	0.0500	0.2000	0.2000	0.0000	0.2600
V I 1.0180 1.0090 1.0080 1.0090 0.9986 1.0000 0.9914 0.9953 1.0070 0.9988 V 2 1.0110 1.0010 1.0010 1.0020 0.9961 0.9963 0.9914 0.9924 0.9910 0.9926 0.9920 V 3 1.0050 0.9956 0.9952 0.9920 0.9920 0.9903 0.9916 0.9920 V 4 1.0040 0.9943 0.9959 0.9942 0.9920 0.9902 0.9903 0.9916 0.9913 V 5 1.0090 0.9861 0.9906 0.9844 1.0110 0.9870 1.0100 0.9942 0.9808 0.9913 V 6 1.0080 0.9855 0.9898 0.9847 0.9866 1.0060 0.9913 0.9761 0.9762 0.9847 0.9866 0.9783 0.9764 0.9840 0.9785 0.9763 0.9770 0.9755 0.9785 0.9785 0.9785 0.9765 0.9703 0.9775 0.9785 0.9760 0.6300 0.	Vd1	1.0140	0.9895	0.9947	0.9961	1.0300	0.9920	1.0290	1.0060	0.9858	1.0020
V 2 1.010 1.0010 1.0010 1.0020 0.9961 0.9963 0.9914 0.9924 0.9914 0.9926 0.9924 V 3 1.0050 0.9956 0.9952 0.9922 0.9927 0.9910 0.9926 0.9926 0.9921 0.9910 0.9926 0.9926 0.9913 V 4 1.0040 0.9943 0.9955 0.9920 0.9920 0.9903 0.9916 0.9913 V 5 1.0090 0.9861 0.9906 0.9844 1.0100 0.9920 0.9903 0.9916 0.9913 V 6 1.0080 0.9855 0.9888 1.0070 0.9866 0.9878 0.9766 0.9712 0.9761 V 9 0.9979 0.9766 0.9722 0.9762 0.9783 0.9777 0.9793 0.9698 0.9643 0.9705 V 10 0.9973 0.9726 0.9753 0.9770 0.9755 0.9785 0.9690 0.6503 0.9700 Training Cases case 71 case 72 case	Vd2	1.0370	1.0330	1.0300	1.0340	1.0070	1.0120	0.9956	1.0070	1.0320	1.0140
V 3 1.050 0.9956 0.9956 0.9952 0.9922 0.9927 0.9910 0.9926 0.9921 V 4 1.0040 0.9943 0.9959 0.9962 0.9924 0.9920 0.9903 0.9916 0.9913 V 5 1.0000 0.9861 0.9906 0.9894 1.010 0.9870 0.9903 0.9916 0.9913 V 6 1.0080 0.9855 0.9884 1.0070 0.9866 1.0060 0.9918 0.9804 0.9896 V 8 0.9979 0.9766 0.9792 0.9762 0.9783 0.9777 0.9733 0.9766 0.9712 0.9763 V 10 0.9973 0.9726 0.9733 0.9770 0.9783 0.9777 0.9733 0.9698 0.9635 0.9700 Training Cases case 71 case 72 case 73 case 73 case 73 case 75 case 76 case 77 case 70 case 70<	V 1	1.0180	1.0090	1.0080	1.0090	0.9986	1.0000	0.9914	0.9953	1.0070	0.9988
V 4 1.0040 0.9943 0.9959 0.9962 0.9920 0.9903 0.9916 0.9913 V 5 1.0090 0.9861 0.9906 0.9894 1.0110 0.9870 1.0100 0.9924 0.9808 0.9915 V 6 1.0080 0.9855 0.9888 0.9884 1.0070 0.9866 1.0060 0.9918 0.9804 0.9896 V 8 0.9979 0.9777 0.9824 0.9837 0.9847 0.9866 0.9678 0.9768 0.9718 0.9712 0.9761 V 9 0.9973 0.9726 0.9733 0.9777 0.9733 0.9763 0.9777 0.9733 0.9698 0.9643 0.9703 V 11 0.9967 0.9730 0.9756 0.9703 0.9775 0.9785 0.9690 0.6600 0.9703 0.9775 0.9785 0.9690 0.9635 0.9700 Training Cases case 71 case 72 case 73 case 74 case 75 case 75 case 75 case 75 case 75	V 2	1.0110	1.0010	1.0010	1.0020	0.9961	0.9963	0.9914	0.9924	0.9991	0.9946
V 51.00900.98610.99060.98941.01100.98701.01000.99420.98080.9915V 61.00800.98550.98880.98841.00700.98661.00600.99180.98040.9896V 80.99790.97970.97270.98240.98370.98470.98560.98780.97660.97120.9761V 90.99970.97660.97220.97620.98400.97860.98400.97880.96980.96430.9705V 100.99730.97260.97330.97760.97350.97750.97850.96900.96350.9700Training Casescase 71case 72case 73case 74case 75case 76case 77case 78case 79case 80Diesel 1 P0.90000.60000.80001.00000.20001.20000.56000.78001.2000Diesel 2 Q0.35560.68240.53400.45000.18000.10000.10000.30000.00000.0000Wind P0.30000.50000.10000.12000.10000.13000.00000.00000.0000Vd11.01700.99991.03301.02400.99921.03100.99631.00700.9934V101.01001.02001.00001.00000.99931.01100.99361.00100.99361.0010Vd21.01401.03001.03000.99410.99110.99140.99110.9910 </td <td>V 3</td> <td>1.0050</td> <td>0.9956</td> <td>0.9962</td> <td>0.9965</td> <td>0.9952</td> <td>0.9929</td> <td>0.9927</td> <td>0.9910</td> <td>0.9926</td> <td>0.9920</td>	V 3	1.0050	0.9956	0.9962	0.9965	0.9952	0.9929	0.9927	0.9910	0.9926	0.9920
V 6 1.0080 0.9855 0.9898 0.9884 1.0070 0.9866 1.0060 0.9918 0.9804 0.9896 V 8 0.9979 0.9777 0.9824 0.9837 0.9847 0.9856 0.9878 0.9766 0.9712 0.9761 V 9 0.9997 0.9766 0.9792 0.9762 0.9840 0.9786 0.9808 0.9643 0.9742 V 10 0.9967 0.9730 0.9756 0.9703 0.9779 0.9755 0.9769 0.9635 0.9709 Training Cases case 71 case 72 case 73 case 75 case 76 case 77 case 78 case 78 case 79 case 78 case 71 case 78 case 79 case 78 case 79 case 70 case 71 case 71	V 4	1.0040	0.9943	0.9959	0.9962	0.9945	0.9920	0.9920	0.9903	0.9916	0.9913
V 80.99790.97970.98240.98370.98470.98560.98780.97660.97120.9761V 90.99970.97660.97920.97620.98400.97860.98400.97480.96940.9742V 100.99730.97260.97530.97070.97830.97770.97930.96980.96430.9700V 110.99670.97300.97560.97030.97790.97550.97850.96900.96350.9700Training Casescase 71case 72case 73case 74case 75case 76case 77case 78case 79case 80Diesel 1 P0.90000.60000.80001.00000.18000.72000.10000.36000.46000.6500Diesel 2 P0.65501.15000.90000.82001.00000.20001.23000.50000.85000.2500Diesel 2 Q0.38560.68240.53400.45000.59000.11880.64000.28000.40000.0000Wind P0.30000.05000.10000.12000.10000.13000.00000.00000.0000Vd11.01700.99991.03301.02400.99901.03100.97611.00801.00701.0230Vd21.01401.03001.02001.00701.01000.99361.01000.99361.00701.02300.9948V 11.00001.00701.02001.00701.01000.9943	V 5	1.0090	0.9861	0.9906	0.9894	1.0110	0.9870	1.0100	0.9942	0.9808	0.9915
V 9 0.9997 0.9766 0.9792 0.9762 0.9840 0.9786 0.9840 0.9748 0.9748 0.9694 0.9742 V 10 0.9973 0.9726 0.9753 0.9707 0.9783 0.9777 0.9793 0.9698 0.9643 0.9705 V 11 0.9967 0.9730 0.9756 0.9703 0.9775 0.9785 0.9690 0.9635 0.9700 Training Cases case 71 case 72 case 73 case 74 case 75 case 76 case 78 case 78 case 79 case 80 Diesel 1 P 0.900 0.6000 1.0000 1.0000 0.2000 1.2000 0.6000 0.6500 1.2000 Diesel 2 P 0.6500 1.1500 0.9000 0.8200 1.0000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.4500 0.5000 0.4500 0.5000 0.1000 0.1000 0.1000 0.2000 0.2000 0.0000 0.0000 0.0000 0.0000	V 6	1.0080	0.9855	0.9898	0.9884	1.0070	0.9866	1.0060	0.9918	0.9804	0.9896
V 10 0.973 0.9726 0.9753 0.9770 0.9783 0.9777 0.9793 0.9698 0.9643 0.9705 V 11 0.9967 0.9730 0.9756 0.9703 0.9779 0.9755 0.9785 0.9690 0.9635 0.9700 Training Cases case 71 case 72 case 73 case 74 case 75 case 76 case 77 case 78 case 79 case 78 case 79 case 70 case	V 8	0.9979	0.9797	0.9824	0.9837	0.9847	0.9856	0.9878	0.9766	0.9712	0.9761
V 11 0.9967 0.9730 0.9756 0.9703 0.9779 0.9755 0.9785 0.9690 0.9635 0.9700 Training Cases case 71 case 72 case 73 case 74 case 75 case 76 case 77 case 78 case 78 <td>V 9</td> <td>0.9997</td> <td>0.9766</td> <td>0.9792</td> <td>0.9762</td> <td>0.9840</td> <td>0.9786</td> <td>0.9840</td> <td>0.9748</td> <td>0.9694</td> <td>0.9742</td>	V 9	0.9997	0.9766	0.9792	0.9762	0.9840	0.9786	0.9840	0.9748	0.9694	0.9742
Training Casescase 71case 72case 73case 73case 74case 75case 76case 77case 78case 79case 80Diesel 1 P0.90000.60000.80001.00000.30001.20000.26000.65000.78001.2000Diesel 1 Q0.53400.35580.47420.48000.18000.72000.10000.36000.46000.6500Diesel 2 P0.65001.15000.90000.82001.00000.20001.23000.50000.85000.2500Diesel 2 Q0.38560.68240.53400.45000.59000.11880.64000.28000.45000.1400Wind P0.30000.05000.10000.10000.10000.10000.10000.00000.00000.0000PV P0.26000.06000.11000.02500.00000.10000.06000.00000.00000.0000Vd11.01700.99991.03301.02400.99901.03100.97601.00601.01801.0310Vd21.01401.00001.02001.00701.01000.99221.00100.99361.00200.9978V 11.00001.00701.02001.00400.99240.99430.99200.99790.9910V 20.99680.99440.99440.99440.99440.99440.99450.99100.97100.9910V 30.99460.99441.01700.99540.99211.0070 </td <td>V 10</td> <td>0.9973</td> <td>0.9726</td> <td>0.9753</td> <td>0.9707</td> <td>0.9783</td> <td>0.9777</td> <td>0.9793</td> <td>0.9698</td> <td>0.9643</td> <td>0.9705</td>	V 10	0.9973	0.9726	0.9753	0.9707	0.9783	0.9777	0.9793	0.9698	0.9643	0.9705
Diesel 1 P0.90000.60000.80001.00000.30001.20000.26000.65000.78001.2000Diesel 1 Q0.53400.35580.47420.48000.18000.72000.10000.36000.46000.6500Diesel 2 P0.65001.15000.90000.82001.00000.20001.23000.50000.85000.2500Diesel 2 Q0.38560.68240.53400.45000.59000.11880.64000.28000.45000.1400Wind P0.30000.05000.10000.10000.12000.10000.13000.00000.00000.0000PV P0.26000.06000.11000.02500.00000.10000.60000.00000.00000.0000Vd11.01700.99991.03301.02400.99901.03100.97601.00601.01801.0310Vd21.01401.03001.03801.01001.03000.99361.03101.00701.02300.9984V 11.00001.00701.02001.00701.01000.98221.00100.99361.00200.9928V 30.99480.99441.00700.99450.99410.99130.99410.99110.99700.9910V 40.99460.99441.01700.99270.99271.00700.97320.99361.00301.0030V 40.99490.99441.01700.99270.99271.00700.9732	V 11	0.9967	0.9730	0.9756	0.9703	0.9779	0.9755	0.9785	0.9690	0.9635	0.9700
Diesel 1 Q0.53400.35580.47420.48000.18000.72000.10000.36000.46000.6500Diesel 2 P0.65001.15000.90000.82001.00000.20001.23000.50000.85000.2500Diesel 2 Q0.38560.68240.53400.45000.59000.11880.64000.28000.45000.1400Wind P0.30000.05000.10000.10000.12000.10000.13000.00000.00000.0000PV P0.26000.06000.11000.02500.00000.10000.06000.00000.00000.0000Vd11.01700.99991.03301.02400.99901.03100.97601.00601.01801.0310Vd21.01401.03001.03801.01001.03000.99361.01011.02700.9934V 11.00001.00701.02001.00701.01000.99221.00100.99361.00200.9979V 20.99680.99941.01301.00201.00400.99240.99430.99200.99790.9930V 40.99460.99411.00700.99540.99810.99130.99410.99100.99700.9910V 51.00200.99441.02000.99540.99271.00700.97320.99361.00301.0080V 60.99890.98871.01700.99270.99271.00700.97320.99361.0030<	Training Cases	case 71	case 72	case 73	case 74	case 75	case 76	case 77	case 78	case 79	case 80
Diesel 2 P0.65001.15000.90000.82001.00000.20001.23000.50000.85000.2500Diesel 2 Q0.38560.68240.53400.45000.59000.11880.64000.28000.45000.1400Wind P0.30000.05000.10000.10000.12000.10000.13000.00000.00000.0000PV P0.26000.06000.11000.02500.00000.10000.10000.06000.00000.0000Vd11.01700.99991.03301.02400.99901.03100.97601.00601.01801.0310Vd21.01401.03001.03801.01001.03000.99361.03101.00701.02300.9984V 11.00001.00701.02001.00701.01000.99221.00100.99361.00200.9936V 20.99680.99991.01301.00201.00400.99240.99430.99200.99790.9930V 30.99490.99481.00700.99450.99840.99240.99430.99200.99700.9910V 40.99460.99411.00700.99270.99130.99410.99100.99700.9910V 51.00200.99441.09270.99271.00700.97320.99361.00301.0080V 60.99890.97661.00300.97540.98150.98030.97320.97640.98240.9812 <td>Diesel 1 P</td> <td>0.9000</td> <td>0.6000</td> <td>0.8000</td> <td>1.0000</td> <td>0.3000</td> <td>1.2000</td> <td>0.2600</td> <td>0.6500</td> <td>0.7800</td> <td>1.2000</td>	Diesel 1 P	0.9000	0.6000	0.8000	1.0000	0.3000	1.2000	0.2600	0.6500	0.7800	1.2000
Diesel 2 Q0.38560.68240.53400.45000.59000.11880.64000.28000.45000.1400Wind P0.30000.05000.10000.10000.12000.10000.13000.00000.00000.0000PV P0.26000.06000.11000.02500.00000.10000.06000.00000.00000.0000Vd11.01700.99991.03301.02400.99901.03100.97601.06001.01801.0310Vd21.01401.03001.03801.01001.03000.99361.03101.00701.02300.9984V 11.00001.00701.02001.00701.01000.98921.00800.99631.00700.9934V 20.99680.99991.01301.00201.00400.99021.00100.99361.00200.9928V 30.99490.99481.00700.99540.99840.99240.99430.99200.99790.9930V 40.99460.99411.00700.99540.99810.99130.99410.99700.9910V 51.00200.99841.01700.99270.99271.00700.97320.99361.00301.0080V 60.99890.98871.01700.99270.99271.00700.97320.99361.00301.0080V 80.98200.97661.00300.97540.98150.98030.97320.97640.98240.9817	Diesel 1 Q	0.5340	0.3558	0.4742	0.4800	0.1800	0.7200	0.1000	0.3600	0.4600	0.6500
Wind P0.30000.05000.10000.10000.12000.10000.13000.00000.00000.0000PV P0.26000.06000.11000.02500.00000.10000.06000.00000.00000.0000Vd11.01700.99991.03301.02400.99901.03100.97601.00601.01801.0310Vd21.01401.03001.03801.01001.03000.99361.03101.00701.02300.9984V 11.00001.00701.02001.00701.01000.99321.00100.99361.00700.9934V 20.99680.99991.01301.00201.00400.99021.00100.99361.00200.9928V 30.99490.99481.00700.99610.99840.99240.99430.99200.99790.9930V 40.99460.99411.00700.99570.99810.99130.99410.99110.99700.9910V 51.00200.99041.02000.99540.99401.01100.97260.99591.00301.0030V 60.99890.98871.01700.99270.99271.00700.97320.99361.00301.0080V 80.98200.97441.00200.97840.98150.98030.97320.97640.98240.9817V 100.97700.97331.00100.97680.97660.97660.97680.97610.9786<	Diesel 2 P	0.6500	1.1500	0.9000	0.8200	1.0000	0.2000	1.2300	0.5000	0.8500	0.2500
PV P0.26000.06000.11000.02500.00000.10000.06000.00000.00000.0000Vd11.01700.99991.03301.02400.99901.03100.97601.00601.01801.0310Vd21.01401.03001.03801.01001.03000.99361.03101.00701.02300.9984V 11.00001.00701.02001.00701.01000.98921.00800.99631.00700.9934V 20.99680.99991.01301.00201.00400.99021.00100.99361.00200.9928V 30.99490.99481.00700.99610.99840.99240.99430.99200.99790.9930V 40.99460.99411.00700.99450.99810.99130.99410.99100.99700.9910V 51.00200.99041.02000.99540.99401.01100.97260.99591.00601.0130V 60.99890.98871.01700.99270.99271.00700.97320.99361.00301.0080V 80.98200.97941.00200.97840.98590.99100.97400.98100.98850.9932V 90.98020.97661.00300.97540.98150.98030.97320.97640.98240.9817V 100.97700.97331.00100.97080.97610.97860.96990.97250.9772	Diesel 2 Q	0.3856	0.6824	0.5340	0.4500	0.5900	0.1188	0.6400	0.2800	0.4500	0.1400
Vd11.01700.99991.03301.02400.99901.03100.97601.00601.01801.0310Vd21.01401.03001.03801.01001.03000.99361.03101.00701.02300.9984V11.00001.00701.02001.00701.01000.98921.00800.99631.00700.9934V20.99680.99991.01301.00201.00400.99021.00100.99361.00200.9928V30.99490.99481.00700.99610.99840.99240.99430.99200.99790.9930V40.99460.99411.00700.99450.99810.99130.99410.99100.99700.9910V51.00200.99041.02000.99540.99401.01100.97260.99591.00601.0130V51.00200.99041.02000.99540.99271.00700.97320.99361.00301.0080V60.99890.98871.01700.99270.99271.00700.97320.99361.00301.0080V80.98200.97941.00200.97840.98590.99100.97400.98100.98850.9932V90.98020.97661.00300.97540.98150.98030.97320.97640.98240.9817V100.97700.97331.00100.97080.97610.97860.96990.97250.97720.9773	Wind P	0.3000	0.0500	0.1000	0.1000	0.1200	0.1000	0.1300	0.0000	0.0000	0.0000
Vd21.01401.03001.03801.01001.03000.99361.03101.00701.02300.9984V11.00001.00701.02001.00701.01000.98921.00800.99631.00700.9934V20.99680.99991.01301.00201.00400.99021.00100.99361.00200.9928V30.99490.99481.00700.99610.99840.99240.99430.99200.99790.9930V40.99460.99411.00700.99450.99810.99130.99410.99110.99700.9910V51.00200.99041.02000.99540.99401.01100.97260.99591.00601.0130V60.99890.98871.01700.99270.99271.00700.97320.99361.00301.0080V80.98200.97941.00200.97840.98590.99100.97400.98100.98850.9932V90.98020.97661.00300.97540.98150.98030.97320.97640.98140.9817V100.97700.97331.00100.97080.97610.97860.96990.97250.97720.9773	PV P	0.2600	0.0600	0.1100	0.0250	0.0000	0.1000	0.0600	0.0000	0.0000	0.0000
V 11.00001.00701.02001.00701.01000.98921.00800.99631.00700.9934V 20.99680.99991.01301.00201.00400.99021.00100.99361.00200.9928V 30.99490.99481.00700.99610.99840.99240.99430.99200.99790.9930V 40.99460.99411.00700.99450.99810.99130.99410.99110.99700.9910V 51.00200.99041.02000.99540.99401.01100.97260.99591.00601.0130V 60.99890.98871.01700.99270.99271.00700.97320.99361.00301.0080V 80.98200.97941.00200.97840.98590.99100.97400.98100.98850.9932V 90.98020.97661.00300.97540.98150.98030.97320.97640.98140.9817V 100.97700.97331.00100.97080.97610.97860.96990.97250.97720.9773	Vd1	1.0170	0.9999	1.0330	1.0240	0.9990	1.0310	0.9760	1.0060	1.0180	1.0310
V 2 0.9968 0.9999 1.0130 1.0020 1.0040 0.9902 1.0010 0.9936 1.0020 0.9928 V 3 0.9949 0.9948 1.0070 0.9961 0.9984 0.9924 0.9943 0.9920 0.9979 0.9930 V 4 0.9946 0.9941 1.0070 0.9945 0.9981 0.9913 0.9941 0.9970 0.9910 V 5 1.0020 0.9904 1.0200 0.9954 0.9940 1.0110 0.9726 0.9959 1.0060 1.0130 V 6 0.9989 0.9887 1.0170 0.9927 0.9927 1.0070 0.9732 0.9936 1.0030 1.0080 V 8 0.9820 0.9794 1.0020 0.9784 0.9859 0.9910 0.9740 0.9810 0.9885 0.9932 V 9 0.9802 0.9766 1.0030 0.9754 0.9815 0.9803 0.9732 0.9764 0.9817 V 10 0.9770 0.9733 1.0010 0.9708	Vd2	1.0140	1.0300	1.0380	1.0100	1.0300	0.9936	1.0310	1.0070	1.0230	0.9984
V 3 0.9949 0.9948 1.0070 0.9961 0.9984 0.9924 0.9943 0.9920 0.9979 0.9930 V 4 0.9946 0.9941 1.0070 0.9945 0.9981 0.9913 0.9941 0.9910 0.9910 V 5 1.0020 0.9904 1.0200 0.9954 0.9940 1.0110 0.9726 0.9959 1.0060 1.0130 V 6 0.9989 0.9887 1.0170 0.9927 0.9927 1.0070 0.9732 0.9936 1.0030 1.0080 V 8 0.9820 0.9794 1.0020 0.9784 0.9859 0.9910 0.9740 0.9810 0.9885 0.9932 V 9 0.9802 0.9766 1.0030 0.9754 0.9815 0.9803 0.9732 0.9744 0.9824 0.9817 V 10 0.9770 0.9733 1.0010 0.9708 0.9761 0.9786 0.9699 0.9725 0.9772 0.9773	V 1	1.0000	1.0070	1.0200	1.0070	1.0100	0.9892	1.0080	0.9963	1.0070	0.9934
V 4 0.9946 0.9941 1.0070 0.9945 0.9981 0.9913 0.9941 0.9911 0.9970 0.9910 V 5 1.0020 0.9904 1.0200 0.9954 0.9940 1.0110 0.9726 0.9959 1.0060 1.0130 V 6 0.9989 0.9887 1.0170 0.9927 0.9927 1.0070 0.9732 0.9936 1.0030 1.0080 V 8 0.9820 0.9794 1.0020 0.9754 0.9859 0.9910 0.9740 0.9810 0.9885 0.9932 V 9 0.9802 0.9766 1.0030 0.9754 0.9815 0.9803 0.9732 0.9764 0.9824 0.9817 V 10 0.9770 0.9733 1.0010 0.9708 0.9761 0.9786 0.9699 0.9725 0.9772 0.9773	V 2	0.9968	0.9999	1.0130	1.0020	1.0040	0.9902	1.0010	0.9936	1.0020	0.9928
V 5 1.0020 0.9904 1.0200 0.9954 0.9940 1.0110 0.9726 0.9959 1.0060 1.0130 V 6 0.9989 0.9887 1.0170 0.9927 0.9927 1.0070 0.9732 0.9936 1.0030 1.0080 V 8 0.9820 0.9794 1.0020 0.9784 0.9859 0.9910 0.9740 0.9810 0.9885 0.9932 V 9 0.9802 0.9766 1.0030 0.9754 0.9815 0.9803 0.9732 0.9764 0.9824 0.9817 V 10 0.9770 0.9733 1.0010 0.9708 0.9761 0.9786 0.9699 0.9725 0.9772 0.9773	V 3	0.9949	0.9948	1.0070	0.9961	0.9984	0.9924	0.9943	0.9920	0.9979	0.9930
V 6 0.9989 0.9887 1.0170 0.9927 0.9927 1.0070 0.9732 0.9936 1.0030 1.0080 V 8 0.9820 0.9794 1.0020 0.9784 0.9859 0.9910 0.9740 0.9810 0.9885 0.9932 V 9 0.9802 0.9766 1.0030 0.9754 0.9815 0.9803 0.9732 0.9764 0.9824 0.9817 V 10 0.9770 0.9733 1.0010 0.9708 0.9761 0.9786 0.9699 0.9725 0.9772 0.9773	V 4	0.9946	0.9941	1.0070	0.9945	0.9981	0.9913	0.9941	0.9911	0.9970	0.9910
V 8 0.9820 0.9794 1.0020 0.9784 0.9859 0.9910 0.9740 0.9810 0.9885 0.9932 V 9 0.9802 0.9766 1.0030 0.9754 0.9815 0.9803 0.9732 0.9764 0.9824 0.9817 V 10 0.9770 0.9733 1.0010 0.9708 0.9761 0.9786 0.9699 0.9725 0.9772 0.9773	V 5	1.0020	0.9904	1.0200	0.9954	0.9940	1.0110	0.9726	0.9959	1.0060	1.0130
V 9 0.9802 0.9766 1.0030 0.9754 0.9815 0.9803 0.9732 0.9764 0.9824 0.9817 V 10 0.9770 0.9733 1.0010 0.9708 0.9761 0.9786 0.9699 0.9725 0.9772 0.9773	V 6	0.9989	0.9887	1.0170	0.9927	0.9927	1.0070	0.9732	0.9936	1.0030	1.0080
V 10 0.9770 0.9733 1.0010 0.9708 0.9761 0.9786 0.9699 0.9725 0.9772 0.9773	V 8	0.9820	0.9794	1.0020	0.9784	0.9859	0.9910	0.9740	0.9810	0.9885	0.9932
	V 9	0.9802	0.9766	1.0030	0.9754	0.9815	0.9803	0.9732	0.9764	0.9824	0.9817
V 11 0.9764 0.9715 1.0010 0.9696 0.9749 0.9781 0.9692 0.9723 0.9762 0.9763	V 10	0.9770	0.9733	1.0010	0.9708	0.9761	0.9786	0.9699	0.9725	0.9772	0.9773
	V 11	0.9764	0.9715	1.0010	0.9696	0.9749	0.9781	0.9692	0.9723	0.9762	0.9763

Diesel I P 0.6800 0.8900 0.6500 0.3000 1.0200 1.3000 1.0200 0.6000 0.6500 Diesel I Q 0.3000 0.4500 0.4700 0.3600 0.1600 0.5800 0.6500 0.5800 0.3600 0.3600 0.3600 0.3600 0.3600 0.3600 0.3600 0.3600 0.4000 0.1000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00		1									
Diesel 1 Q0.80000.45000.47000.36000.16000.58000.58000.20000.22000.60000.9800Diesel 2 Q0.34000.40000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.30000.3	Training Cases	case 81	case 82	case 83	case 84	case 85	case 86	case 87	case 88	case 89	case 90
Diesel 2 P0.60000.78000.65000.50001.10000.70000.20000.22000.60000.5000Wind P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000<	Diesel 1 P	0.6800	0.8000		0.6500	0.3000	1.0200	1.3000	1.0200	0.6000	0.6500
Diesel 2 Q 0.3400 0.4000 0.3000 0.3000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0	Diesel 1 Q	0.3800	0.4500	0.4700	0.3600	0.1600	0.5800	0.6500	0.5800	0.3300	0.3400
Wind P 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000<	Diesel 2 P	0.6000	0.7800	0.6500	0.6500	1.1000	0.7000	0.2000	0.2200	0.6000	0.9800
PV P0.00000.00000.00000.00000.00000.00000.00000.00000.0000Vd11.01201.02801.01501.01001.03001.03501.0201.01000.99331.0120Vd21.01001.01000.99890.99671.01201.01200.99550.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.99050.9905	Diesel 2 Q	0.3400	0.4600	0.3600	0.3600	0.5800	0.4000	0.1100	0.1200	0.3300	0.5700
Vd11.01201.02801.01501.01001.00400.99301.03501.0201.01001.01201.0300Vd21.01001.01001.01001.01001.03001.0201.01000.99450.99051.0100V11.00001.01400.99890.99671.01201.01000.99550.99051.0100V20.99641.00000.99550.99120.99731.01000.99440.99391.0050V30.93931.00500.99190.98770.99671.00300.99420.99030.99221.0030V40.99201.00500.99190.98770.99671.01000.99480.99730.97730.9760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.99760.97730.97710.97710.97710.97710.97730.97710.97730.97710.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.97730.9773	Wind P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vd21.01201.03001.01201.01001.03301.02701.00100.99441.01201.0300V 11.00001.01400.99890.99671.01201.01200.99650.99050.99051.0100V 20.99641.00000.99530.99120.99731.00400.99490.99330.99221.0030V 30.99201.00500.99190.98700.99671.00300.99420.98920.99101.0030V 40.99201.00500.99190.98700.98671.01000.99420.98920.90101.0030V 51.00101.01501.00200.99400.98851.01501.01000.99380.98721.0210V 60.99841.01200.97860.99170.97710.97710.99790.98660.98330.9760.9935V 100.97660.99220.97760.97720.97870.98780.98650.97140.9060.9887V 110.97660.99220.97660.97220.97780.99690.97670.97120.96690.9872TrainingCasescase 91case 92case 92case 92case 93case 94case 95case 960.97670.97120.96690.9720Disel 1 Q0.50000.40000.50000.40000.70000.84000.40000.50000.40000.40000.40000.4000Disel 2 Q0.28000.70000.	PV P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V 11.0001.01400.99890.99671.01201.01200.99650.99050.99051.0100V 20.99641.00900.95950.99361.00401.00800.99440.99300.99221.0030V 30.99201.00500.99190.98770.90771.00300.99420.98920.90101.0030V 40.99201.00101.01501.00200.99400.98851.01001.01100.99930.98791.0020V 51.00101.01501.00200.99400.98851.01501.00600.99830.98621.0101V 60.99841.01200.99860.99150.97710.97710.99770.98660.98390.99650.9865V 90.98190.99610.98150.97170.97770.99870.98080.97140.97000.9887V 100.97620.99220.9760.97220.97280.99950.97670.97120.96950.9872Training Casecase 91case 92case 93case 95case 96case 97case 90case 95case 900.47000.40000.50000.4000Disesl 1 P0.50000.40000.50000.40000.40000.50000.40000.40000.50000.40000.40000.50000.40000.40000.50000.40000.40000.50000.40000.00000.00000.00000.00000.00000.00000.0	Vd1	1.0120	1.0280	1.0150	1.0040	0.9930	1.0350	1.0290	1.0150	0.9973	1.0120
V 20.99641.00000.99590.99361.00401.00800.99540.98940.99571.0100V 30.99391.00500.99130.99170.99731.00400.99440.99030.99221.0030V 40.99201.00500.99100.98770.99671.00300.99420.98920.91011.0100V 51.00101.01501.00200.99400.98851.01011.01000.99380.98721.0010V 60.99841.01200.99780.97730.97810.99790.98660.98390.97060.9936V 90.98190.99160.98150.97710.97770.99870.98880.97330.98250.9887V 100.97660.99220.97760.97220.97280.99690.97670.97120.96950.9872V 110.97620.99120.97660.92200.97690.98091.10000.99000.5000Diesel 1 P0.50000.40000.65000.40000.70000.89001.10000.40000.53000.3400Diesel 2 P0.50000.70000.55000.58000.50000.40000.40000.50000.00000.00000.00000.0000Diesel 2 Q0.28000.40000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000	Vd2	1.0120	1.0300	1.0120	1.0100	1.0330	1.0270	1.0010	0.9949	1.0120	1.0380
V 30.99391.00500.99350.99120.99731.00400.99440.99030.99221.0030V 40.99201.00500.99190.98770.96771.00300.94220.98920.91011.0100V 51.00101.01501.00200.99400.98851.01011.01000.99330.93731.0020V 60.99841.01200.99730.97730.97810.99790.98660.98390.97060.9936V 90.98190.99160.98150.97710.97770.99870.98080.97320.98720.97140.97060.9887V 100.97660.99220.97760.97220.97280.99690.97670.97120.96950.9872Training Casescase 91case 92case 93case 94case 95case 96case 97case 98case 99case 10Disel 1 P0.50000.40000.65000.40000.70000.89001.10000.50000.30000.3000Disel 2 P0.50000.70000.55000.58000.50000.40000.40000.50000.00000.00000.0000Disel 2 P0.90000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000V111.00100.99261.00100.99731.02501.02501.02701.02501.0263Disel 2 P0.50000.00000.00000	V 1	1.0000	1.0140	0.9989	0.9967	1.0120	1.0120	0.9965	0.9905	0.9996	1.0180
V 40.9201.00500.99170.98770.90671.00300.94220.98220.99101.0030V 51.00101.01501.00200.99400.98851.01901.01100.99330.98731.0020V 60.99841.01200.99860.99160.98761.01501.00600.99580.98621.0101V 80.98331.00200.97930.97730.97810.99790.98660.98390.97630.9936V 90.98190.99610.91510.97710.97770.98720.97820.97140.97000.9885V 100.97660.99220.97760.97220.97280.99690.97670.97120.96950.9872Training Casescase 91case 92case 93case 94case 95case 96case 97case 98case 99case 10Disel 1 P0.50000.40000.65000.40000.70000.47000.40000.46000.53000.3400Disel 2 Q0.28000.40000.55000.58000.75000.43000.46000.40000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.	V 2	0.9964	1.0090	0.9959	0.9936	1.0040	1.0080	0.9954	0.9894	0.9957	1.0100
V 51.00101.01501.00200.99400.98851.01901.01100.99930.98791.0020V 60.99841.01200.99860.99160.98761.01501.00600.99580.98621.0101V 80.98331.00200.97330.97730.97810.99790.98660.98390.97960.9936V 90.98190.99610.98150.97710.97770.99870.98080.97830.98250.9885V 100.97660.99220.97760.97220.97280.99690.97670.97120.96950.9872Training Casescase 91case 92case 93case 94case 95case 96case 97case 98case 99case 10Diesel 1 P0.50000.40000.65000.40000.70000.47000.40000.46000.53000.3400Diesel 2 Q0.28000.40000.55000.58000.75000.43000.46000.40000.0000Diesel 2 Q0.28000.40000.00000.00000.00000.00000.00000.00000.00000.00000.0000V 111.0100.99261.01000.99731.02501.03001.00000.00000.00000.00000.00000.0000Diesel 2 Q0.28000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.	V 3	0.9939	1.0050	0.9935	0.9912	0.9973	1.0040	0.9949	0.9903	0.9922	1.0030
V 60.99841.01200.99860.99160.98761.01501.00600.99580.98621.0010V 80.98931.00200.97330.97730.97710.99770.98660.93390.97660.9336V 90.98190.99610.98150.97710.97770.99870.98080.97830.98250.9885V 100.97660.99220.97760.97220.97400.99650.97820.97140.97000.9887V 110.97620.99120.97660.97220.97280.99690.97670.97120.96950.9872Training Casescase 91case 92case 93case 94case 95case 96case 97case 98case 99case 10Diesel 1 P0.50000.40000.65000.40000.70000.89001.10000.70000.99000.5500Diesel 2 Q0.28000.22000.38000.22000.42000.42000.43000.44000.40000.4000Diesel 2 Q0.28000.40000.31000.34000.50000.00000.00000.00000.00000.00000.00000.0000Wind P0.0000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000 <t< td=""><td>V 4</td><td>0.9920</td><td>1.0050</td><td>0.9919</td><td>0.9897</td><td>0.9967</td><td>1.0030</td><td>0.9942</td><td>0.9892</td><td>0.9910</td><td>1.0030</td></t<>	V 4	0.9920	1.0050	0.9919	0.9897	0.9967	1.0030	0.9942	0.9892	0.9910	1.0030
V 80.98931.00200.97930.97730.97810.99790.98660.98390.97960.9936V 90.98190.99610.98150.97710.97770.99870.98080.97830.98250.9885V 100.97660.99220.97760.97320.97400.99650.97820.97140.97000.9887V 110.97620.99120.97660.97220.97280.99690.97670.97120.96950.9872Training Casescase 91case 92case 93case 94case 95case 96case 97case 98case 900.5600Disel 1 P0.50000.40000.65000.42000.47000.64000.40000.53000.3400Disel 2 P0.50000.70000.55000.58000.95000.75000.43000.40000.00000.0000Disel 2 Q0.28000.40000.31000.34000.50000.00000.00000.00000.00000.00000.0000Disel 2 Q0.28000.40000.00000.00000.00000.00000.00000.00000.00000.00000.0000PV P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000Vd11.0100.99780.99710.99781.02011.01011.0201.01011.0201.0101V101.00201.01101.01000.99221.	V 5	1.0010	1.0150	1.0020	0.9940	0.9885	1.0190	1.0110	0.9993	0.9879	1.0020
V 90.98190.99610.98150.97710.97770.99870.98080.97830.98250.9885V 100.97660.99220.97760.97320.97400.99650.97820.97140.97000.9887V 110.97620.99120.97660.97220.97280.99690.97670.97120.96950.9872Training Casescase 91case 92case 93case 94case 95case 96case 97case 98case 99case 10Diesel 1 P0.50000.40000.65000.40000.70000.89001.10000.70000.99000.5000Diesel 2 P0.50000.70000.55000.58000.95000.75000.43000.45000.40000.4000Diesel 2 Q0.28000.40000.31000.34000.50000.40000.40000.40000.40000.40000.4000Diesel 2 Q0.28000.40000.31000.34000.50000.42000.24000.46000.4000Diesel 2 Q0.28000.40000.00000.00000.00000.00000.00000.00000.00000.00000.0000Wind P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000V 111.0100.99251.01101.01001.02201.02501.02501.04011.00701.02911.0150V 111.02021.0100 <td< td=""><td>V 6</td><td>0.9984</td><td>1.0120</td><td>0.9986</td><td>0.9916</td><td>0.9876</td><td>1.0150</td><td>1.0060</td><td>0.9958</td><td>0.9862</td><td>1.0010</td></td<>	V 6	0.9984	1.0120	0.9986	0.9916	0.9876	1.0150	1.0060	0.9958	0.9862	1.0010
V 10 0.9766 0.9922 0.9776 0.9732 0.9740 0.9965 0.9782 0.9714 0.9700 0.9887 V 11 0.9762 0.9912 0.9766 0.9722 0.9728 0.9969 0.9767 0.9712 0.9695 0.9872 Training Cases case 91 case 92 case 93 case 94 case 95 case 96 case 97 case 98 case 90 0.9700 0.9700 0.9700 0.9700 0.9700 0.9900 0.6500 Diesel 1 P 0.5000 0.4000 0.6500 0.4200 0.4700 0.6400 0.4000 0.3400 Diesel 2 P 0.5000 0.7000 0.5500 0.5800 0.9500 0.4200 0.4300 0.4600 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000 0.4000	V 8	0.9893	1.0020	0.9793	0.9773	0.9781	0.9979	0.9866	0.9839	0.9796	0.9936
V 110.97620.99120.97660.97220.97280.99690.97670.97120.96950.9872Training Casescase 91case 92case 93case 93case 94case 95case 96case 97case 98case 98case 10Diesel 1 P0.50000.40000.65000.40000.70000.89001.10000.70000.99000.6500Diesel 1 Q0.28000.22000.38000.22000.42000.47000.64000.40000.50000.3400Diesel 2 P0.50000.70000.55000.58000.95000.75000.43000.45000.85000.7400Diesel 2 Q0.28000.40000.50000.58000.50000.42000.25000.24000.46000.4000Diesel 2 Q0.28000.40000.31000.34000.50000.42000.25000.24000.46000.4300Diesel 2 Q0.28000.40000.00000.00000.00000.00000.00000.00000.00000.00000.0000Wind P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000<	V 9	0.9819	0.9961	0.9815	0.9771	0.9777	0.9987	0.9808	0.9783	0.9825	0.9885
Training Casescase 91case 92case 93case 93case 94case 95case 96case 97case 98case 99case 100Diesel 1 P0.50000.40000.65000.40000.70000.89001.10000.70000.99000.6500Diesel 1 Q0.28000.22000.38000.22000.42000.47000.64000.40000.53000.3400Diesel 2 P0.50000.70000.55000.58000.95000.75000.43000.45000.85000.4000Diesel 2 Q0.28000.40000.31000.34000.50000.42000.25000.24000.46000.4300Diesel 2 Q0.28000.40000.00000.00000.00000.42000.25000.24000.46000.4300Wind P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000Vd11.00100.99261.00700.99731.02501.03001.00001.00701.02701.0150Vd21.01201.01101.01001.03201.02601.00501.00401.02701.0150V 11.00201.00101.00000.99421.01401.00100.99430.99111.01600.9943V 20.99780.99450.99141.00401.00300.99440.99161.01000.9913V 40.99390.99240.99460.99141	V 10	0.9766	0.9922	0.9776	0.9732	0.9740	0.9965	0.9782	0.9714	0.9700	0.9887
Diesel 1 P0.50000.40000.65000.40000.70000.89001.10000.70000.99000.6500Diesel 1 Q0.28000.22000.38000.22000.42000.42000.47000.64000.40000.53000.3400Diesel 2 P0.50000.70000.55000.58000.95000.75000.43000.45000.45000.85000.7400Diesel 2 Q0.28000.40000.31000.34000.50000.42000.25000.24000.46000.4300Wind P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000PV P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000Vd11.01010.99261.00101.01001.03201.02601.00501.00401.02701.0150V 11.02021.01011.01000.99821.01401.01100.99550.99521.01100.9943V 20.99780.99650.99710.99481.00401.00300.99430.99111.00100.9923V 30.99740.99240.99460.99141.00401.01030.99350.99051.01000.9913V 40.99340.99240.99480.99650.99750.99850.98910.91640.99130.99130.9914	V 11	0.9762	0.9912	0.9766	0.9722	0.9728	0.9969	0.9767	0.9712	0.9695	0.9872
Diesel 1 Q0.28000.22000.38000.22000.42000.47000.64000.40000.53000.3400Diesel 2 P0.50000.70000.55000.58000.95000.75000.43000.45000.85000.7400Diesel 2 Q0.28000.40000.31000.34000.50000.42000.25000.24000.46000.4300Wind P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000PV P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000Vd11.0100.99261.00700.99731.02501.03001.00501.02001.02001.0103Vd21.01201.01011.01001.03201.02601.00501.00401.02701.0150V 11.00201.00101.00000.99821.01401.01100.99550.99521.01100.9943V 20.99780.99650.99710.99481.00401.00300.99440.99161.00100.9923V 40.99390.99240.99460.99141.04001.01000.99351.01000.9913V 50.99340.98630.99700.99150.98550.98911.01000.9913V 60.99140.97410.98180.98050.99750.98550.98910.91640.9914 <td< td=""><td>Training Cases</td><td>case 91</td><td>case 92</td><td>case 93</td><td>case 94</td><td>case 95</td><td>case 96</td><td>case 97</td><td>case 98</td><td>case 99</td><td>case 100</td></td<>	Training Cases	case 91	case 92	case 93	case 94	case 95	case 96	case 97	case 98	case 99	case 100
Diesel 2 P0.50000.70000.55000.58000.95000.75000.43000.45000.85000.7400Diesel 2 Q0.28000.40000.31000.34000.50000.42000.25000.24000.46000.4300Wind P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000 <td>Diesel 1 P</td> <td>0.5000</td> <td>0.4000</td> <td>0.6500</td> <td>0.4000</td> <td>0.7000</td> <td>0.8900</td> <td>1.1000</td> <td>0.7000</td> <td>0.9900</td> <td>0.6500</td>	Diesel 1 P	0.5000	0.4000	0.6500	0.4000	0.7000	0.8900	1.1000	0.7000	0.9900	0.6500
Diesel 2 Q0.28000.40000.31000.34000.50000.42000.25000.24000.46000.4300Wind P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000<	Diesel 1 Q	0.2800	0.2200	0.3800	0.2200	0.4200	0.4700	0.6400	0.4000	0.5300	0.3400
Wind P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.000	Diesel 2 P	0.5000	0.7000	0.5500	0.5800	0.9500	0.7500	0.4300	0.4500	0.8500	0.7400
PV P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000<	Diesel 2 Q	0.2800	0.4000	0.3100	0.3400	0.5000	0.4200	0.2500	0.2400	0.4600	0.4300
Vd11.00100.99261.00700.99731.02501.03001.10001.00701.02901.0030Vd21.01201.01501.01101.01001.03201.02601.00501.00401.02701.0150V11.00201.00101.00000.99821.01401.01100.99650.99521.01100.9994V20.99780.99650.99710.99481.00901.00700.99430.99311.00600.9943V30.99440.99290.99480.99241.00401.00300.99440.99161.00100.9923V40.99390.99240.99460.99141.00401.00300.99350.99051.00000.9914V50.99340.98630.99700.99101.01401.01701.01200.99621.01000.9933V60.99120.98490.99480.98961.01101.01401.00700.99351.01000.9913V80.97740.97410.98180.98050.99750.98510.98110.97670.99040.9804V90.97110.97570.98110.98010.99710.99510.97700.97220.98580.9732V100.97100.97370.97600.97590.99410.99510.97700.97220.98580.9732	Wind P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vd21.01201.01501.01101.01001.03201.02601.00501.00401.02701.0150V 11.00201.00101.00000.99821.01401.01100.99650.99521.01100.9994V 20.99780.99650.99710.99481.00901.00700.99430.99311.00600.9948V 30.99440.99290.99480.99241.00401.00300.99440.99161.00100.9923V 40.99390.99240.99460.99141.00401.00300.99350.90551.00000.9914V 50.99340.98630.99700.99101.01401.01701.01200.99621.01400.9933V 60.99120.98490.99480.98961.01101.01401.00700.99351.01000.9913V 80.97940.97410.98180.98050.99750.99850.98910.97670.99040.9804V 90.97710.97570.98110.98010.99710.99810.97700.97560.98920.9774V 100.97100.97370.97600.97590.99410.99510.97700.97220.98580.9732	PV P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V 1 1.0020 1.0010 1.0000 0.9982 1.0140 1.0110 0.9965 0.9952 1.0110 0.9994 V 2 0.9978 0.9965 0.9971 0.9948 1.0090 1.0070 0.9943 0.9931 1.0060 0.9948 V 3 0.9944 0.9929 0.9948 0.9924 1.0040 1.0030 0.9944 0.9916 1.0010 0.9923 V 4 0.9939 0.9924 0.9946 0.9914 1.0040 1.0030 0.9943 0.9905 1.0010 0.9923 V 4 0.9939 0.9924 0.9946 0.9914 1.0040 1.0030 0.9935 0.9905 1.0000 0.9914 V 5 0.9934 0.9863 0.9970 0.9910 1.0140 1.0170 1.0120 0.9962 1.0140 0.9933 V 6 0.9912 0.9849 0.9948 0.9896 1.0110 1.0140 1.0070 0.9935 1.0100 0.9913 V 8 0.9774 0.9741	Vd1	1.0010	0.9926	1.0070	0.9973	1.0250	1.0300	1.1000	1.0070	1.0290	1.0030
V 2 0.9978 0.9965 0.9971 0.9948 1.0090 1.0070 0.9943 0.9931 1.0060 0.9948 V 3 0.9944 0.9929 0.9948 0.9924 1.0040 1.0030 0.9944 0.9916 1.0010 0.9923 V 4 0.9939 0.9924 0.9946 0.9914 1.0040 1.0030 0.9935 0.9905 1.0000 0.9913 V 5 0.9934 0.9863 0.9970 0.9910 1.0140 1.0170 1.0120 0.9962 1.0140 0.9933 V 6 0.9912 0.9849 0.9948 0.9896 1.0110 1.0140 1.0070 0.9935 1.0100 0.9913 V 8 0.9794 0.9741 0.9818 0.9805 0.9975 0.9985 0.9891 0.9767 0.9904 0.9804 V 9 0.9771 0.9757 0.9811 0.9801 0.9971 0.9827 0.9756 0.9892 0.9774 V 10 0.9710 0.9737 0.9760	Vd2	1.0120	1.0150	1.0110	1.0100	1.0320	1.0260	1.0050	1.0040	1.0270	1.0150
V 30.99440.99290.99480.99241.00401.00300.99440.99161.00100.9923V 40.99390.99240.99460.99141.00401.00300.99350.99051.00000.9914V 50.99340.98630.99700.99101.01401.01701.01200.99621.01400.9933V 60.99120.98490.99480.98961.01101.01401.00700.99351.01000.9913V 80.97940.97410.98180.98050.99750.99850.98910.97670.99040.9804V 90.97710.97570.98110.98010.99710.99810.98270.97560.98920.9774V 100.97100.97370.97600.97590.99410.99510.97700.97220.98580.9732	V 1	1.0020	1.0010	1.0000	0.9982	1.0140	1.0110	0.9965	0.9952	1.0110	0.9994
V 4 0.9939 0.9924 0.9946 0.9914 1.0040 1.0030 0.9935 0.9905 1.0000 0.9914 V 5 0.9934 0.9863 0.9970 0.9910 1.0140 1.0170 1.0120 0.9962 1.0140 0.9933 V 6 0.9912 0.9849 0.9948 0.9896 1.0110 1.0140 1.0070 0.9935 1.0100 0.9913 V 6 0.9912 0.9849 0.9948 0.9896 1.0110 1.0140 1.0070 0.9935 1.0100 0.9913 V 8 0.9794 0.9741 0.9818 0.9805 0.9975 0.9985 0.9891 0.9767 0.9904 0.9804 V 9 0.9771 0.9757 0.9811 0.9801 0.9971 0.9827 0.9756 0.9892 0.9774 V 10 0.9710 0.9737 0.9760 0.9759 0.9941 0.9951 0.9770 0.9722 0.9858 0.9732	V 2	0.9978	0.9965	0.9971	0.9948	1.0090	1.0070	0.9943	0.9931	1.0060	0.9948
V 5 0.9934 0.9863 0.9970 0.9910 1.0140 1.0170 1.0120 0.9962 1.0140 0.9933 V 6 0.9912 0.9849 0.9948 0.9896 1.0110 1.0140 1.0070 0.9935 1.0100 0.9913 V 8 0.9794 0.9741 0.9818 0.9805 0.9975 0.9985 0.9891 0.9767 0.9904 0.9804 V 9 0.9771 0.9757 0.9811 0.9801 0.9971 0.9827 0.9756 0.9892 0.9774 V 10 0.9710 0.9737 0.9760 0.9759 0.9941 0.9951 0.9770 0.9722 0.9858 0.9732	V 3	0.9944	0.9929	0.9948	0.9924	1.0040	1.0030	0.9944	0.9916	1.0010	0.9923
V 6 0.9912 0.9849 0.9948 0.9896 1.0110 1.0140 1.0070 0.9935 1.0100 0.9913 V 8 0.9794 0.9741 0.9818 0.9805 0.9975 0.9985 0.9891 0.9767 0.9904 0.9804 V 9 0.9771 0.9757 0.9811 0.9801 0.9971 0.9827 0.9756 0.9892 0.9774 V 10 0.9710 0.9737 0.9760 0.9759 0.9941 0.9951 0.9770 0.9722 0.9858 0.9732	V 4	0.9939	0.9924	0.9946	0.9914	1.0040	1.0030	0.9935	0.9905	1.0000	0.9914
V 8 0.9794 0.9741 0.9818 0.9805 0.9975 0.9985 0.9891 0.9767 0.9904 0.9804 V 9 0.9771 0.9757 0.9811 0.9801 0.9971 0.9756 0.9892 0.9774 V 10 0.9710 0.9737 0.9760 0.9759 0.9941 0.9951 0.9770 0.9722 0.9858 0.9732	V 5	0.9934	0.9863	0.9970	0.9910	1.0140	1.0170	1.0120	0.9962	1.0140	0.9933
V 9 0.9771 0.9757 0.9811 0.9801 0.9971 0.9981 0.9827 0.9756 0.9892 0.9774 V 10 0.9710 0.9737 0.9760 0.9759 0.9941 0.9951 0.9770 0.9722 0.9858 0.9732	V 6	0.9912	0.9849	0.9948	0.9896	1.0110	1.0140	1.0070	0.9935	1.0100	0.9913
V 10 0.9710 0.9737 0.9760 0.9759 0.9941 0.9951 0.9770 0.9722 0.9858 0.9732	V 8	0.9794	0.9741	0.9818	0.9805	0.9975	0.9985	0.9891	0.9767	0.9904	0.9804
	V 9	0.9771	0.9757	0.9811	0.9801	0.9971	0.9981	0.9827	0.9756	0.9892	0.9774
V 11 0.9716 0.9703 0.9788 0.9768 0.9922 0.9933 0.9766 0.9708 0.9846 0.9719	V 10	0.9710	0.9737	0.9760	0.9759	0.9941	0.9951	0.9770	0.9722	0.9858	0.9732
	V 11	0.9716	0.9703	0.9788	0.9768	0.9922	0.9933	0.9766	0.9708	0.9846	0.9719

Training Cases	case 101	case 102	case 103	case 104	case 105	case 106	case 107	case 108	case 109	case 110
Diesel 1 P	0.6500	0.6200	1.3000	0.7600	0.9500	0.3400	0.3400	1.3000	0.6500	0.5500
Diesel 1 Q	0.3856	0.3500	0.6800	0.4500	0.5300	0.2000	0.2000	0.6800	0.3500	0.3263
Diesel 2 P	1.1500	0.8500	0.3000	0.6800	0.8200	1.2000	1.2000	0.3000	0.5800	0.4000
Diesel 2 Q	0.6000	0.4500	0.1700	0.3500	0.5000	0.6400	0.6400	0.1700	0.3200	0.2371
Wind P	0.0000	0.1000	0.2000	0.0000	0.0000	0.0000	0.0000	0.2000	0.0000	0.2000
PV P	0.0000	0.1000	0.1000	0.1000	0.0000	0.0000	0.0000	0.1000	0.0000	0.2000
Vd1	1.0120	1.0000	1.0310	1.0100	1.0300	0.9914	0.9914	1.0310	1.0050	1.0030
Vd2	1.0300	1.0140	0.9963	1.0100	1.0270	1.0300	1.0300	0.9963	1.0070	1.0010
V 1	1.0080	0.9974	0.9902	0.9971	1.0100	1.0070	1.0070	0.9902	0.9958	0.9927
V 2	1.0020	0.9934	0.9902	0.9937	1.0050	1.0000	1.0000	0.9902	0.9930	0.9919
V 3	0.9980	0.9911	0.9917	0.9918	1.0020	0.9945	0.9945	0.9917	0.9916	0.9914
V 4	0.9971	0.9901	0.9906	0.9909	1.0010	0.9936	0.9936	0.9906	0.9902	0.9907
V 5	1.0020	0.9906	1.0120	0.9974	1.0160	0.9857	0.9857	1.0120	0.9950	0.9937
V 6	0.9994	0.9885	1.0070	0.9945	1.0120	0.9849	0.9849	1.0070	0.9928	0.9919
V 8	0.9840	0.9731	0.9835	0.9777	0.9934	0.9750	0.9750	0.9835	0.9827	0.9824
V 9	0.9848	0.9705	0.9801	0.9765	0.9960	0.9725	0.9725	0.9801	0.9777	0.9780
V 10	0.9837	0.9645	0.9769	0.9721	0.9962	0.9685	0.9685	0.9769	0.9745	0.9732
V 11	0.9825	0.9652	0.9768	0.9721	0.9955	0.9669	0.9669	0.9768	0.9741	0.9736
Training Cases	case 111	case 112		•	•	•	•			
Diesel 1 P	0.7200	1.1500								
Diesel 1 Q	0.4200	0.6824								
Diesel 2 P	0.6500	0.4000								
Diesel 2 Q	0.3800	0.2371								
Wind P	0.0000	0.1500								
PV P	0.0000	0.2000								
Vd1	1.0110	1.0300								
Vd2	1.0120	1.0070								
V 1	0.9984	0.9986								
V 2	0.9948	0.9961								
V 3	0.9928	0.9952								
V 4	0.9913	0.9945								
V 5	0.9996	1.0110								
V 6	0.9971	1.0070								
V 8	0.9856	0.9847								
V.O	0.9811	0.9840								
V 9										
V 9 V 10	0.9767	0.9783								

		-	-		_		_	0		10
Output Targets	case 1	case 2	case 3	case 4	case 5	case 6	case 7	case 8	case 9	case 10
Diesel 1 P	0.6500	0.8600	0.6500	0.5500	0.7000	0.9000	0.7500	0.7500	0.9200	0.8300
Diesel 1 Q	0.3856	0.5100	0.3856	0.3263	0.4154	0.5450	0.4450	0.4450	0.5500	0.4925
Diesel 2 P	0.6500	0.6500	0.6500	0.3000	0.6500	0.8000	0.5500	0.6500	0.8300	0.7500
Diesel 2 Q	0.3856	0.3856	0.3856	0.1800	0.3856	0.4742	0.3263	0.3856	0.5100	0.4450
S1	0.7558	0.9998	0.7558	0.6395	0.8140	1.0522	0.8721	0.8721	1.0719	0.9651
S2	0.7558	0.7558	0.7558	0.3499	0.7558	0.9300	0.6395	0.7558	0.9742	0.8721
PF1	0.8601	0.8601	0.8601	0.8600	0.8600	0.8554	0.8600	0.8600	0.8583	0.8600
PF2	0.8601	0.8601	0.8601	0.8575	0.8601	0.8602	0.8600	0.8601	0.8520	0.8600
Output Targets	case 11	case 12	case 13	case 14	case 15	case 16	case 17	case 18	case 19	case 20
Diesel 1 P	0.8200	0.8200	0.9000	0.9500	0.6500	0.9200	0.9200	0.9800	0.9500	0.9500
Diesel 1 Q	0.4866	0.4866	0.5340	0.5824	0.3856	0.5460	0.5460	0.5800	0.5600	0.5600
Diesel 2 P	0.7500	0.8200	0.8000	0.8000	0.5500	0.7500	0.7800	0.8000	0.8000	0.8000
Diesel 2 Q	0.4450	0.4866	0.4742	0.4742	0.3263	0.4450	0.4700	0.4742	0.4742	0.4742
S1	0.9535	0.9535	1.0465	1.1143	0.7558	1.0698	1.0698	1.1388	1.1028	1.1028
S2	0.8721	0.9535	0.9300	0.9300	0.6395	0.8721	0.9107	0.9300	0.9300	0.9300
PF1	0.8600	0.8600	0.8600	0.8525	0.8601	0.8600	0.8600	0.8606	0.8615	0.8615
PF2	0.8600	0.8600	0.8602	0.8602	0.8600	0.8600	0.8565	0.8602	0.8602	0.8602
Output Targets	case 21	case 22	case 23	case 24	case 25	case 26	case 27	case 28	case 29	case 30
Diesel 1 P	1.0200	0.6500	1.1000	0.4000	0.6300	0.5500	0.9500	0.9200	0.9500	0.6000
Diesel 1 Q	0.6100	0.3856	0.6800	0.2100	0.3900	0.3000	0.4800	0.4800	0.5500	0.3000
Diesel 2 P	0.9000	0.5500	0.8200	0.4500	0.6000	0.7000	0.7500	0.7500	0.6800	0.4800
Diesel 2 Q	0.5340	0.3263	0.4500	0.2500	0.3200	0.4000	0.4500	0.4500	0.4000	0.2800
S1	1.1885	0.7558	1.2932	0.4518	0.7409	0.6265	1.0644	1.0377	1.0977	0.6708
S2	1.0465	0.6395	0.9354	0.5148	0.6800	0.8062	0.8746	0.8746	0.7889	0.5557
PF1	0.8582	0.8601	0.8506	0.8854	0.8503	0.8779	0.8925	0.8866	0.8654	0.8944
PF2	0.8600	0.8600	0.8767	0.8742	0.8824	0.8682	0.8575	0.8575	0.8619	0.8638
Output Targets	case 31	case 32	case 33	case 34	case 35	case 36	case 37	case 38	case 39	case 40
Diesel 1 P	0.8600	0.9000	0.8400	0.7500	0.6800	0.7300	0.8200	0.6500	0.9000	0.9500
Diesel 1 Q	0.5000	0.5200	0.5000	0.3900	0.4000	0.4100	0.5000	0.3400	0.4600	0.5600
Diesel 2 P	0.8000	0.8500	0.8000	0.6400	0.6400	0.7500	0.6500	0.3900	0.6900	0.6500
Diesel 2 Q	0.4000	0.4500	0.4200	0.3200	0.3500	0.4500	0.3200	0.2200	0.3900	0.3800
S1	0.9948	1.0394	0.9775	0.8453	0.7889	0.8373	0.9604	0.7336	1.0107	1.1028
S2	0.8944	0.9618	0.9035	0.7155	0.7295	0.8746	0.7245	0.4478	0.7926	0.7529
PF1	0.8645	0.8659	0.8593	0.8872	0.8619	0.8719	0.8538	0.8861	0.8904	0.8615
	0.0045	0.0007	0.0072							

						1		1	1	
Output Targets	case 41	case 42	case 43	case 44	case 45	case 46	case 47	case 48	case 49	case 50
Diesel 1 P	0.8600	0.8000	0.7100	0.8200	0.9500	1.1000	0.9900	0.5600	0.6800	0.7300
Diesel 1 Q	0.4600	0.4400	0.3600	0.4300	0.5600	0.6200	0.5600	0.3100	0.3600	0.4300
Diesel 2 P	0.6800	0.6900	0.6000	0.8000	0.9500	0.8000	0.7600	0.5600	0.6400	0.7000
Diesel 2 Q	0.3800	0.3500	0.3100	0.4300	0.5000	0.4800	0.4300	0.3200	0.3400	0.4000
S1	0.9753	0.9130	0.7961	0.9259	1.1028	1.2627	1.1374	0.6401	0.7694	0.8472
S2	0.7790	0.7737	0.6754	0.9082	1.0735	0.9330	0.8732	0.6450	0.7247	0.8062
PF1	0.8818	0.8762	0.8919	0.8856	0.8615	0.8712	0.8704	0.8749	0.8838	0.8616
PF2	0.8729	0.8918	0.8884	0.8808	0.8849	0.8575	0.8703	0.8682	0.8831	0.8682
Output Targets	case 51	case 52	case 53	case 54	case 55	case 56	case 57	case 58	case 59	case 60
Diesel 1 P	0.7800	0.7500	0.8000	0.7500	0.8000	0.8300	0.6000	0.7500	0.7000	0.9300
Diesel 1 Q	0.4800	0.4600	0.4200	0.4300	0.4500	0.4500	0.3500	0.3800	0.3500	0.5000
Diesel 2 P	0.8000	0.6200	0.6500	0.6800	0.7000	0.6500	0.7800	0.7300	0.8000	0.9000
Diesel 2 Q	0.4800	0.3800	0.3500	0.3500	0.3500	0.3200	0.3800	0.3800	0.4000	0.4500
S1	0.9159	0.8798	0.9035	0.8645	0.9179	0.9441	0.6946	0.8408	0.7826	1.0559
S2	0.9330	0.7272	0.7382	0.7648	0.7826	0.7245	0.8676	0.8230	0.8944	1.0062
PF1	0.8517	0.8524	0.8854	0.8675	0.8716	0.8791	0.8638	0.8920	0.8944	0.8808
PF2	0.8575	0.8526	0.8805	0.8891	0.8944	0.8972	0.8990	0.8870	0.8944	0.8944
Output Targets	case 61	case 62	case 63	case 64	case 65	case 66	case 67	case 68	case 69	case 70
Diesel 1 P	0.4000	0.8200	0.7000	0.9000	0.9500	0.6500	0.9200	0.9200	0.9800	0.9500
Diesel 1 Q	0.2100	0.4500	0.4154	0.5340	0.5824	0.3856	0.5460	0.5460	0.5800	0.5600
Diesel 2 P	0.5000	0.7000	0.7200	0.8000	0.8000	0.5500	0.7500	0.7800	0.8000	0.8000
Diesel 2 Q	0.2500	0.4154	0.4250	0.4742	0.4742	0.3263	0.4450	0.4700	0.4742	0.4742
S1	0.4518	0.9354	0.8140	1.0465	1.1143	0.7558	1.0698	1.0698	1.1388	1.1028
S2	0.5590	0.8140	0.8361	0.9300	0.9300	0.6395	0.8721	0.9107	0.9300	0.9300
PF1	0.8854	0.8767	0.8600	0.8600	0.8525	0.8601	0.8600	0.8600	0.8606	0.8615
PF2	0.8944	0.8600	0.8612	0.8602	0.8602	0.8600	0.8600	0.8565	0.8602	0.8602
Output Targets	case 71	case 72	case 73	case 74	case 75	case 76	case 77	case 78	case 79	case 80
Diesel 1 P	0.9500	1.0200	0.6500	1.1000	0.6500	0.9200	0.9500	0.8000	0.9000	0.9700
Diesel 1 Q	0.5600	0.6100	0.3856	0.6800	0.3856	0.5500	0.5600	0.4742	0.5000	0.5000
Diesel 2 P	0.8000	0.9000	0.5500	0.8200	0.6500	0.8300	0.6500	0.7000	0.9000	0.8000
Diesel 2 Q	0.4742	0.5340	0.3263	0.4500	0.3856	0.5100	0.3800	0.4000	0.4500	0.4900
S1	1.1028	1.1885	0.7558	1.2932	0.7558	1.0719	1.1028	0.9300	1.0296	1.0913
S2	0.9300	1.0465	0.6395	0.9354	0.7558	0.9742	0.7529	0.8062	1.0062	0.9381
PF1	0.8615	0.8582	0.8601	0.8506	0.8601	0.8583	0.8615	0.8602	0.8742	0.8889
PF2	0.8602	0.8600	0.8600	0.8767	0.8601	0.8520	0.8633	0.8682	0.8944	0.8528

output target	case 81	case 82	case 83	case 84	case 85	case 86	case 87	case 88	case 89	case 90
Diesel 1 P	0.7800	0.6800	0.9600	0.8900	0.8000	0.8000	1.1000	1.0000	0.9500	0.8500
Diesel 1 Q	0.4600	0.3800	0.5000	0.4700	0.4700	0.4742	0.5400	0.6000	0.5500	0.4500
Diesel 2 P	0.7000	0.6000	0.7800	0.7500	0.6500	0.6500	0.7000	0.8000	0.6800	0.5000
Diesel 2 Q	0.4000	0.3400	0.4600	0.4450	0.3600	0.3600	0.4300	0.4600	0.3800	0.2800
S 1	0.9055	0.7790	1.0824	1.0065	0.9278	0.9300	1.2254	1.1662	1.0977	0.9618
S2	0.8062	0.6896	0.9055	0.8721	0.7430	0.7430	0.8215	0.9228	0.7790	0.5731
PF1	0.8614	0.8729	0.8869	0.8843	0.8622	0.8602	0.8977	0.8575	0.8654	0.8838
PF2	0.8682	0.8700	0.8614	0.8600	0.8748	0.8748	0.8521	0.8669	0.8729	0.8725
output target	case 91	case 92	case 93	case 94	case 95	case 96	case 97	case 98	case 99	case 100
Diesel 1 P	0.7500	0.8500	0.8500	0.7800	0.4000	0.6500	0.8900	0.8500	0.8800	0.8800
Diesel 1 Q	0.4400	0.4600	0.4700	0.4000	0.2200	0.3800	0.5500	0.5000	0.4800	0.5200
Diesel 2 P	0.5500	0.6500	0.6200	0.7200	0.6500	0.6500	0.8600	0.7800	0.7400	0.7500
Diesel 2 Q	0.3000	0.3800	0.3600	0.3800	0.3800	0.3800	0.5200	0.4400	0.4300	0.4600
S 1	0.8695	0.9665	0.9713	0.8766	0.4565	0.7529	1.0462	0.9862	1.0024	1.0222
S2	0.6265	0.7529	0.7169	0.8141	0.7529	0.7529	1.0050	0.8955	0.8559	0.8798
PF1	0.8625	0.8795	0.8751	0.8898	0.8762	0.8633	0.8507	0.8619	0.8779	0.8609
PF2	0.8779	0.8633	0.8648	0.8844	0.8633	0.8633	0.8557	0.8710	0.8646	0.8524
output target	case 101	case 102	case 103	case 104	case 105	case 106	case 107	case 108	case 109	case 110
Diesel 1 P	0.8500	0.9500	0.9500	0.9500	0.7800	0.9500	0.9500	0.9500	0.8800	0.7000
Diesel 1 Q	0.4500	0.5800	0.5700	0.5300	0.4500	0.5300	0.5300	0.5700	0.4800	0.4154
Diesel 2 P	0.8500	0.9000	0.9000	0.8200	0.7500	0.8800	0.8800	0.9000	0.7500	0.6500
Diesel 2 Q	0.4500	0.5500	0.5500	0.5000	0.4500	0.4700	0.4700	0.5500	0.4400	0.3856
S1	0.9618	1.1131	1.1079	1.0878	0.9005	1.0878	1.0878	1.1079	1.0024	0.8140
S2	0.9618	1.0548	1.0548	0.9604	0.8746	0.9976	0.9976	1.0548	0.8695	0.7558
PF1	0.8838	0.8535	0.8575	0.8733	0.8662	0.8733	0.8733	0.8575	0.8779	0.8600
PF2	0.8838	0.8533	0.8533	0.8538	0.8575	0.8821	0.8821	0.8533	0.8625	0.8601
output target	case 111	case 112								
Diesel 1 P	0.8600	0.9500								
Diesel 1 Q	0.4800	0.5824]							
Diesel 2 P	0.7500	0.8000								
			1							

Diesel 2 Q

S1

S2

PF1

PF2

0.4400

0.9849

0.8695

0.8732

0.8625

0.4742

1.1143

0.9300

0.8525

0.8602

APPENDIX C: Test Cases

		-	-	-		-	-			-
Test Cases	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10
Diesel 1 P	0.6000	1.2000	0.9800	1.2500	0.5000	1.2000	1.0000	0.4600	0.3200	1.3000
Diesel 1 Q	0.2500	0.7200	0.5824	0.7400	0.2800	0.6200	0.5800	0.2600	0.1900	0.7000
Diesel 2 P	0.4500	0.3000	0.2000	0.2500	0.6000	0.2200	0.8000	0.5500	1.0500	0.3000
Diesel 2 Q	0.1500	0.1800	0.1188	0.1300	0.3500	0.1200	0.5200	0.3000	0.6500	0.1600
Wind P	0.0000	0.0000	0.1000	0.1000	0.2000	0.1500	0.0000	0.0600	0.0500	0.0000
PV P	0.2000	0.0000	0.0600	0.2000	0.2000	0.0300	0.0000	0.1200	0.0100	0.0000
Vd1	0.9997	1.0370	1.0350	1.0280	0.9989	1.0270	1.0300	1.0040	1.0020	1.0310
Vd2	1.0010	1.0020	1.0040	0.9982	1.0080	0.9968	1.0270	1.0090	1.0370	0.9967
V 1	0.9939	0.9958	1.0000	0.9933	0.9953	0.9923	1.0100	0.9983	1.0150	0.9907
V 2	0.9931	0.9953	0.9993	0.9921	0.9934	0.9919	1.0040	0.9956	1.0070	0.9903
V 3	0.9930	0.9962	0.9997	0.9925	0.9921	0.9928	1.0010	0.9942	1.0000	0.9914
V 4	0.9931	0.9960	0.9996	0.9915	0.9923	0.9917	0.9994	0.9934	0.9994	0.9899
V 5	0.9917	1.0180	1.0200	1.0080	0.9909	1.0100	1.0140	0.9961	0.9966	1.0120
V 6	0.9896	1.0130	1.0160	1.0030	0.9895	1.0060	1.0100	0.9943	0.9953	1.0070
V 8	0.9865	0.9870	1.0010	0.9862	0.9787	0.9876	0.9944	0.9842	0.9869	0.9869
V 9	0.9796	0.9915	0.9986	0.9821	0.9747	0.9829	0.9916	0.9808	0.9819	0.9824
V 10	0.9752	0.9873	0.9958	0.9770	0.9695	0.9778	0.9869	0.9761	0.9744	0.9780
V 11	0.9751	0.9872	0.9957	0.9769	0.9694	0.9773	0.9862	0.9766	0.9760	0.9770
Test Cases	case11	case12	case13	case 14	case 15	case 16				
Diesel 1 P	0.5000	0.9800	0.6300	0.8500	0.6500	0.4200				
Diesel 1 Q	0.2800	0.5600	0.3400	0.5000	0.3500	0.2500				
Diesel 2 P	1.1000	1.1000	0.6500	0.3000	0.6500	0.8500				
Diesel 2 Q	0.6100	0.6000	0.3500	0.1600	0.3500	0.5000				
Wind P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
PV P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
Vd1	1.0010	1.0320	1.0030	1.0130	1.0130	1.0030				
Vd2	1.0280	1.0350	1.0090	1.0040	1.0220	1.0300				
V 1	1.0070	1.0140	0.9956	0.9977	1.0090	1.0130				
V 2	1.0010	1.0080	0.9936	0.9956	1.0040	1.0070				
V 3	0.9965	1.0040	0.9924	0.9937	0.9999	1.0000				
V 4	0.9962	1.0040	0.9919	0.9933	0.9997	1.0000				
V 5	0.9930	1.0160	0.9933	0.9994	1.0030	0.9965				
V 6	0.9916	1.0130	0.9914	0.9963	0.9999	0.9947				
V 8	0.9817	0.9968	0.9774	0.9754	0.9803	0.9776				
V 9	0.9774	0.9924	0.9774	0.9762	0.9807	0.9780				
V 10	0.9719	0.9871	0.9730	0.9705	0.9753	0.9726	1			
V 11	0.9719	0.9871	0.9754	0.9696	0.9745	0.9718				

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Results	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10
Diesel 1 P	0.6292	0.8597	0.6845	1.0831	0.8619	0.9350	0.9295	0.6785	0.6922	1.0800
Diesel 1 Q	0.3760	0.4789	0.3366	0.6143	0.4578	0.5270	0.5313	0.3626	0.3807	0.5792
Diesel 2 P	0.6820	0.8103	0.5286	0.7625	0.6797	0.8027	0.7837	0.6574	0.6833	0.8557
Diesel 2 Q	0.3586	0.4619	0.2915	0.4604	0.4019	0.4720	0.4395	0.3607	0.3507	0.5009
Wind P	0.0000	0.0000	0.1000	0.1000	0.2000	0.1500	0.0000	0.0600	0.0500	0.0000
PV P	0.2000	0.0000	0.0600	0.2000	0.2000	0.0300	0.0000	0.1200	0.0100	0.0000
Vd1	1.0150	1.0200	1.0160	1.0240	1.0210	1.0250	1.0230	1.0180	1.0200	1.0260
Vd2	1.0190	1.0220	1.0150	1.0240	1.0170	1.0250	1.0210	1.0180	1.0210	1.0230
V 1	1.0060	1.0060	1.0040	1.0080	1.0030	1.0080	1.0060	1.0050	1.0080	1.0060
V 2	1.0030	1.0010	1.0010	1.0020	1.0010	1.0030	1.0010	1.0010	1.0030	1.0010
V 3	1.0000	0.9982	0.9990	0.9984	0.9987	0.9995	0.9977	0.9990	1.0000	0.9973
V 4	1.0010	0.9979	0.9988	0.9974	0.9988	0.9982	0.9967	0.9982	0.9991	0.9956
V 5	1.0040	1.0070	1.0060	1.0070	1.0080	1.0100	1.0090	1.0070	1.0090	1.0110
V 6	1.0010	1.0040	1.0050	1.0030	1.0060	1.0070	1.0050	1.0050	1.0060	1.0070
V 8	0.9963	0.9832	0.9941	0.9892	0.9906	0.9914	0.9904	0.9920	0.9933	0.9895
V 9	0.9896	0.9876	0.9922	0.9853	0.9866	0.9869	0.9876	0.9886	0.9894	0.9853
V 10	0.9854	0.9833	0.9892	0.9803	0.9816	0.9819	0.9830	0.9840	0.9847	0.9809
V 11	0.9852	0.9833	0.9892	0.9802	0.9815	0.9814	0.9821	0.9845	0.9840	0.9798
Results	case11	case12	case13	case 14	case 15	case 16				
Diesel 1 P	0.9130	0.9185	0.8736	0.9749	0.8097	0.7887				
Diesel 1 Q	0.5305	0.5019	0.4653	0.5587	0.4731	0.4947				
Diesel 2 P	0.8839	0.8110	0.7633	0.6803	0.6592	0.6142				
Diesel 2 Q	0.4909	0.4464	0.4371	0.3977	0.3887	0.3664				
Wind P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
PV P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
Vd1	1.0250	1.0220	1.0200	1.0260	1.0260	1.0260				
Vd2	1.0250	1.0200	1.0190	1.0260	1.0260	1.0250				
V 1	1.0070	1.0040	1.0040	1.0120	1.0130	1.0120				
V 2	1.0030	1.0010	1.0000	1.0070	1.0080	1.0080				
V 3	1.0000	0.9985	0.9980	1.0020	1.0040	1.0030				
V 4	0.9998	0.9982	0.9978	1.0010	1.0030	1.0030				
V 5	1.0110	1.0080	1.0060	1.0110	1.0130	1.0130				
V 6	1.0080	1.0050	1.0030	1.0070	1.0090	1.0090				
V 8	0.9920	0.9900	0.9869	0.9851	0.9870	0.9870				
V 9	0.9879	0.9856	0.9868	0.9859	0.9874	0.9875				
V 10	0.9823	0.9803	0.9825	0.9803	0.9820	0.9819				
V 11	0.9823	0.9802	0.9848	0.9796	0.9813	0.9812				

APPENDIX D: First Scenario Results

Results	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10
Diesel 1 P	0.6727	0.9427	0.7178	1.0371	0.8400	0.9407	0.8593	0.6748	0.8289	1.0378
Diesel 1 Q	0.3575	0.5270	0.3687	0.6134	0.4849	0.5206	0.4937	0.3815	0.4587	0.5780
Diesel 2 P	0.7270	0.7913	0.4751	0.7301	0.7631	0.8300	0.8432	0.6878	0.6146	0.7994
Diesel 2 Q	0.3684	0.4671	0.2756	0.4295	0.4435	0.4780	0.4942	0.3813	0.3482	0.4724
Wind P	0.0000	0.0000	0.1000	0.1000	0.2000	0.1500	0.0000	0.0600	0.0500	0.0000
PV P	0.2000	0.0000	0.0600	0.2000	0.2000	0.0300	0.0000	0.1200	0.0100	0.0000
Vd1	1.0150	1.0260	1.0190	1.0230	1.0240	1.0250	1.0200	1.0190	1.0260	1.0260
Vd2	1.0210	1.0230	1.0140	1.0210	1.0220	1.0250	1.0240	1.0200	1.0210	1.0200
V 1	1.0070	1.0070	1.0040	1.0060	1.0060	1.0080	1.0070	1.0060	1.0090	1.0040
V 2	1.0040	1.0020	1.0010	1.0010	1.0030	1.0030	1.0020	1.0020	1.0050	0.9995
V 3	1.0010	0.9995	0.9991	0.9972	1.0000	0.9996	0.9980	0.9998	1.0020	0.9963
V 4	1.0010	0.9992	0.9990	0.9963	1.0000	0.9985	0.9969	0.9990	1.0010	0.9948
V 5	1.0040	1.0110	1.0080	1.0060	1.0110	1.0100	1.0060	1.0090	1.0150	1.0100
V 6	1.0020	1.0080	1.0060	1.0020	1.0080	1.0070	1.0040	1.0060	1.0110	1.0060
V 8	0.9965	0.9857	0.9951	0.9880	0.9925	0.9916	0.9896	0.9932	0.9970	0.9886
V 9	0.9898	0.9901	0.9930	0.9839	0.9885	0.9870	0.9868	0.9898	0.9931	0.9840
V 10	0.9856	0.9860	0.9902	0.9790	0.9836	0.9819	0.9819	0.9851	0.9882	0.9797
V 11	0.9854	0.9858	0.9903	0.9788	0.9834	0.9816	0.9810	0.9857	0.9877	0.9785
Results	case11	case12	case13	case 14	case 15	case 16				
Diesel 1 P	0.9097	0.8768	0.8712	1.0249	0.8241	0.8679				
Diesel 1 Q	0.5148	0.5054	0.4706	0.5866	0.4802	0.4959				
Diesel 2 P	0.8330	0.9032	0.7628	0.6001	0.5766	0.5623				
Diesel 2 Q	0.4597	0.4727	0.4334	0.3315	0.3214	0.3299				
Wind P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
PV P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
Vd1	1.0230	1.0220	1.0200	1.0260	1.0250	1.0260				
Vd2	1.0220	1.0230	1.0190	1.0210	1.0220	1.0230				
V 1	1.0050	1.0060	1.0030	1.0090	1.0110	1.0110				
V 2	1.0020	1.0020	1.0000	1.0050	1.0070	1.0070				
V 3	0.9991	0.9992	0.9980	1.0010	1.0020	1.0030				
V 4	0.9989	0.9990	0.9979	1.0000	1.0020	1.0030				
V 5	1.0090	1.0090	1.0070	1.0110	1.0120	1.0130	1			
V 6	1.0060	1.0050	1.0040	1.0080	1.0080	1.0090	1			
V 8	0.9906	0.9905	0.9870	0.9850	0.9860	0.9870	1			
V 9	0.9866	0.9863	0.9869	0.9857	0.9864	0.9873	1			
V 10	0.9809	0.9808	0.9826	0.9802	0.9810	0.9818	1			
V 11	0.9810	0.9808	0.9849	0.9793	0.9802	0.9810				

APPENDIX E: Second Scenario Results

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Results	case 1	case 2	case 3	case 4	case 5	case 6	case 7	case 8	case 9	case 10
Diesel 1 P	0.6763	0.9424	0.6470	1.0042	0.7708	0.9094	0.8972	0.6464	0.7295	0.9627
Diesel 1 Q	0.3641	0.5333	0.3577	0.5875	0.4474	0.5264	0.5209	0.3576	0.4206	0.5551
Diesel 2 P	0.6102	0.7256	0.5880	0.7224	0.7853	0.8274	0.8319	0.6979	0.7469	0.8396
Diesel 2 Q	0.3267	0.4405	0.3192	0.4429	0.4465	0.4687	0.4791	0.3800	0.3969	0.5047
Wind P	0.0000	0.0000	0.1000	0.1000	0.2000	0.1500	0.0000	0.0600	0.0500	0.0000
PV P	0.2000	0.0000	0.0600	0.2000	0.2000	0.0300	0.0000	0.1200	0.0100	0.0000
Vd1	1.0140	1.0250	1.0180	1.0200	1.0200	1.0240	1.0230	1.0170	1.0240	1.0230
Vd2	1.0160	1.0200	1.0180	1.0210	1.0210	1.0250	1.0240	1.0190	1.0250	1.0220
V 1	1.0040	1.0050	1.0060	1.0060	1.0050	1.0080	1.0070	1.0050	1.0110	1.0050
V 2	1.0020	1.0010	1.0020	1.0000	1.0020	1.0030	1.0020	1.0020	1.0060	0.9999
V 3	0.9996	0.9988	1.0000	0.9969	0.9994	0.9994	0.9984	0.9993	1.0020	0.9962
V 4	0.9996	0.9985	0.9998	0.9960	0.9994	0.9981	0.9971	0.9984	1.0010	0.9948
V 5	1.0030	1.0100	1.0080	1.0040	1.0080	1.0100	1.0090	1.0070	1.0130	1.0080
V 6	1.0010	1.0070	1.0060	1.0000	1.0050	1.0070	1.0050	1.0040	1.0100	1.0050
V 8	0.9955	0.9852	0.9953	0.9869	0.9905	0.9913	0.9906	0.9920	0.9961	0.9877
V 9	0.9888	0.9896	0.9933	0.9831	0.9868	0.9868	0.9876	0.9887	0.9922	0.9833
V 10	0.9845	0.9852	0.9904	0.9780	0.9817	0.9816	0.9829	0.9840	0.9874	0.9790
V 11	0.9843	0.9851	0.9905	0.9778	0.9816	0.9814	0.9824	0.9845	0.9868	0.9780
Results	case 11	case 12	case 13	case 14	case 15	case 16		I		•
Diesel 1 P	0.8872	0.9061	0.8841	0.9731	0.7847	0.7813				
Diesel 1 Q	0.5188	0.5391	0.4948	0.5474	0.4533	0.4538				
Diesel 2 P	0.8841	0.7925	0.7359	0.6452	0.6852	0.6977				
Diesel 2 Q	0.4937	0.4732	0.4243	0.3663	0.3537	0.3620				
Wind P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
PV P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
Vd1	1.0240	1.0250	1.0220	1.0240	1.0230	1.0230				
Vd2	1.0250	1.0220	1.0180	1.0230	1.0250	1.0260				
V 1	1.0070	1.0060	1.0030	1.0100	1.0120	1.0120				
V 2	1.0030	1.0020	1.0000	1.0050	1.0070	1.0070				
V 3	0.9999	0.9995	0.9981	1.0010	1.0030	1.0030				
V 4	0.9995	0.9992	0.9979	1.0000	1.0020	1.0030				
V 5	1.0100	1.0110	1.0080	1.0090	1.0100	1.0110				
V 6	1.0070	1.0070	1.0050	1.0060	1.0070	1.0070				
V 8	0.9915	0.9915	0.9877	0.9840	0.9856	0.9857				
V 9	0.9872	0.9874	0.9876	0.9848	0.9860	0.9862				
V 10	0.9816	0.9819	0.9833	0.9792	0.9804	0.9807				
V 11	0.9817	0.9819	0.9856	0.9783	0.9797	0.9799				
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APPENDIX F: Third Scenario Results

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Results	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10
Diesel 1 P	0.6727	0.9427	0.7178	1.0371	0.8400	0.9407	0.8593	0.6748	0.8289	1.0378
Diesel 1 Q	0.3575	0.5270	0.3687	0.6134	0.4849	0.5206	0.4937	0.3815	0.4587	0.5780
Diesel 2 P	0.7270	0.7913	0.4751	0.7301	0.7631	0.8300	0.8432	0.6878	0.6146	0.7994
Diesel 2 Q	0.3684	0.4671	0.2756	0.4295	0.4435	0.4780	0.4942	0.3813	0.3482	0.4724
Wind P	0.0000	0.0000	0.1000	0.1000	0.2000	0.1500	0.0000	0.0600	0.0500	0.0000
PV P	0.2000	0.0000	0.0600	0.2000	0.2000	0.0300	0.0000	0.1200	0.0100	0.0000
Vd1	1.0150	1.0260	1.0190	1.0230	1.0240	1.0250	1.0200	1.0190	1.0260	1.0260
Vd2	1.0210	1.0230	1.0140	1.0210	1.0220	1.0250	1.0240	1.0200	1.0210	1.0200
V 1	1.0070	1.0070	1.0040	1.0060	1.0060	1.0080	1.0070	1.0060	1.0090	1.0040
V 2	1.0040	1.0020	1.0010	1.0010	1.0030	1.0030	1.0020	1.0020	1.0050	0.9995
V 3	1.0010	0.9995	0.9991	0.9972	1.0000	0.9996	0.9980	0.9998	1.0020	0.9963
V 4	1.0010	0.9992	0.9990	0.9963	1.0000	0.9985	0.9969	0.9990	1.0010	0.9948
V 5	1.0040	1.0110	1.0080	1.0060	1.0110	1.0100	1.0060	1.0090	1.0150	1.0100
V 6	1.0020	1.0080	1.0060	1.0020	1.0080	1.0070	1.0040	1.0060	1.0110	1.0060
V 8	0.9965	0.9857	0.9951	0.9880	0.9925	0.9916	0.9896	0.9932	0.9970	0.9886
V 9	0.9898	0.9901	0.9930	0.9839	0.9885	0.9870	0.9868	0.9898	0.9931	0.9840
V 10	0.9856	0.9860	0.9902	0.9790	0.9836	0.9819	0.9819	0.9851	0.9882	0.9797
V 11	0.9854	0.9858	0.9903	0.9788	0.9834	0.9816	0.9810	0.9857	0.9877	0.9785
Results	case11	case12	case13	case 14	case 15	case 16				
Diesel 1 P	0.9097	0.8768	0.8712	1.0249	0.8241	0.8679				
Diesel 1 Q	0.5148	0.5054	0.4706	0.5866	0.4802	0.4959				
Diesel 2 P	0.8330	0.9032	0.7628	0.6001	0.5766	0.5623				
Diesel 2 Q	0.4597	0.4727	0.4334	0.3315	0.3214	0.3299				
Wind P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
PV P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
Vd1	1.0230	1.0220	1.0200	1.0260	1.0250	1.0260				
Vd2	1.0220	1.0230	1.0190	1.0210	1.0220	1.0230				
V 1	1.0050	1.0060	1.0030	1.0090	1.0110	1.0110				
V 2	1.0020	1.0020	1.0000	1.0050	1.0070	1.0070				
V 3	0.9991	0.9992	0.9980	1.0010	1.0020	1.0030				
V 4	0.9989	0.9990	0.9979	1.0000	1.0020	1.0030				
V 5	1.0090	1.0090	1.0070	1.0110	1.0120	1.0130				
V 6	1.0060	1.0050	1.0040	1.0080	1.0080	1.0090				
V 8	0.9906	0.9905	0.9870	0.9850	0.9860	0.9870				
V 9	0.9866	0.9863	0.9869	0.9857	0.9864	0.9873				
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V 10	0.9809	0.9808	0.9826	0.9802	0.9810	0.9818				

APPENDIX G: Fourth Scenario Results

Results	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10
Diesel 1 P	0.7290	0.8354	0.6210	1.0332	0.7856	0.9142	0.9285	0.6725	0.6679	1.0646
Diesel 1 Q	0.4070	0.4833	0.3513	0.6138	0.4524	0.5323	0.5332	0.3764	0.4032	0.6174
Diesel 2 P	0.6444	0.7936	0.5525	0.7855	0.7267	0.8179	0.8378	0.6536	0.6628	0.8175
Diesel 2 Q	0.3627	0.4566	0.3048	0.4648	0.4156	0.4683	0.4828	0.3666	0.3823	0.4785
Wind P	0.0000	0.0000	0.1000	0.1000	0.2000	0.1500	0.0000	0.0600	0.0500	0.0000
PV P	0.2000	0.0000	0.0600	0.2000	0.2000	0.0300	0.0000	0.1200	0.0100	0.0000
Vd1	1.0190	1.0200	1.0160	1.0230	1.0200	1.0240	1.0240	1.0180	1.0210	1.0290
Vd2	1.0200	1.0210	1.0160	1.0240	1.0180	1.0240	1.0250	1.0180	1.0220	1.0220
V 1	1.0070	1.0050	1.0050	1.0080	1.0040	1.0080	1.0080	1.0050	1.0090	1.0050
V 2	1.0040	1.0010	1.0010	1.0020	1.0010	1.0030	1.0030	1.0010	1.0040	1.0010
V 3	1.0010	0.9980	0.9993	0.9981	0.9988	0.9993	0.9989	0.9992	1.0010	0.9974
V 4	1.0010	0.9977	0.9991	0.9971	0.9989	0.9982	0.9977	0.9985	0.9999	0.9957
V 5	1.0070	1.0070	1.0070	1.0060	1.0070	1.0100	1.0100	1.0080	1.0100	1.0130
V 6	1.0040	1.0040	1.0050	1.0020	1.0050	1.0070	1.0070	1.0050	1.0070	1.0080
V 8	0.9983	0.9829	0.9944	0.9886	0.9901	0.9914	0.9914	0.9925	0.9943	0.9903
V 9	0.9916	0.9874	0.9923	0.9847	0.9862	0.9867	0.9887	0.9893	0.9904	0.9859
V 10	0.9874	0.9831	0.9895	0.9796	0.9812	0.9817	0.9840	0.9846	0.9857	0.9815
V 11	0.9872	0.9829	0.9896	0.9795	0.9811	0.9814	0.9833	0.9850	0.9850	0.9805
Results	case11	case12	case13	case 14	case 15	case 16				
Diesel 1 P	0.8931	0.8945	0.8053	0.9545	0.7188	0.7193				
Diesel 1 Q	0.5065	0.5058	0.4529	0.5560	0.4230	0.4309				
Diesel 2 P	0.7950	0.8119	0.7274	0.6398	0.5657	0.5842				
Diesel 2 Q	0.4551	0.4639	0.4126	0.3731	0.3244	0.3379				
Wind P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
PV P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
Vd1	1.0220	1.0220	1.0170	1.0250	1.0180	1.0190				
Vd2	1.0210	1.0210	1.0160	1.0230	1.0200	1.0220				
V 1	1.0040	1.0050	1.0020	1.0100	1.0090	1.0100				
V 2	1.0010	1.0010	0.9989	1.0050	1.0050	1.0050				
V 3	0.9984	0.9988	0.9970	1.0010	1.0010	1.0010				
V 4	0.9983	0.9985	0.9966	1.0000	1.0000	1.0010				
V 5	1.0080	1.0080	1.0040	1.0100	1.0070	1.0080				
V 6	1.0050	1.0050	1.0010	1.0060	1.0040	1.0040				
V 8	0.9899	0.9903	0.9851	0.9841	0.9828	0.9833				
V 9	0.9859	0.9860	0.9851	0.9850	0.9832	0.9837				
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V 10	0.9803	0.9805	0.9807	0.9793	0.9777	0.9785				

APPENDIX H: Fifth Scenario Results

Results	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10
Diesel 1 P	0.7155	0.9171	0.6556	1.0170	0.7722	0.9285	0.9062	0.6636	0.6594	0.9623
Diesel 1 Q	0.3820	0.5140	0.3542	0.5975	0.4421	0.5219	0.5269	0.3577	0.3969	0.5648
Diesel 2 P	0.6657	0.8038	0.5578	0.7699	0.7244	0.8142	0.8344	0.6522	0.6041	0.8315
Diesel 2 Q	0.3264	0.4559	0.3120	0.4660	0.4102	0.4542	0.4834	0.3461	0.3653	0.4994
Wind P	0.0000	0.0000	0.1000	0.1000	0.2000	0.1500	0.0000	0.0600	0.0500	0.0000
PV P	0.2000	0.0000	0.0600	0.2000	0.2000	0.0300	0.0000	0.1200	0.0100	0.0000
Vd1	1.0160	1.0240	1.0180	1.0220	1.0190	1.0240	1.0230	1.0170	1.0200	1.0240
Vd2	1.0180	1.0220	1.0170	1.0230	1.0180	1.0240	1.0240	1.0170	1.0200	1.0220
V 1	1.0050	1.0060	1.0050	1.0070	1.0030	1.0070	1.0070	1.0040	1.0070	1.0040
V 2	1.0030	1.0020	1.0020	1.0020	1.0000	1.0030	1.0020	1.0000	1.0030	0.9999
V 3	1.0000	0.9990	0.9997	0.9978	0.9984	0.9990	0.9986	0.9985	1.0000	0.9964
V 4	1.0000	0.9987	0.9994	0.9968	0.9985	0.9979	0.9975	0.9978	0.9991	0.9947
V 5	1.0050	1.0100	1.0080	1.0050	1.0060	1.0100	1.0090	1.0060	1.0090	1.0090
V 6	1.0020	1.0070	1.0060	1.0020	1.0040	1.0060	1.0060	1.0040	1.0060	1.0050
V 8	0.9967	0.9848	0.9949	0.9880	0.9895	0.9910	0.9911	0.9914	0.9933	0.9878
V 9	0.9901	0.9892	0.9930	0.9840	0.9855	0.9864	0.9883	0.9880	0.9894	0.9836
V 10	0.9858	0.9851	0.9901	0.9790	0.9805	0.9814	0.9835	0.9834	0.9848	0.9791
V 11	0.9856	0.9850	0.9901	0.9789	0.9804	0.9809	0.9828	0.9838	0.9841	0.9781
Results	case11	case12	case13	case 14	case 15	case 16				
Diesel 1 P	0.8539	0.7890	0.8534	0.9484	0.6774	0.6665				
Diesel 1 Q	0.5004	0.4850	0.4805	0.5272	0.3956	0.4071				
Diesel 2 P	0.8254	0.8714	0.7848	0.5994	0.4832	0.4580				
Diesel 2 Q	0.4858	0.5067	0.4475	0.3353	0.2752	0.2777				
Wind P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
PV P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
Vd1	1.0220	1.0200	1.0210	1.0220	1.0140	1.0150				
Vd2	1.0230	1.0240	1.0200	1.0200	1.0160	1.0150				
V 1	1.0060	1.0060	1.0040	1.0080	1.0060	1.0060				
V 2	1.0020	1.0020	1.0010	1.0040	1.0020	1.0020				
V 3	0.9989	0.9989	0.9985	0.9993	0.9986	0.9988				
V 4	0.9986	0.9988	0.9982	0.9991	0.9986	0.9985				
V 5	1.0080	1.0060	1.0070	1.0070	1.0030	1.0040				
V 6	1.0050	1.0040	1.0040	1.0040	1.0000	1.0010				
V 8	0.9901	0.9895	0.9875	0.9822	0.9801	0.9803				
V 9	0.9857	0.9852	0.9874	0.9830	0.9805	0.9806				
V 10	0.9802	0.9796	0.9831	0.9774	0.9750	0.9752				
V 11	0.9804	0.9798	0.9855	0.9766	0.9742	0.9744				

APPENDIX I: Sixth Scenario Results

ResultsCase1Case2Case3Case4Case 5Case 6Case 7Case 8Case 9Case 1Dicsel 1P0.72820.80700.8331.0130.78180.0130.7110.78130.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7810.7				-	n	-				•	
Diesel 1 Q 0.3930 0.5155 0.3481 0.6020 0.4415 0.5375 0.5260 0.3540 0.4173 0.6107 Diesel 2 P 0.6473 0.7556 0.6204 0.8735 0.7088 0.7786 0.8990 0.6833 0.6462 0.6930 Diesel 2 Q 0.3462 0.4399 0.5383 0.5139 0.3985 0.4599 0.5071 0.3735 0.3494 0.4120 Wind P 0.0000 0.0000 0.0000 0.2000 0.1000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1.0201 1.0210 1.0210 1.0210 1.0210 1.0010 1.0230 1.0010 1.0030 1.0001 1.0030 1.0010 1.0030 1.0010 1.0030 1.0010 1.0030 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 <td>Results</td> <td>Case 1</td> <td>Case 2</td> <td>Case 3</td> <td>Case 4</td> <td>Case 5</td> <td>Case 6</td> <td>Case 7</td> <td>Case 8</td> <td>Case 9</td> <td>Case 10</td>	Results	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10
Diesel 2 P 0.6473 0.7556 0.6204 0.8735 0.7083 0.7786 0.8990 0.6833 0.6462 0.6930 Diesel 2 Q 0.3462 0.4399 0.3583 0.5139 0.3985 0.4599 0.5071 0.3735 0.3494 0.4120 Wind P 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1.0240 1.0050 1.0070 1.0024 1.0050 1.0010 0.9973 1.0010 1.0010 1.0010 0.9975 0.9981 1.0030 0.9975 0.9981 1.0030 0.9981 0.9991 1.0010 0.9983 0.9914 0.9991 1.0010 0.9882 <td>Diesel 1 P</td> <td>0.7282</td> <td>0.8907</td> <td>0.5832</td> <td>1.0173</td> <td>0.7818</td> <td>0.9139</td> <td>0.9112</td> <td>0.6349</td> <td>0.7665</td> <td>1.0680</td>	Diesel 1 P	0.7282	0.8907	0.5832	1.0173	0.7818	0.9139	0.9112	0.6349	0.7665	1.0680
Diesel 2 Q0.34620.43990.35830.51390.39850.45990.50710.37350.34940.4120Wind P0.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.00000.0000<	Diesel 1 Q	0.3930	0.5155	0.3481	0.6020	0.4415	0.5375	0.5260	0.3540	0.4173	0.6107
Wind P 0.0000 0.0000 0.1000 0.1000 0.1000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1.0020 1.0210 1.0240 1.0100 1.0200 1.0210 1.0200 1.0210 1.0200 1.0210 1.0200 1.0210 1.0200 1.0210 1.0200 1.0210 1.0010 1.0210 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010<	Diesel 2 P	0.6473	0.7556	0.6204	0.8735	0.7083	0.7786	0.8990	0.6833	0.6462	0.6930
PVP0.20000.00000.00001.02001.02001.03001.02001.02001.02001.02001.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.02101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.0010 </td <td>Diesel 2 Q</td> <td>0.3462</td> <td>0.4399</td> <td>0.3583</td> <td>0.5139</td> <td>0.3985</td> <td>0.4599</td> <td>0.5071</td> <td>0.3735</td> <td>0.3494</td> <td>0.4120</td>	Diesel 2 Q	0.3462	0.4399	0.3583	0.5139	0.3985	0.4599	0.5071	0.3735	0.3494	0.4120
Vali1.01801.02301.01701.02301.01901.02401.01601.02401.01601.02401.0160Vd21.01001.00001.00301.00301.00301.00301.00301.00301.00401.00301.00401.00101.00301.00401.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00100.9978V 31.00100.99831.00000.99920.99810.99910.99840.99811.00101.00100.9953V 41.00100.99801.00001.00701.00701.00701.00701.00701.00101.00101.00100.9933V 51.00601.09911.00701.00701.00701.00701.00701.00701.00101.01001.01000.9833V 61.00301.00601.00301.00301.00401.00101.00401.01101.00401.01101.0010V 61.00301.00601.00301.00301.00401.00101.00101.00100.98330.98140.99171.01100.9825V 700.99680.98410.99110.98550.98550.98550.98660.98110.98440.99790.9773V 110.98640.98410.99030.98040.89040.84730.98310.98440.99790.9784Diesel 1 P0.97721.04130.5530.986	Wind P	0.0000	0.0000	0.1000	0.1000	0.2000	0.1500	0.0000	0.0600	0.0500	0.0000
Vd2 1.0190 1.0210 1.0200 1.0280 1.0170 1.0240 1.0280 1.0170 V1 1.0060 1.0050 1.0070 1.0100 1.0030 1.0080 1.0090 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 1.0010 0.9983 0.9981 0.9995 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9983 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9983 0.9983 0.9981 0.9984 0.9981 0.9983 0.9911 0.9060 0.9983 0.9911 0.9070 0.9885 0.9811 0.9920 0.9111 0.010 0.9883 0.9911 0.9884 0.9911 0.9883 0.9813 0.9884 0.9981 0.9884 0.9911 0.9884 0.9911 0.9884 0.9911 0.9814 0.9921	PV P	0.2000	0.0000	0.0600	0.2000	0.2000	0.0300	0.0000	0.1200	0.0100	0.0000
V11.00601.00501.00701.01001.00301.00801.00901.00501.01001.0010V21.00301.00100.0031.00000.09920.99810.99910.99950.99891.00000.9978V31.00100.99831.00000.99830.99830.99810.99940.99940.99811.00000.9938V51.00601.00901.00701.00701.00601.01001.01001.00601.01001.01001.01001.01001.01001.01001.01001.01001.01001.01000.98380.93830.93840.99131.00401.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00601.01011.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.00101.0010 <td>Vd1</td> <td>1.0180</td> <td>1.0230</td> <td>1.0170</td> <td>1.0230</td> <td>1.0190</td> <td>1.0250</td> <td>1.0240</td> <td>1.0160</td> <td>1.0290</td> <td>1.0270</td>	Vd1	1.0180	1.0230	1.0170	1.0230	1.0190	1.0250	1.0240	1.0160	1.0290	1.0270
V21.00301.00101.00301.00001.00301.00401.00101.00700.9978V31.00100.99831.00000.9920.99810.99910.99950.99891.00400.9954V41.00100.99801.00000.99830.99830.99810.99840.99840.99811.00300.9383V51.00601.00001.00701.00701.00701.00701.00701.00401.01001.01001.01001.01000.98830.99310.98830.99140.99200.99171.00100.9882V50.99080.98850.99310.98550.98550.98660.98910.98840.99980.9840V100.98670.98440.99010.98070.98020.98130.98380.98440.99790.9777V110.98640.98410.99030.98050.98020.98130.98380.98440.99790.9787Resultscase11case12case13case15case16case16case170.47710.4577Diesel 1 P0.97721.04130.85630.98040.83060.84730.30840.30840.3084Oisel 2 Q0.47100.40980.44470.42900.31700.30840.5550Diesel 2 Q0.47100.40980.40000.00000.00000.0000V111.00301.02001.02201.02101.0210V411.0300 </td <td>Vd2</td> <td>1.0190</td> <td>1.0210</td> <td>1.0200</td> <td>1.0280</td> <td>1.0170</td> <td>1.0240</td> <td>1.0270</td> <td>1.0180</td> <td>1.0240</td> <td>1.0160</td>	Vd2	1.0190	1.0210	1.0200	1.0280	1.0170	1.0240	1.0270	1.0180	1.0240	1.0160
V31.00100.99831.00000.99920.99810.99910.99950.99841.00400.9954V41.00100.99801.00000.99830.99830.99810.99840.99811.00300.9383V51.00601.00001.00701.00701.00701.00701.00701.00701.00401.0100V61.00301.00601.00501.00301.00401.00701.00701.00401.01000.9883V90.99880.99850.99810.98850.98950.98650.98660.98910.98840.99980.9884V100.98670.98440.99010.98070.98020.98130.98380.98440.99790.9777V110.98640.98410.99030.98050.98020.98130.98380.98440.99790.9777V110.96630.58110.49210.57290.47110.45770.58130.98710.57290.47110.4577Diesel 1 P0.97721.04130.85630.98040.80000.00000.00000.00000.0000Diesel 2 Q0.47100.40980.44470.42900.31700.30840.5503Diesel 2 Q0.47100.40980.40000.00000.00000.0000V111.00201.02201.02201.02201.02201.0210V411.00301.00001.00001.00101.0100V111.00	V 1	1.0060	1.0050	1.0070	1.0100	1.0030	1.0080	1.0090	1.0050	1.0110	1.0010
V41.00100.99801.00000.99830.99830.99810.99840.99811.00300.9938V51.00601.00001.00701.00701.00601.01001.01001.00601.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01001.01000.98820.99150.98150.98150.98150.98150.98160.99170.99171.00100.98820.99170.98140.99030.98050.98120.98160.98470.98380.99870.9771V110.98640.99410.99030.98050.98020.98130.98380.98440.99750.97720.97720.97720.97720.97720.97720.97720.97720.97700.77600.72300.58610.5650Diesel 1 P0.90721.04030.44710.42900.31700.30840.98440.9910.9970.9787Diesel 2 Q0.47100.40980.44470.42900.31700.30840.98140.9960.98650.9865Diesel 2 Q0.47100.00000.00000.00000.00000.00000.00000.00000.0000V111.02041.02001.02001.02001.02001.02001.02101.0210	V 2	1.0030	1.0010	1.0030	1.0040	1.0000	1.0030	1.0040	1.0010	1.0070	0.9978
V 5 1.0060 1.0070 1.0070 1.0060 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 1.0100 0.0000 1.0010 0.9882 0.9917 1.0010 0.9882 0.9917 0.9882 0.9910 0.9885 0.9813 0.9814 0.9983 0.9981 0.9884 0.9979 0.9772 V 10 0.9864 0.9814 0.9903 0.9805 0.9802 0.9813 0.9838 0.9838 0.9973 0.977 V 11 0.9864 0.9911 0.5853 0.9801 0.8305 0.9813 0.9844 0.9979 0.9772 Diesel 1 P 0.9772 1.0413 0.8563 0.9814 0.4200 0.3170 0.3084 Diesel 2 P 0.8331 0.7	V 3	1.0010	0.9983	1.0000	0.9992	0.9981	0.9991	0.9995	0.9989	1.0040	0.9954
V 6 1.0030 1.0050 1.0030 1.0040 1.0070 1.0040 1.0140 1.0060 V 8 0.9975 0.9842 0.9950 0.9897 0.9893 0.9914 0.9920 0.9917 1.0010 0.9882 V 9 0.9908 0.9885 0.931 0.9855 0.9855 0.9866 0.9891 0.9884 0.9998 0.9977 V 10 0.9867 0.9844 0.9901 0.9805 0.9802 0.9813 0.9883 0.9987 0.977 V 11 0.9864 0.9901 0.9805 0.9802 0.9813 0.9838 0.9979 0.977 V 11 0.9864 0.9901 0.5803 0.9804 0.8306 0.8473 Diesel 1 P 0.9772 1.0413 0.8563 0.9804 0.8306 0.8473 Diesel 2 P 0.8331 0.7257 0.760 0.7230 0.5610 0.5650 Diesel 2 P 0.6000 0.0000 0.0000 0.0000 0.0000 0.0000	V 4	1.0010	0.9980	1.0000	0.9983	0.9983	0.9981	0.9984	0.9981	1.0030	0.9938
V 8 0.9975 0.9842 0.9950 0.9897 0.9893 0.9914 0.9920 0.9917 1.0010 0.9882 V 9 0.9908 0.9885 0.9931 0.9855 0.9865 0.9866 0.9891 0.9844 0.9907 0.9807 0.9866 0.9811 0.9838 0.9977 0.9777 V 10 0.9864 0.9941 0.9903 0.9805 0.9802 0.9813 0.9838 0.9977 0.9773 V 11 0.9864 0.9941 0.9903 0.9805 0.9802 0.9813 0.9838 0.9977 0.9773 Results case11 case12 case13 case14 case15 case16 Diesel 1 P 0.9772 1.0413 0.8553 0.9804 0.8306 0.8473 Diesel 2 Q 0.4710 0.4098 0.4447 0.4200 0.3170 0.3084 Wind P 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 V1 1.0070 1.0040 1.02	V 5	1.0060	1.0090	1.0070	1.0070	1.0060	1.0100	1.0100	1.0060	1.0180	1.0110
V 9 0.9908 0.9885 0.9931 0.9855 0.9855 0.9866 0.9891 0.9884 0.9998 0.9840 V 10 0.9867 0.9844 0.9901 0.9807 0.9802 0.9816 0.9841 0.9937 0.9777 V 11 0.9864 0.9841 0.9903 0.9805 0.9802 0.9813 0.9838 0.9844 0.977 Results case11 case12 case13 case14 case15 case16 Diesel 1 P 0.9772 1.0413 0.8563 0.9804 0.8306 0.8473 Diesel 2 P 0.8331 0.7257 0.7760 0.7230 0.5861 0.5650 Diesel 2 Q 0.4710 0.4098 0.4447 0.4200 0.3170 0.3084 Wind P 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 V11 1.0280 1.029 1.0280 1.0210 1.0210 1.0210 V11 1.0070 1.0040 1.0080 1.0020	V 6	1.0030	1.0060	1.0050	1.0030	1.0040	1.0070	1.0070	1.0040	1.0140	1.0060
V100.98670.98440.99010.98070.98020.98160.98470.98380.99870.977V110.98640.98410.99030.98050.98020.98130.98380.98440.9970.9783Resultscase11case12case13case14case 15case 16Diesel 1 P0.97721.04130.85630.98040.83060.8473Diesel 2 P0.83310.72570.77600.72300.58610.5650Diesel 2 Q0.47100.40980.44470.42900.31700.3084Wind P0.00000.00000.00000.00000.0000PV P0.00000.00000.00000.0000V111.02801.02901.02801.02101.0210V111.00701.00401.00801.00601.0010V111.00000.99930.99881.02001.0020V111.00000.99930.99841.02001.0010V111.00000.99930.99841.00201.0010V111.00000.99930.99841.00201.0010V121.01301.01001.00101.0010V131.01301.00801.00201.0010V141.00000.99930.98841.02001.0010V151.01301.01001.00101.0010V161.00930.98800.98720.98530.9853V100.9835	V 8	0.9975	0.9842	0.9950	0.9897	0.9893	0.9914	0.9920	0.9917	1.0010	0.9882
V11 0.9864 0.9841 0.9903 0.9805 0.9802 0.9813 0.9838 0.9844 0.9979 0.9787 Results case11 case12 case13 case 14 case 15 case 16 Diesel 1 P 0.9772 1.0413 0.8563 0.9804 0.8306 0.8473 Diesel 1 Q 0.5563 0.5811 0.4921 0.5729 0.4471 0.4577 Diesel 2 P 0.8331 0.7257 0.7760 0.7230 0.5861 0.5650 Diesel 2 Q 0.4710 0.4098 0.4447 0.4290 0.3170 0.3084 Wind P 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Vd1 1.0280 1.0220 1.0280 1.0210 1.0210 1.0210 V11 1.0070 1.0040 1.0103 1.0100 1.0100 1.0210 V1 1.0070 1.0040 1.0203 1.0020 1.0020 1.0020 V 1 1.0000 0.999	V 9	0.9908	0.9885	0.9931	0.9855	0.9855	0.9866	0.9891	0.9884	0.9998	0.9840
Results case11 case12 case13 case14 case15 case16 Diesel 1 P 0.9772 1.0413 0.8563 0.9804 0.8306 0.8473 Diesel 1 Q 0.5563 0.5811 0.4921 0.5729 0.4471 0.4577 Diesel 2 P 0.8331 0.7257 0.7760 0.7230 0.5861 0.5650 Diesel 2 Q 0.4710 0.4098 0.4447 0.4290 0.3170 0.3084 Wind P 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 PV P 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Vd1 1.0240 1.0210 1.0280 1.0210 1.0210 1.0210 Vd2 1.0030 1.0020 1.0280 1.0020 1.0020 1.0020 V 1 1.0070 1.0040 1.0080 1.0020 1.0020 1.0020 V 3 1.0000 0.9993 0.9984 1.0020 1.0020 1.0020	V 10	0.9867	0.9844	0.9901	0.9807	0.9802	0.9816	0.9847	0.9838	0.9987	0.9797
Diesel 1 P0.97721.04130.85630.98040.83060.8473Diesel 1 Q0.55630.58110.49210.57290.44710.4577Diesel 2 P0.83310.72570.77600.72300.58610.5650Diesel 2 Q0.47100.40980.44470.42900.31700.3084Wind P0.00000.00000.00000.00000.00000.0000PV P0.00000.00000.00000.00000.0000Vd11.02801.02901.02801.02101.0210Vd21.02401.01001.02801.02101.0210V 11.00701.00401.01301.01001.0020V 31.00000.99930.99881.00201.0010V 41.00000.99900.99841.02001.0010V 51.01301.01001.01001.01001.0100V 61.09901.01801.01901.02001.0210V 70.99310.98800.98720.98480.9849V 90.98310.98350.98370.98480.9853	V 11	0.9864	0.9841	0.9903	0.9805	0.9802	0.9813	0.9838	0.9844	0.9979	0.9787
Diesel 1 Q0.55630.58110.49210.57290.44710.4577Diesel 2 P0.83310.72570.77600.72300.58610.5650Diesel 2 Q0.47100.40980.44470.42900.31700.3084Wind P0.00000.00000.00000.00000.00000.0000PV P0.00000.00000.00000.00000.0000Vd11.02801.02901.02201.02801.0210Vd21.02401.01901.02001.02801.0210V 11.00701.00401.01001.01001.0100V 21.03000.99930.99881.00201.0020V 41.00000.99900.99841.00201.0010V 51.01301.01301.01001.0100V 61.00901.01001.00901.0010V 70.98310.98800.98720.9853V 100.98350.98350.98170.98160.9777	Results	case11	case12	case13	case 14	case 15	case 16				•
Diesel 2 P0.83310.72570.77600.72300.58610.5650Diesel 2 Q0.47100.40980.44470.42900.31700.3084Wind P0.00000.00000.00000.00000.00000.0000PV P0.00000.00000.00000.00000.00000.0000Vd11.02801.02901.02201.02801.02201.0230Vd21.02401.01901.02001.02801.02101.0210V 11.00701.00401.01001.01001.00601.0020V 21.00300.99930.99881.00301.00201.0010V 51.01301.01301.01201.01001.0100V 61.00900.99310.98800.98650.98480.9849V 90.98310.98350.98370.98160.97770.9798	Diesel 1 P	0.9772	1.0413	0.8563	0.9804	0.8306	0.8473				
Diesel 2 Q0.47100.40980.44470.42900.31700.3084Wind P0.00000.00000.00000.00000.00000.0000PV P0.00000.00000.00000.00000.00000.0000Vd11.02801.02901.02201.02801.02101.0230Vd21.02401.01901.02001.02801.02101.0210V 11.00701.00401.00401.01301.01001.0100V 21.00301.00201.00301.00201.00201.0020V 31.00000.99930.99881.00301.00201.0010V 41.00000.99900.99841.00201.01001.0110V 51.01301.01301.01901.01001.0100V 61.00901.01001.00901.00901.00901.0090V 80.99310.98800.98720.98480.9849V 90.98350.98350.98370.98160.9770.9798	Diesel 1 Q	0.5563	0.5811	0.4921	0.5729	0.4471	0.4577				
Wind P0.00000.00000.00000.00000.00000.0000PV P0.00000.00000.00000.00000.0000Vd11.02801.02901.02201.02801.0210Vd21.02401.01901.02001.02801.0210V11.00701.00401.01001.01001.0100V21.00301.00201.00101.00601.0020V31.00000.99930.99881.00201.00101.0010V51.01301.01301.01001.01001.0100V61.00901.01001.00901.00101.0010V80.99310.98800.98650.98480.9849V90.98350.98350.98370.98160.97970.9798	Diesel 2 P	0.8331	0.7257	0.7760	0.7230	0.5861	0.5650				
PV P0.00000.00000.00000.00000.00000.0000Vd11.02801.02901.02201.02801.02201.0230Vd21.02401.01901.02001.02801.02101.0210V 11.00701.00401.00401.01301.01001.0100V 21.00301.00201.00101.00801.00601.0060V 31.00000.99930.99841.00201.00101.0010V 41.00000.99900.99841.00201.01001.0100V 51.01301.01301.00801.01001.01001.0100V 61.00901.01001.00501.00901.00601.0070V 80.99310.98800.98720.98480.9849V 90.98310.98350.98370.98160.97970.9798	Diesel 2 Q	0.4710	0.4098	0.4447	0.4290	0.3170	0.3084				
Vd11.02801.02901.02201.02801.02201.0230Vd21.02401.01901.02001.02801.02101.0210V11.00701.00401.00401.01301.01001.0100V21.00301.00201.00101.00601.0060V31.00000.99930.99881.00301.00201.0010V41.00000.99900.99841.00201.00101.0010V51.01301.01301.01201.01001.0100V61.00901.01001.00901.00601.0070V80.99310.98810.98650.98480.9849V90.98910.98350.98370.98160.97970.9798	Wind P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
Vd21.02401.01901.02001.02801.02101.0210V11.00701.00401.00401.01301.01001.0100V21.00301.00201.00101.00801.00601.0060V31.00000.99930.99881.00301.00201.0020V41.00000.99900.99841.00201.00101.0010V51.01301.01301.00801.01001.0100V61.00901.01001.00901.00901.0090V80.99310.99810.98800.98450.9848V90.98910.98890.98800.98720.9850V100.98350.98350.98370.98160.97970.9798	PV P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
V11.00701.00401.00401.01301.01001.0100V21.00301.00201.00101.00801.00601.0060V31.00000.99930.99881.00301.00201.0020V41.00000.99900.99841.00201.00101.0010V51.01301.01301.00801.01201.01001.0100V61.00901.01001.00901.09801.00601.0070V80.99310.99310.98800.98650.98480.9849V90.98910.98890.98370.98160.97970.9798	Vd1	1.0280	1.0290	1.0220	1.0280	1.0220	1.0230				
V 21.00301.00201.00101.00801.00601.0060V 31.00000.99930.99881.00301.00201.0020V 41.00000.99900.99841.00201.00101.0010V 51.01301.01301.00801.01201.01001.0100V 61.00901.01001.00901.00901.00901.0984V 80.99310.99310.98800.98650.98480.9849V 90.98910.98890.98370.98160.97970.9798	Vd2	1.0240	1.0190	1.0200	1.0280	1.0210	1.0210				
V 31.00000.99930.99881.00301.00201.0020V 41.00000.99900.99841.00201.00101.0010V 51.01301.01301.00801.01201.01001.0100V 61.00901.01001.00501.00901.00601.0070V 80.99310.99310.98800.98650.98480.9849V 90.98910.98890.98800.98720.98500.9853V 100.98350.98350.98370.98160.97970.9798	V 1	1.0070	1.0040	1.0040	1.0130	1.0100	1.0100				
V 41.00000.99900.99841.00201.00101.0010V 51.01301.01301.00801.01201.01001.0100V 61.00901.01001.00501.00901.00601.0070V 80.99310.99310.98800.98650.98480.9849V 90.98910.98890.98800.98720.98500.9853V 100.98350.98350.98370.98160.97970.9798	V 2	1.0030	1.0020	1.0010	1.0080	1.0060	1.0060				
V 51.01301.01301.00801.01201.01001.0100V 61.00901.01001.00501.00901.00601.0070V 80.99310.99310.98800.98650.98480.9849V 90.98910.98890.98800.98720.98500.9853V 100.98350.98350.98370.98160.97970.9798	V 3	1.0000	0.9993	0.9988	1.0030	1.0020	1.0020				
V 6 1.0090 1.0100 1.0050 1.0090 1.0060 1.0070 V 8 0.9931 0.9931 0.9880 0.9865 0.9848 0.9849 V 9 0.9891 0.9889 0.9880 0.9872 0.9850 0.9853 V 10 0.9835 0.9837 0.9816 0.9797 0.9798	V 4	1.0000	0.9990	0.9984	1.0020	1.0010	1.0010				
V 8 0.9931 0.9931 0.9880 0.9865 0.9848 0.9849 V 9 0.9891 0.9889 0.9880 0.9872 0.9850 0.9853 V 10 0.9835 0.9835 0.9837 0.9816 0.9797 0.9798	V 5	1.0130	1.0130	1.0080	1.0120	1.0100	1.0100				
V 90.98910.98890.98800.98720.98500.9853V 100.98350.98350.98370.98160.97970.9798	V 6	1.0090	1.0100	1.0050	1.0090	1.0060	1.0070				
V 10 0.9835 0.9835 0.9837 0.9816 0.9797 0.9798	V 8	0.9931	0.9931	0.9880	0.9865	0.9848	0.9849				
	V 9	0.9891	0.9889	0.9880	0.9872	0.9850	0.9853				
V 11 0.9837 0.9835 0.9861 0.9809 0.9788 0.9791	V 10	0.9835	0.9835	0.9837	0.9816	0.9797	0.9798				
	V 11	0.9837	0.9835	0.9861	0.9809	0.9788	0.9791				

APPENDIX J: Seventh Scenario Results