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Summary Sheet.

Energy Profile Evaluation and Forecasting

The United States is the leading energy consumer in the world, the formulation of its interstate energy policy is fundamental to the country's economy and security. Based on the historical evolution of the energy structure in California, Arizona, New Mexico, and Texas from 1960 to 2009, this paper explores the main determinants of the energy profile of the four states. Based on what we have done, we forecasted the energy profiles of these four states in 2025 and 2050 and put forward specific proposals to promote cooperation and energy structure optimization in the four states.

This paper mainly discussed from the following aspects:

First, we have established a dimension-reduction model based on **factor analysis**, which is used to determine the common factors. The number of the common factors is much smaller than the number of original variables, but they can contain most of the information of the original variables. We got 5 common factors from the 605 original variables, which contain 81.8% information of the original data. Based on the common factors we obtained, we calculated the comprehensive scores for each state to further determine the usage of clean and renewable energy of the state. After our calculation, we found that **CA** had the “best” energy profile in 2009.

We then used the **Microsoft Timing Series algorithm** to predict the changes in energy profiles of the four states from 2010 to 2050. The Microsoft Time Series algorithm provides multiple algorithms that are optimized for forecasting continuous values over time. The algorithm fully considers the influence of factors such as seasonal variation and data changing period, and can predict the timing data accurately.

To make good proposals, we considered the geographical location and resource reserves of the four states. And we put forward targeted goals and corresponding recommendations to help them increase the use of clean, renewable energy.

Keywords: Factor analysis, Timing Series Analysis, Energy Profile, Principal Component Analysis

Memo

Introduction to the profiles of the four states in 2009.

Arizona has a large share of nuclear energy, but few oil and gas reserves. California's oil production accounts for a major portion of energy production, with abundant renewable resources. New Mexico and Texas have large gas production ratios. In terms of energy consumption, California has the largest share of clean energy usage, while Arizona has a smaller share of clean energy usage.

Intuitively, California has the highest clean energy usage percentage and should have the best energy structure. Arizona's oil and coal usage percentage is high, and its energy structure needs to be optimized.

Predictions we made based on the given data

Based on the data we have obtained, we forecasted the energy profiles for each state from 2010 to 2050. The result shows that the proportion of oil used in Arizona will decline, and the use of nuclear power and coal will be overwhelming. California's clean energy use will rise, including nuclear, natural gas and other renewable resources. The use of coal and natural gas in New Mexico will be a major part of the total energy consumption, with fewer renewable resources. The use of oil and gas in Texas accounts for the bulk of total energy consumption.

According to our predictions, natural gas usage percentage is so high that New Mexico will have the best energy structure by 2050. However, California's oil usage rate is still high in 2050, making California's energy structure not so reasonable.

We strongly recommend that officials, from now on, consider the interstate cooperation among the four states to promote the transformation and upgrading of the states' energy structure through interstate energy transfer.

Goals we think the compact should adopt

Decreasing the usage of oil and coal and increasing the usage of clean energy, e.g. nuclear electric and natural gas, will improve the energy structure of the state. So, we put forward the following goals that we think the compact should achieve in the future.

In 2025, renewable energy consumption and production in California and Arizona should reach more than 20%. Renewable energy consumption and production in New Mexico and Texas should be more than 10%.

The consumption and production of crude oil in California and Texas should fall below 40 percent, while the consumption and production of crude oil in New Mexico and Arizona should drop below 20%.

Content

1. Introduction

1.1. Background

At present, the world's energy development is facing a severe challenge. As the world's largest energy consuming country, the USA plays a crucial role in the world. Although the state in USA has its own unique culture, climate, law, economic structure and develop priority, states are making progress in energy development, strategic security, green and low-carbon, new energy system, science and technology innovation, policy system and interstate cooperation.

There are two major problems in the four states (CA, AZ, NM, TX) energy development. First, the energy profile is greatly affected by such factors as geography, industry, population and climate, which are difficult to explain and forecast. Second, energy development in each state has its own characteristics, making it difficult for states to optimize their energy development through an interstate compact. Therefore, it makes great sense to form a realistic new energy compact.

1.2. Our work

To further present our solution, we arrange our paper as follows.

The introduction part expounds the background, significance of this thesis, problem-solving ideas and thesis structure.

In section 2, we give out the reliable assumptions and notations to simplify the model.

In section 3, we established a model to solve these problems, factor analysis model and time series prediction model.

In section 4, we apply our model to solve a series of problem, such as creating an energy profile, explaining the similarities and difference between the four states, predicting the energy profile and determining an interstate compact.

Finally, the strengths and weaknesses of the model are discussed in detail.

2. Model Assumptions and Notations

2.1 Model Assumptions

To simplify the problem, we made some assumptions.

1. All the given data are valid and the four states have the same quantitative standards.
2. From 1960 to 2009, there was no policy change in the U.S. states, that is, there was no human factor in the data set.
3. Nuclear and natural gas are non-renewable resources, but they are clean energy.

4. Transmission of electricity among states is the most economical way of transmitting energy.
5. Energy production and consumption in the four states are only related to natural factors, i.e., energy production and consumption among states do not affect each other.

2.2 Notations

Table 1

Symbol	Description
$F_{petroleum}$	petroleum factor
F_{coal}	coal factor
F_{natgas}	natural gas factor
$F_{nucpower}$	nuclear power factor
$F_{renewenergy}$	renewable energy factor
x_i	the i^{th} original variable
A	the component matric
a_{ij}	load factor
f_i	the i^{th}common factor
ε	the special factor
y_i	uncorrelated variables converted from original related variables
u_{ij}	the coefficients used to convert variables
β_{ij}	the coefficients used for regression

3. The Basic Model

3.1. Evaluation model

We use factor analysis to establish the model. Get five indicators to show state energy profiles and judge which state is best. Since the energy profile is determined by 605 factors, the model replaces most of the original variables with five independent factor scalars.

3.1.1. Model establishment

From the original 605 variables, we select the variables (3.1.1 explanation) suitable for factor analysis and get 581 variables. Suppose there are p variables in the original variables, and they are $x_1, x_2, x_{3,} \cdots, x_p (p = 581)$. $F_1, F_2, F_{3,} \cdots F_m$represents m factor variables, and m should be less than p. Thus, equations can be described below:

$$x_1 = a_{11}F_1 + a_{12}F_2 + \cdots + a_{15}F_5 + a_1\varepsilon_1$$
$$x_2 = a_{21}F_1 + a_{22}F_2 + \cdots + a_{25}F_5 + a_2\varepsilon_2$$
$$\cdots$$
$$x_p = a_{p1}F_1 + a_{p2}F_2 + \cdots + a_{p5}F_5 + a_p\varepsilon_p \tag{1}$$

It can also be expressed as a matrix:

$$\mathrm{X} = \mathrm{AF} + \mathrm{a}\varepsilon \tag{2}$$

F: Factor variables or common factors.

A: component matrix,

a_{ij}: Load factor, which is a composite of the i^{th}original variable on the j^{th} factor variable, reflects the relative importance of the i^{th} original variable over the j^{th} common factor. Therefore, the greater the absolute value of a_{ij}, the stronger the relationship between the common factor F_j and the original variable x_i.

ε: The special factor, which represents the part of the original variable that cannot be explained by the public factor, is equivalent to the residual term in the multivariate regression analysis model

3.1.2. Determine the original variables.

To determine whether the original variables is suitable for factor analysis, demand a strong correlation between variables. If there is no strong relationship between the original variables, it is impossible to synthesize the variables that can reflect the public characteristics of variables. Here we use the KMO(Kaiser-Meyer-Olkin) test:

$$\mathrm{KMO} = \frac{\sum\sum_{i\neq j} r_{ij}^2}{\sum\sum_{i\neq j} r_{ij}^2 + \sum\sum_{i\neq j} p_{ij}^2} \tag{3}$$

r_{ij}: The simple correlation coefficient between variable i and variable j.

p_{ij}: The partial correlation coefficient between variable i and variable j.

The value of KMO statistic is between 0 and 1, When the square sum of the simple correlation coefficient between all the variables is much larger than the square of the partial correlation coefficient, the KMO value is close to 1. The closer the KMO value is to 1, the more suitable for the factor analysis. Kaiser provides a metric for KMO:

Table 2 : a metric for KMO

KMO	0.9	0.8	0.7	0.6	0.5

	Very good	good	general	bad	Very bad

3.1.3. Determine factor variables and calculate factor loading matrix.

Constructing factor variables is one of the key steps in factor analysis. Here we choose a wide-used of principal component analysis in factor analysis. The principal component analysis can provide the initial solution for factor analysis, and the factor analysis is based on the analysis of principal component analysis for the further analysis.

The principal component analysis method converts the original p related variables x_i into a set of uncorrelated variables y_i through coordinate transformation, which can be expressed as:

$$\begin{gathered} y_1 = u_{11}x_1 + u_{21}x_2 + \cdots + u_{p1}x_p \\ y_2 = u_{12}x_1 + u_{22}x_2 + \cdots + u_{p2}x_p \\ \cdots \\ y_p = u_{1p}x_1 + u_{2p}x_2 + \cdots + u_{pp}x_p \end{gathered} \tag{4}$$

The equation requires:

$$u_{1k}^2 + u_{2k}^2 + \cdots + u_{pk}^2 = 1 (k = 1,2,3, \cdots p) \tag{5}$$

In the formula, the coefficient u_{ij} is determined according to two principles:

1. y_i and y_j $(i \neq j,\ i,\ j = 1,2,3, \cdots p)$ are uncorrelated to each other.
2. y_1 is the largest variance among all the linear combinations of x_1, $x_2, x_3, \cdots x_p$ (the coefficients satisfying the above equations) $y_2$is the largest variance among all linear combinations of $x_1,\ x_2, x_3, \cdots x_p$ which is uncorrelated with y_1. y_p is the largest variance in all the linear combinations of $x_1,\ x_2, x_3, \cdots x_p$ which is uncorrelated with y_1;

The variables $y_1, y_2, y_3, \cdots, y_p$ that we respectively determine according to this principle are called the first, the second, the third, ..., the p^{th} principal component of the original variable. Among them, y_1 occupies the largest proportion of the variance, and it integrates the original variables $x_1, x_2, x_3, \cdots x_p$ with the strongest ability and $y_2, y_3, \cdots, y_p$ in the total variance, in other words, the remaining principal components $y_2, y_3, \cdots, y_p$ the ability to synthesize the original variables in turn weakened.

Factor Analysis Based on principal component analysis, we obtain p eigenvalues and corresponding eigenvectors. Based on this, the factor loading matrix is calculated according to the following method:

$$\mathrm{A} = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & a_{22} & & a_{1m} \\ \vdots & & \ddots & \vdots \\ a_{p1} & a_{p2} & \cdots & a_{1m} \end{pmatrix} = \begin{pmatrix} u_{11}\sqrt{\lambda_1} & u_{12}\sqrt{\lambda_2} & \cdots & u_{1m}\sqrt{\lambda_m} \\ u_{21}\sqrt{\lambda_1} & u_{22}\sqrt{\lambda_2} & & u_{1m}\sqrt{\lambda_m} \\ \vdots & & \ddots & \vdots \\ u_{p1}\sqrt{\lambda_1} & u_{p2}\sqrt{\lambda_2} & \cdots & u_{1m}\sqrt{\lambda_m} \end{pmatrix} \tag{6}$$

where: m < p.

Next, according to the cumulative variance contribution rate of the factor, we have determined m. the cumulative variance contribution rate of the first m public factors is:

$$C = \sum_{i=1}^{m} \lambda_i \Big/ \sum_{i=1}^{p} \lambda_i$$

In this problem, we choose top five principal components, the cumulative contribution rate reached 81.8%, which will reduce the number of variables and can use less principal component to contain the most information of original variables.

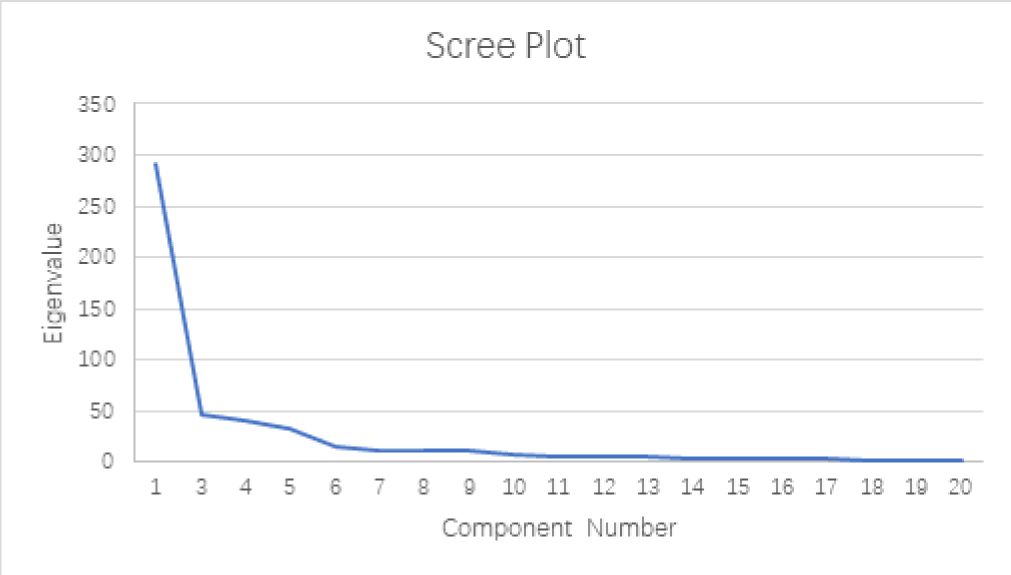

Figure 1 : Scree Plot

3.1.4. Naming of factor variables.

According to the rotated factor loading matrix, an original variable x_i may have a large correlation with several factor variables at the same time. In other words, the information of an original variable x_i needs to be explained by several factors; At the same time, although a factor variable may be able to interpret the information of many variables, it can only explain the small amount of information of a variable, not the typical representative of any variable. So, we hope that through the factor loading matrix rotation, let the load on one of the factor tends to 1, while on the other factor of load tends to 0. In this way, a factor variable will be able to become the typical representative of a variable.

We use the rotation of the method is to load matrix rotation matrix (see the appendix). Since rotation on the load scatter plot of intuitive, on the axis of the endpoint variable refers to a higher load on the factor variables, close to the figure of the origin of variables on two factors have little load.

From the rotation matrix (see Appendix), we obtained 5 factor variables, and according to their comprehensive generalization ability of 605 original variables, they were:

$$F_{renewenergy},\quad F_{natgas},\quad F_{nucpower},\quad F_{coal},\quad F_{petroleum}.$$

3.1.5. Calculate factor score.

After getting five factor variables, the four states of different data samples, different factors also have the corresponding numerical values, the values is the factor score, we also evaluate the performance of a state energy structure in the end, the factor score, would not be in the next analysis for 605 variable, but is reduced to five factor score variable research, so as to achieve the purpose of dimension reduction. The factor scoring function is:

$$\mathrm{F}_j = \beta_{j1}x_1 + \beta_{j2}x_2 + \beta_{j3}x_3 + \cdots + \beta_{jp}x_p \;\; (j = 1, 2, 3, \cdots, m) \tag{7}$$

Here we use regression to calculate factor scores.

In this case, according to the explanation of factors, the numerical value reflects the uncleanness and non-renewable energy of energy. The higher the factor scores, the less clean the state's energy structure. The states with the lowest scores, on the other hand, are the states with the best energy structure.

3.2. Microsoft timing algorithm model

By analyzing the time series data, the time series prediction method is able to grasp the change rule of time series and realize the prediction. Time series is to point to the same kind of phenomenon of successive observations in different time arrangement of a set of numerical sequence, in regular intervals to collect an ordered set of measurements, a set of values is a period, expressed by the following set:

$$\{X_{i-1} =< t_1, a_1 >, X_{i-2} =< t_2, a_2 >, \cdots, X_{i-n} =< t_n, a_n >\} \tag{8}$$

Where a_i is a variable value at $t_i (i = 1,2,3, \cdots, n)$, and $\nabla = t_{i+1} - t_i (i = 1,2,3, \cdots, n)$ for the fixed value, ∇ said time interval, different values in different time sequence. Time series analysis can quantitatively reveal the law of the development and change of a phenomenon. The basic idea is to establish a mathematical model that can accurately reflect the dynamic relationships contained in a time series based on known data of finite length.

The Microsoft timing algorithm consists of two steps: autoregressive and segmenting the tree model. Regression is often used to deal with time series, analysis of existing data that exist in the model and forecast, to determine the future value of the range of possible, of which linear regression model is the most common type of time series analysis model. The Microsoft timing algorithm uses a linear autoregressive model of length p, denoted AR (p), which is described by the following equation.

$$f\left(y_i \middle| y_{i-p}, \cdots, y_{i-1}, \theta\right) = N\left(m + \textstyle\sum_{j=1}^{p} b_j y_{i-j}\, , \sigma^2\right) \tag{9}$$

Among them, the $f(y_i|y_{i-p},\cdots,y_{i-1},\theta)$ is a linear regression, N（μ, σ^2） is a obey averages μ, variance of σ^2 normal distribution, θ = （m, b_1, ⋯, b_j, σ^2） are the various parameters of the model.

The model established by Microsoft timing algorithm is a self-regression tree model, each leaf node represents an independent autoregressive model. The regression tree formula is as follows:

$$f(y_i|y_{i-p},\cdots,y_{i-1},\theta)=\prod_{i=1}^{L} f_i(y_i|y_{i-p},\cdots,y_{i-1},\theta_i)=\prod_{i=1}^{L} N(m_i+\sum_{j=1}^{p} b_{ij}y_{i-j},\sigma_i^2)(10)$$

Where L is the number of leaf nodes, θ = （θ_1, $\theta_2\cdots$, θ_L） and θ_i = （m_i, b_{i1}, ⋯, b_{ip}, σ_i^2） are leaf nodesl_i （$i = 1,2,3, \cdots, L$） at the linear regression model parameters.

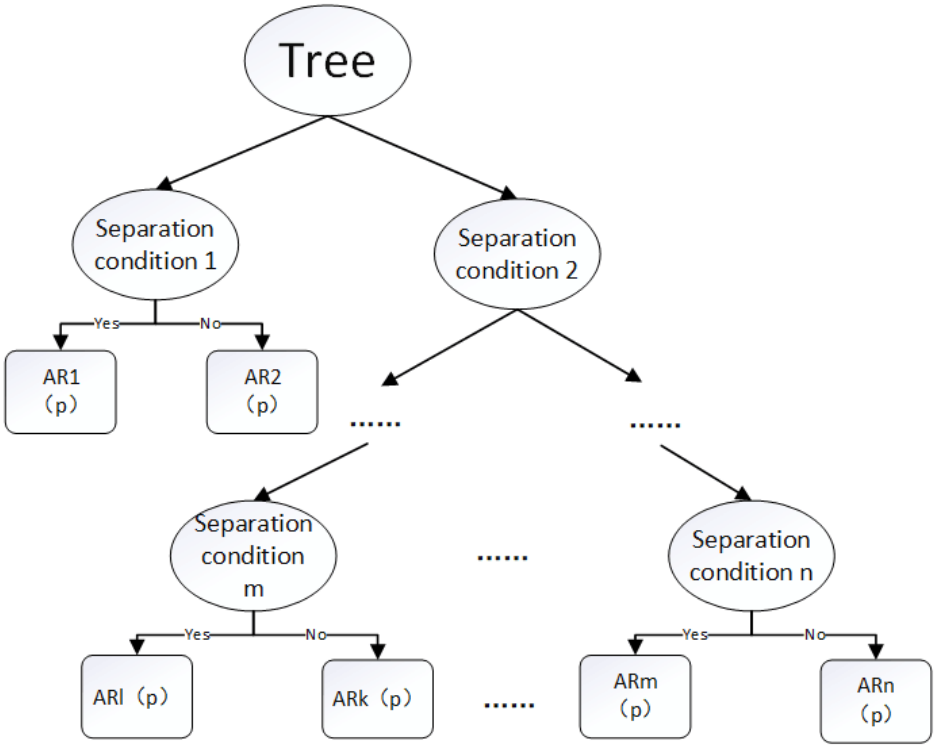

Figure 2 : autoregressive tree model.

FIG. 1 shows a self-regression tree model in which each non-leaf node in the decision tree is determined by a Boolean regression formula. Each leaf node is obtained by means of the corresponding intermediate node and is expressed as AR (p).

Using this model, we can predict the values of the corresponding data in 2025 and 2050 based on the known 50-year data. For example, if a_i represents the total consumption of natural gas over 50 years, $\nabla = t_{i+1} - t_i (i = 1960,1961,1962,\cdots,2008)$ is a fixed value, we use the relevant data with SQL Server2005 in accordance with the above model of integrated operation to get the desired prediction.

4. Applications and Analysis

After all the equations have been determined, our model is final completed. Next, we focus on solving relative problems and giving out analysis as well.

4.1. Task 1: create an energy profile

To work out a reasonable interstate compact, firstly, we need to understand the energy profiles of the four states (AZ, CA, NM, TX). Based on the data provided, we analyzed the energy profile in 2009. Energy profile is mainly indicated by the production and consumption of energy. Due to the many and miscellaneous data, we have selected the five most important energy sources in the US energy consumption structure: petroleum, natural gas, coal, nuclear power and renewable energy.

4.1.1. Arizona

Arizona's crude petroleum reserves are small and there are no refineries. Nearly nine-tenths of the petroleum is used in transportation sector, and most of the rest goes to the industrial sector. Arizona has one of the 30 largest coal mines in the United States, accounting for a quarter of the state's energy production. Arizona has no significant gas reserves, and the electricity industry consumes three-quarters of Arizona's gas. Arizona has the largest nuclear power plant in the United States, and nuclear production is the top of the state's energy production, accounting for more than half of the state's energy production. Arizona is rich in solar and geothermal energy and has the potential for wind power because of its steep terrain. The transportation sector is the state's biggest energy consumer, followed by the residential sector.

4.1.2. California

California is the third largest petroleum -producing state in the country with more than half the state's energy output, but output has declined overall since 1985, and California is increasingly dependent on imported petroleum to meet its demand. Petroleum is used almost exclusively in transportation sector. The industrial sector, the second-largest consuming sector, uses only one-eighth as much petroleum as the transportation sector. California has no coal reserves and production, and almost all coal is used for industrial production. A tenth of California energy produces is natural gas, and almost two-thirds of households use natural gas for warmth. Nuclear power accounts for 13% of the state's energy output. California is one of the largest renewable energy states in the United States, represented by solar energy, geothermal energy and biomass.

4.1.3. New Mexico

New Mexico is the sixth largest petroleum producing states in the country, nearly fifteen percent of its energy production from petroleum, with the transportation sector dominating New Mexico's energy consumption, followed by the industrial, residential and commercial sectors. Coal in New Mexico accounts for nearly one-fifth of the state's energy output, with almost all the state's coal being used in the state or shipped to Arizona to generate electricity. New Mexico is one of the top ten natural gas production states, accounts for sixty-five percent of the state's energy production. About one-fifth of the state natural gas is consumed in the state, and the power sector is the state's largest natural gas consumer, followed by residential sector. The state has no nuclear power plants. New Mexico has plenty of renewable resources, especially wind and solar energy, but also hydropower, biomass and geothermal energy.

4.1.4. Texas

Texas petroleum accounts for one-fifth of the state's energy output, with its energy consumption ranking first, and almost all of it is consumed by the industrial sector. Texas is the largest coal-consuming state and has the highest coal output in the country. Texas has a quarter of the country's proven natural gas reserves, and it accounts for most of the state's energy production. The industry and electric power sector dominate the use of natural gas in Texas. The state produces one-tenth of the country's net electricity, and 30% of its energy comes from nuclear power. Almost all of Texas's renewable energy comes from wind power, but it still has the potential of solar, biomass and geothermal energy.

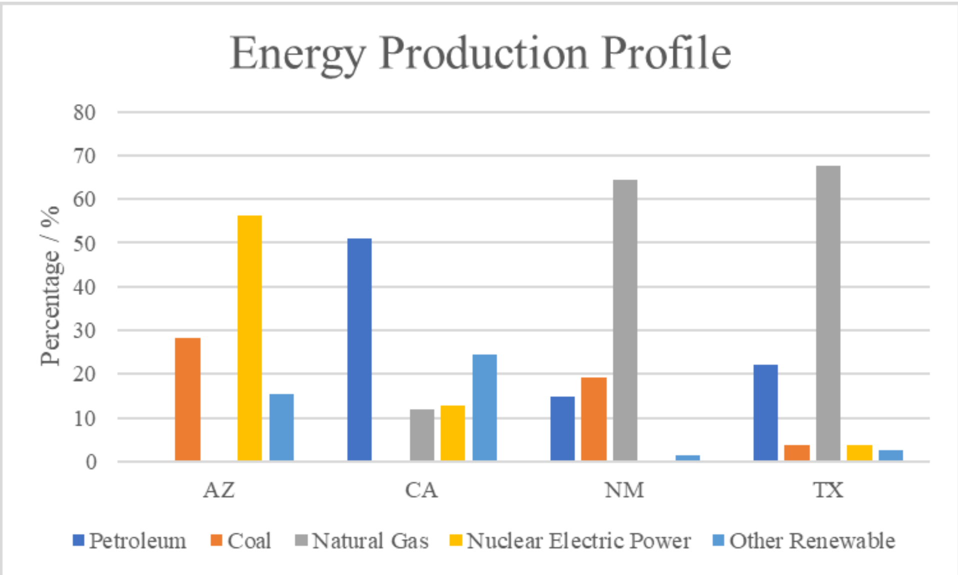

Figure 3 Energy Production Profile

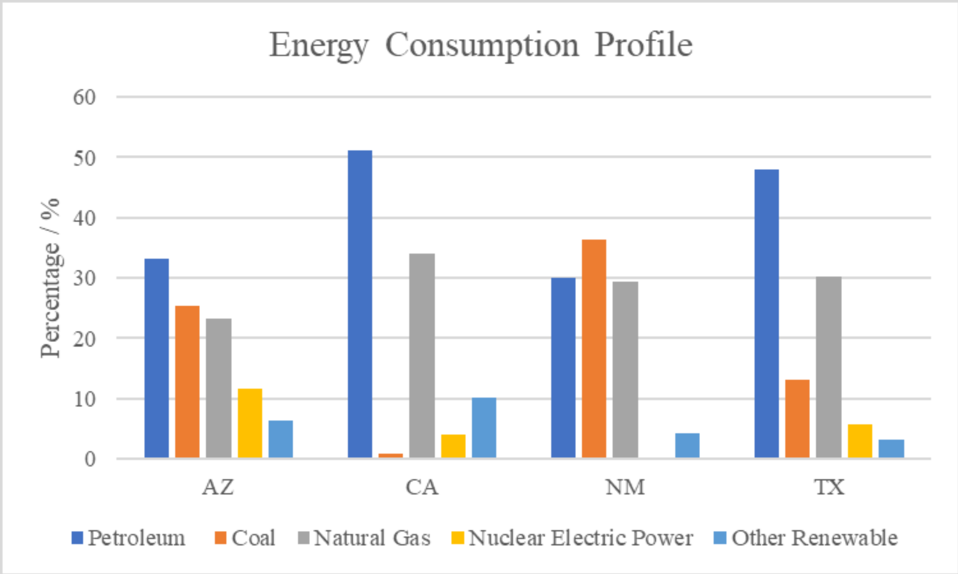

Figure 4 Energy Consumption Profile

4.2. Task 2：Factor Analysis Model and The Best Energy Profile

We established a factor analysis model, using the principal component analysis to obtain the initial solution of factor analysis, maximum variance method for factor rotation, regression factor calculation factor score (analysis results see Appendix). The top five factors from the gravel map (front) can represent more than 82% of the information. Next, explain the five factors by rotating the load matrix.

Table 3 : Rotated Component Matric

First factor		Second factor		third factor		Forth factor		fifth factor	
Number	Share	Number	Share	Number	Share	Number	Share	Number	Share
240	0.965	452	0.829	572	0.938	427	0.983	394	0.916
234	0.961	448	0.829	569	0.928	428	0.983	485	0.914
230	0.961	456	0.829	552	0.906	415	0.983	97	0.908
114	0.958	458	0.828	564	0.898	77	0.983	475	0.904
348	0.957	450	0.828	546	0.885	430	0.983	228	0.904
92	0.953	454	0.828	566	0.877	139	0.983	393	0.902
298	0.953	211	0.815	568	0.859	429	0.983	391	0.901
102	0.953	212	0.815	72	0.848	425	0.983	484	0.893
106	0.953	209	0.814	55	0.848	543	0.983	482	0.893
573	0.953	210	0.814	45	0.848	138	0.983	232	0.890

By analyzing the meaning of the five variables in the original variables, the first factor mainly represents renewable resources, the second resource mainly represents natural gas, the third factor represents nuclear power, the fourth factor represents coal, the fifth factor is mainly on behalf of crude oil. which is：

$$F_{renewenergy},\ F_{natgas},\ F_{nucpower},\ F_{coal},\ F_{petroleum}$$

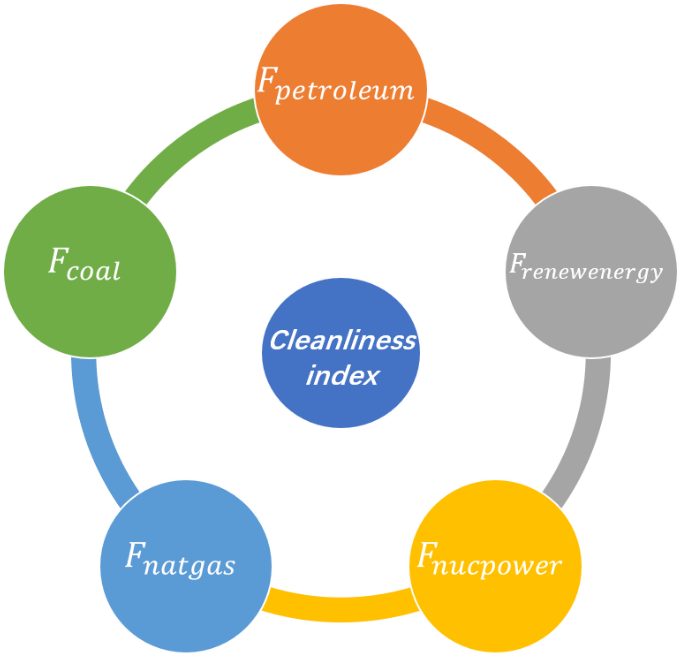

Figure 5 : The 5 factors

We obtain the coefficient $\beta_{jp}(j = 1,2,3,\cdots,m,\ p = 1,2,\cdots,4)$ of the score of the calculation factor by calculating the percentage of variance of $F_{renewenergy}$, F_{natgas}, $F_{nucpower}$, F_{coal}, $F_{petroleum}$. The calculation result is:

Table 4 : Coefficient matric

	AZ	CA	NM	TX
$F_{renewenergy}$	0.365	0.385	0.375	0.378
F_{natgas}	0.160	0.186	0.173	0.265
$F_{nucpower}$	0.119	0.128	0.111	0.099
F_{coal}	0.090	0.079	0.084	0.050
$F_{petroleum}$	0.085	0.052	0.057	0.040

Substitution function：

$$\mathrm{F}_j = \beta_{j1}x_1 + \beta_{j2}x_2 + \beta_{j3}x_3 + \cdots + \beta_{jp}x_p \ \ (j = 1,2,3,\cdots,m)$$

The factor score reflects the uncleanness index, and the state with the lowest score has the best energy structure, so California is the best. The result is shown below:

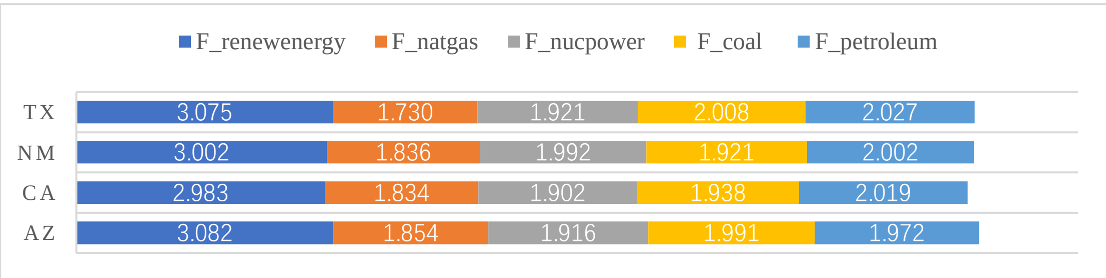

Figure 6 : Scores of the four states

In terms of the cleanliness of renewable energy, the states did not do very well, and the renewable resources produced and consumed were not more than 10 percent. California's net generation of renewable resource in the four states in the first place, in the southeast desert abundant solar energy resources, with solar energy, at the same time in northern California volcanic region provides a rich geothermal resources. Texas and California have less production and use of renewable resources. In terms of natural gas energy cleanliness, the states have performed better, with New Mexico as the representative, the electricity sector dominated by electricity consumption, followed by the housing sector. Arizona, which has no significant natural gas reserves and has the smallest use of natural gas in four states, has the highest score. In terms of nuclear energy cleanliness, California has a quarter of nuclear power, so $F_{nucpower}$r has the lowest score, while New Mexico and Texas have no obvious nuclear power plants, so $F_{nucpower}$ has a higher score. In terms of coal energy cleanliness, Texas has the worst performance, as the largest coal consumption state, so it is higher. Other states have not done particularly well. In terms of cleanness of petroleum energy, Arizona is doing better on clean energy, so $F_{nucpower}$ scored lowest because of no crude oil reserves and no refineries, while California and Texas, the most oil-producing and consuming nations, scored higher and were less clean.

4.3. Task 3 : Time Series Predicting

We used the Microsoft Time Series Algorithm to predict the consumption of five energy sources from 2010 to 2050, and further calculated the energy profiles of the states that were predicted. The forecast results are as follows.

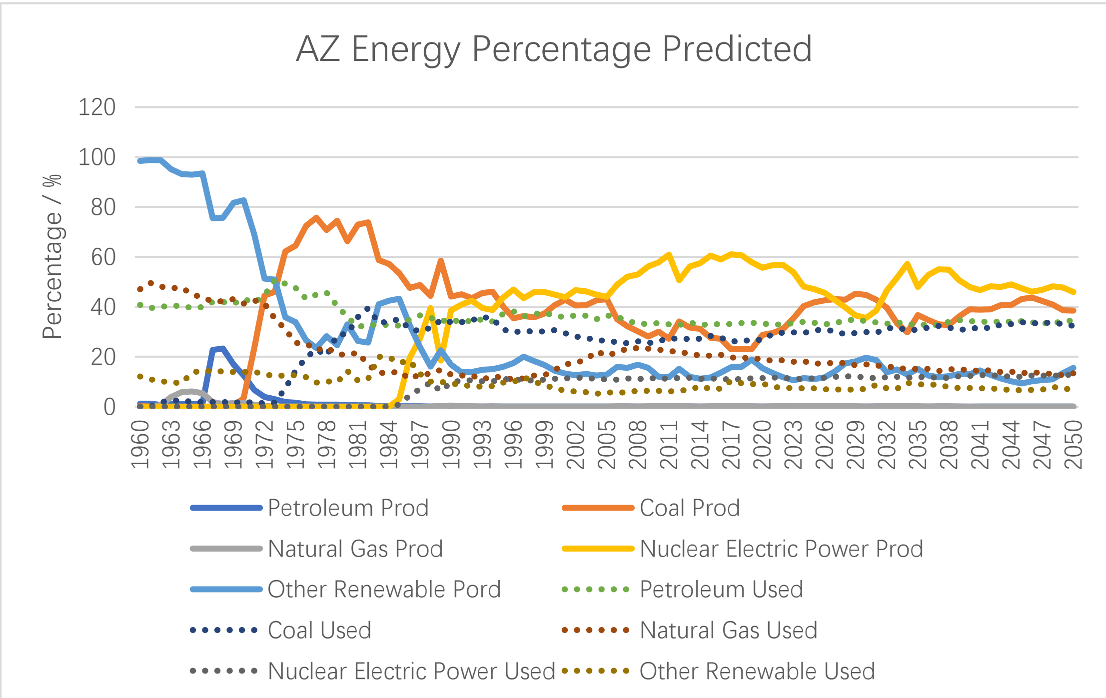

Figure 7 : AZ Energy Percentage Predicted

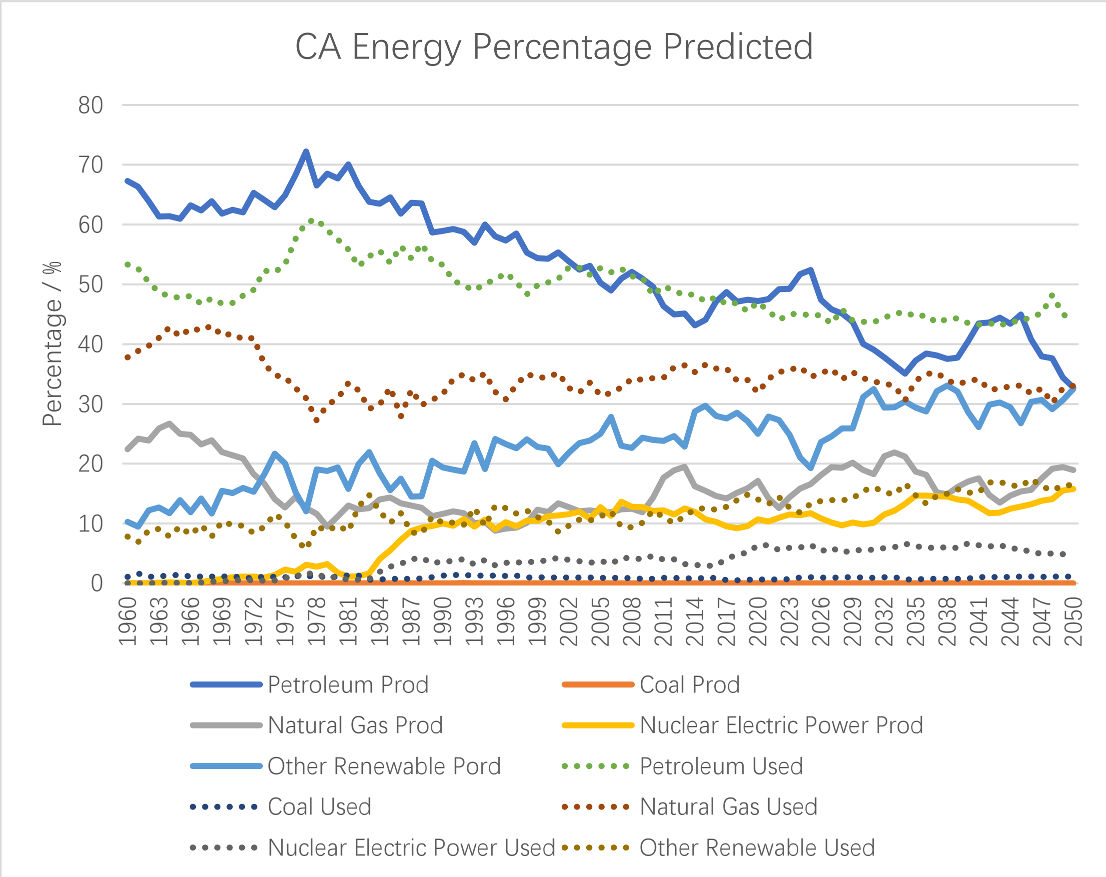

Figure 8 : CA Energy Percentage Predicted

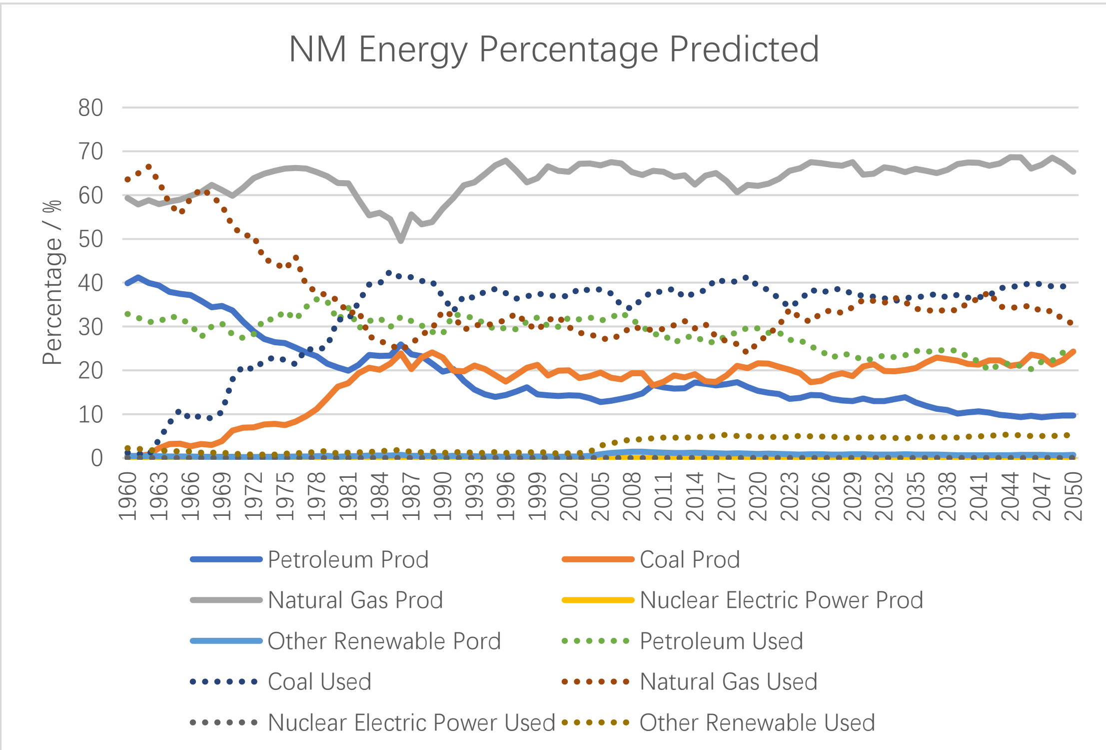

Figure 9 : NM Energy Percentage Predicted

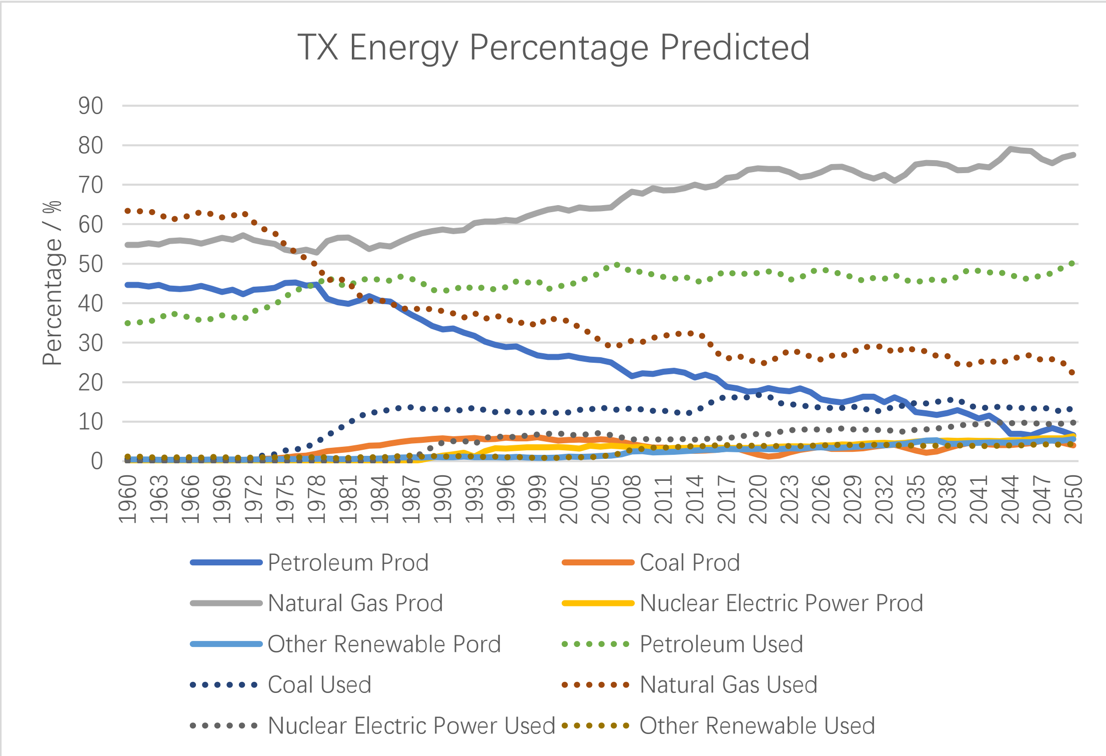

Figure 10 : TX Energy Percentage Predicted

The amount of oil produced in Arizona will not change much over the next few decades, and nuclear energy production will increase year by year. As a result, the state's share of clean energy output will increase. California's oil output will decline year by year, and the remaining four kinds of energy output will remain largely unchanged. New Mexico's natural gas production will increase slowly, and the proportion of clean energy will remain high. Texas's natural gas output will remain essentially unchanged, and oil production will decline year by year.

Arizona has a higher share of petroleum products and coal, resulting in a low percentage of clean energy usage in the state. California uses a higher percentage of its petroleum products and natural gas and uses a higher percentage of clean energy. The main energy sources used in New Mexico are coal, oil and natural gas. The main energy sources in Texas are petroleum products and natural gas.

In 2025, the energy profile of the 4 states are predicted as follows.

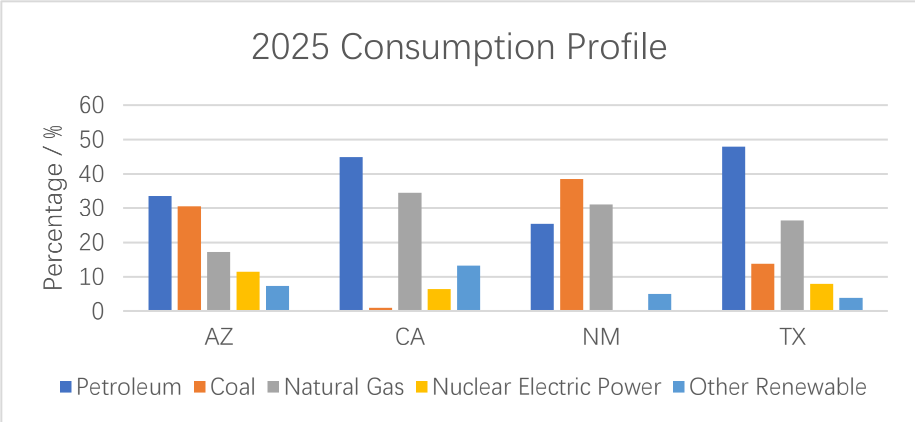

Figure 11 : 2025 Consumption Profile

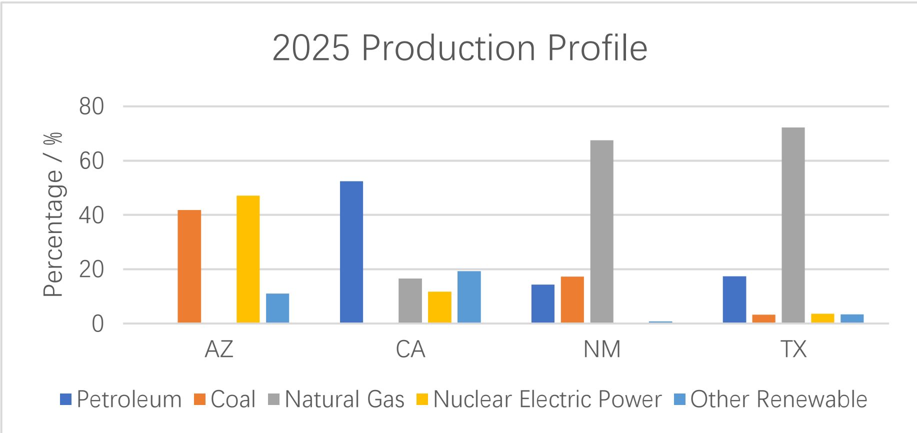

Figure 12 : 2025 Production Profile

In 2050, the energy profile of the 4 states are predicted as follows.

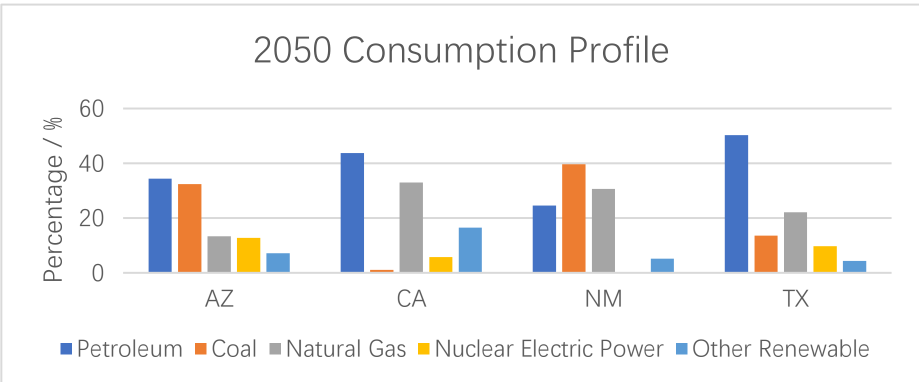

Figure 13 : 2050 Consumption Profile

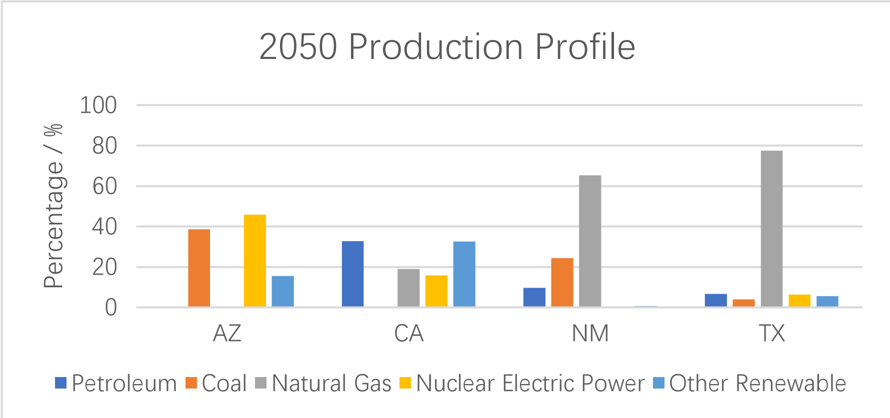

Figure 14 : 2050 Production Profile

4.4. Task 4 : Goals

The following four charts illustrate our projected energy production and consumption in the four states 2025 and 2050.

We from the data in the graph is not difficult to find in the absence of any policy change, in 2025 and 2050, the production and consumption of natural gas and oil occupies a large proportion, but in 2025 and 2050, the amount of renewable energy production and consumption has increased significantly. Even so the proportion of renewable energy production and consumption is not high, still one of the California and Arizona, the proportion of renewable energy has the obvious rise, according to our forecast of the existing condition, we can set the following for each state in 2025 and 2050, renewable energy to reach a goal:

1, California and Arizona in 2025, the proportion of renewable energy consumption and production of more than 20%, New Mexico and Texas, the proportion of renewable energy consumption and production of more than 10%; California and Arizona in 2050, the proportion of renewable energy consumption and production of more than 30%, New Mexico and Texas, the proportion of renewable energy consumption and production of more than 15%.

2. The consumption and production ratio of crude oil in California and Texas drops below 40% in 2025, and the consumption and production ratio of crude oil in New Mexico and Arizona drops below 25%. Oil consumption and production in California and Texas fell below 30 percent in 2050, while oil consumption and production in New Mexico and Arizona dropped below 20 percent.

3. The proportion of coal consumption and production in New Mexico and Arizona dropped below 30% in 2025. Coal consumption and production fell below 25 percent in new Mexico and Arizona in 2050.

4. In 2025 and 2050, the consumption and production ratio of nuclear energy in four states will reach more than 20%, and the production and consumption of natural gas will remain above 30%.

If the above target is met, the evaluation scores of the four states will be improved significantly.

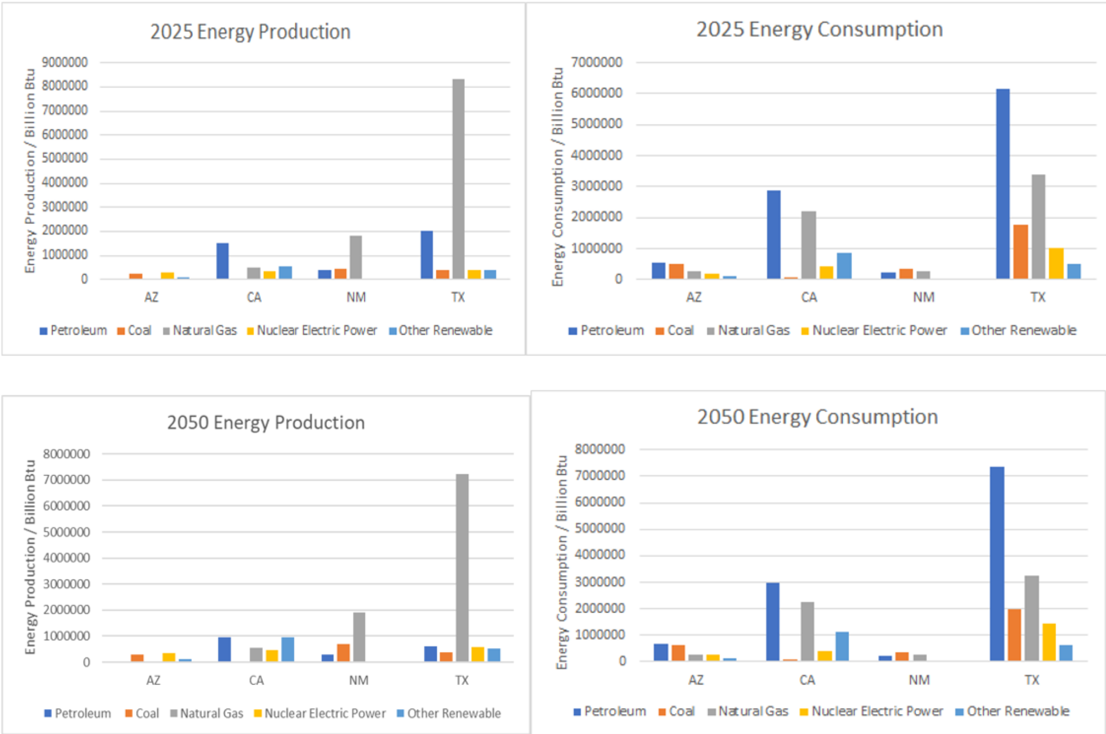

Figure 15 : the target of four states

4.5. Task 5: Actions Should Be Taken

Four states to achieve the above goal of using renewable resources, we have formulated the following several measures:

1. To formulate specific policies including economic incentives to support the development of the renewable energy industry such as investment and production tax credits, subsidies and green electricity tariffs to reduce the cost of renewable energy products and services and raise market competition force.
2. Use market means to guide and expand the development of renewable energy, including the use of financial and financial incentives to promote the commercial development of renewable energy technologies, actively formulate and promote renewable energy-related production and energy efficiency standards, set up a special venture capital fund for renewable energy, and formulate Renewable energy power generation quotas system.
3. Push the development of small hydropower stations. As large hydropower stations will affect the surrounding environment and develop large-scale hydropower stations facing greater social resistance, the development of small and medium-sized power stations will also become an important way to use hydropower resources. Small hydro projects are powered by various levels of energy that can be fully transported to the current and are sufficient to produce a large amount of energy in smaller Spaces.

4. According to the geographical environment of each state, it is appropriate to develop suitable renewable resources.

5. Strengths and Weaknesses

5.1. Strengths

Factor analysis greatly reduces the number of variables and retains most of the information of the original data. This brings convenience to our analysis and prediction.

The final score which is calculated by the common factor, to a certain extent, reflects the state's use of clean, renewable energy. In this way, we can compare the energy structures of each state through a measurable score.

5.2. Weaknesses

In factor analysis, the meaning of some common factors may be ambiguous, which may makes the final score difficult to accurately reflect the energy profiles of each state.

In fact, the data from 1960 to 2009 were related to natural and human factors. For example, force majeure such as natural disasters or policy changes will limit the accuracy of data forecast.

6. References

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【2】 Lei Yu Research and implementation of renewable energy building data analysis system based on sequential algorithm[D]. Beijing：Beijing Technology and Business University 2010

【3】 Wei Xue Statistical analysis and SPSS application[M].Beijing:China Renmin University Press 2008 P250~P253

【4】 <https://docs.microsoft.com/en-us/sql/analysis-services/data-mining/microsoft-time-series-algorithm> (Feb.12,2018)

【5】 <http://www.cec.org.cn/guojidianli/2013-06-14/103873.html> (Feb.12,2018)

【6】 <https://www.eia.gov/state/analysis.php?sid=CA > (Feb.12,2018)

【7】 <https://www.eia.gov/state/analysis.php?sid=AZ > (Feb.12,2018)

【8】 < https://www.eia.gov/state/analysis.php?sid=NM> (Feb.12,2018)

【9】 < https://www.eia.gov/state/analysis.php?sid=TX> (Feb.12,2018)

【10】 <https://az.gov/ > (Feb.12,2018)

7. Appendix

Rotated Component Matric

	Component				
	1	2	3	4	5
V1	-0.009	-0.246	0.370	-0.022	0.002
V2	-0.009	-0.246	0.370	-0.022	0.002
V3	0.495	0.539	-0.051	-0.248	0.196
V4	0.703	0.268	0.624	-0.097	-0.005
V5	0.495	0.539	-0.051	-0.248	0.196
V6	0.810	0.388	0.299	-0.075	-0.025
V7	0.495	0.539	-0.051	-0.248	0.196
V8	0.703	0.268	0.624	-0.097	-0.005
V9	0.495	0.539	-0.051	-0.248	0.196
V10	0.810	0.388	0.299	-0.075	-0.025
V11	0.495	0.539	-0.051	-0.248	0.196
V12	0.703	0.268	0.624	-0.097	-0.005
V13	0.495	0.539	-0.051	-0.248	0.196
V14	0.810	0.388	0.299	-0.075	-0.025
V15	-0.461	-0.466	-0.637	0.254	-0.001
V16	0.903	0.225	0.339	-0.073	-0.057
V17	-0.461	-0.466	-0.637	0.254	-0.001
V18	0.817	0.220	0.387	-0.104	0.180
V19	-0.461	-0.466	-0.637	0.254	-0.001
V20	0.903	0.225	0.339	-0.073	-0.057
V21	-0.461	-0.466	-0.637	0.254	-0.001
V22	0.817	0.220	0.387	-0.104	0.180
V23	-0.461	-0.466	-0.637	0.254	-0.001
V24	0.903	0.225	0.339	-0.073	-0.057
V25	-0.461	-0.466	-0.637	0.254	-0.001
V26	0.817	0.220	0.387	-0.104	0.180
V27	0.736	-0.030	0.577	-0.063	-0.151
V28	-0.194	-0.207	-0.281	0.868	0.084
V29	-0.177	-0.082	-0.256	-0.074	0.750
V30	-0.808	-0.319	0.138	0.031	0.055
V31	-0.197	-0.208	-0.285	0.862	0.100
V32	-0.103	-0.047	-0.110	0.001	0.718
V33	0.095	0.227	0.272	-0.028	-0.197
V34	0.254	0.624	0.409	-0.046	-0.289
V35	0.119	0.233	0.276	-0.028	-0.199
V36	0.116	0.223	0.263	-0.027	-0.195
V37	0.592	0.543	0.547	-0.082	-0.124
V38	0.567	0.444	0.641	-0.100	-0.172

V39	0.041	0.110	0.197	-0.716	0.187
V40	0.613	0.545	0.521	-0.081	-0.131
V41	0.675	0.489	0.455	-0.069	-0.260
V42	0.178	0.652	0.435	-0.051	-0.301
V43	0.205	0.040	0.840	-0.059	0.051
V44	0.610	0.425	0.629	-0.122	0.062
V45	0.183	0.033	0.848	-0.059	0.051
V46	0.323	0.053	0.826	-0.062	-0.041
V47	-0.066	-0.061	-0.083	0.983	-0.042
V48	-0.066	-0.061	-0.083	0.983	-0.042
V49	-0.066	-0.061	-0.083	0.983	-0.042
V50	-0.066	-0.061	-0.083	0.983	-0.042
V51	-0.066	-0.061	-0.083	0.983	-0.042
V52	0.205	0.040	0.840	-0.059	0.051
V53	0.610	0.425	0.629	-0.122	0.062
V54	0.276	-0.074	-0.333	0.172	-0.291
V55	0.183	0.033	0.848	-0.059	0.051
V56	0.323	0.053	0.826	-0.062	-0.041
V57	0.206	0.041	0.841	-0.061	0.053
V58	0.256	0.511	0.753	-0.105	0.179
V59	0.303	0.382	0.536	0.137	0.396
V60	0.263	0.515	0.748	-0.105	0.176
V61	0.018	0.173	0.341	-0.033	-0.206
V62	0.267	0.507	0.456	-0.045	-0.260
V63	0.032	0.175	0.352	-0.034	-0.210
V64	0.049	0.118	0.410	-0.035	-0.205
V65	-0.066	-0.061	-0.083	0.983	-0.042
V66	0.581	0.524	0.581	-0.083	-0.115
V67	0.563	0.432	0.659	-0.101	-0.151
V68	0.601	0.526	0.557	-0.082	-0.123
V69	0.666	0.468	0.500	-0.071	-0.250
V70	0.205	0.040	0.840	-0.058	0.051
V71	0.610	0.425	0.629	-0.122	0.062
V72	0.183	0.033	0.848	-0.059	0.051
V73	0.324	0.054	0.826	-0.062	-0.042
V74	0.563	0.432	0.659	-0.101	-0.151
V75	0.666	0.468	0.500	-0.071	-0.250
V76	-0.066	-0.061	-0.083	0.983	-0.042
V77	-0.066	-0.061	-0.083	0.983	-0.042
V78	-0.066	-0.061	-0.083	0.983	-0.042
V79	0.802	0.549	0.130	-0.078	-0.054
V80	0.884	0.329	0.285	-0.066	-0.090
V81	0.802	0.549	0.130	-0.078	-0.054

V82	0.944	0.268	-0.009	-0.029	-0.103
V83	0.502	0.607	-0.047	-0.096	0.281
V84	0.944	0.150	0.224	-0.059	-0.012
V85	0.502	0.607	-0.047	-0.096	0.281
V86	0.871	0.147	-0.068	-0.034	-0.004
V87	0.937	0.172	0.252	-0.058	-0.030
V88	0.295	0.057	0.325	-0.047	0.645
V89	0.623	0.470	0.122	-0.093	0.468
V90	0.943	0.182	0.217	-0.053	-0.062
V91	0.623	0.470	0.122	-0.093	0.468
V92	0.953	0.136	0.018	-0.034	-0.016
V93	0.589	0.489	0.280	-0.124	0.489
V94	-0.294	-0.183	-0.356	-0.050	0.822
V95	0.915	0.301	0.155	-0.058	-0.051
V96	-0.294	-0.183	-0.356	-0.050	0.822
V97	-0.096	-0.010	-0.071	-0.043	0.908
V98	-0.090	-0.024	0.411	-0.048	-0.153
V99	0.792	0.563	0.131	-0.088	0.099
V100	0.902	0.298	0.263	-0.062	-0.090
V101	0.792	0.563	0.131	-0.088	0.099
V102	0.953	0.245	-0.004	-0.030	-0.081
V103	0.797	0.564	0.124	-0.086	0.058
V104	0.902	0.298	0.265	-0.062	-0.090
V105	0.797	0.564	0.124	-0.086	0.058
V106	0.953	0.245	-0.007	-0.030	-0.085
V107	-0.094	-0.012	0.117	-0.040	0.868
V108	0.938	0.171	0.246	-0.061	-0.025
V109	-0.094	-0.012	0.116	-0.040	0.868
V110	0.285	0.054	0.308	-0.054	0.673
V111	0.886	-0.141	-0.320	-0.050	0.064
V112	0.729	0.150	0.352	-0.062	-0.076
V113	0.886	-0.141	-0.320	-0.050	0.064
V114	0.958	-0.073	-0.167	-0.014	-0.012
V115	0.537	0.302	-0.008	-0.010	-0.100
V116	0.769	0.404	-0.138	-0.017	0.006
V117	0.537	0.302	-0.008	-0.010	-0.100
V118	0.768	0.229	-0.084	-0.005	-0.087
V119	-0.596	-0.552	-0.435	0.031	0.267
V120	-0.464	0.395	0.321	0.043	-0.149
V121	-0.464	0.395	0.321	0.043	-0.149
V122	0.946	-0.015	-0.161	-0.010	-0.062
V123	0.948	-0.071	-0.162	-0.010	-0.046
V124	0.802	-0.084	-0.146	-0.015	-0.066

V125	0.849	-0.118	-0.157	-0.014	-0.057
V126	0.787	-0.173	-0.149	-0.017	-0.040
V127	0.951	-0.054	-0.163	-0.009	-0.052
V128	0.950	-0.089	-0.162	-0.009	-0.042
V129	0.787	-0.173	-0.149	-0.017	-0.040
V130	0.947	-0.015	-0.161	-0.010	-0.061
V131	0.949	-0.071	-0.162	-0.010	-0.046
V132	0.946	-0.015	-0.161	-0.010	-0.062
V133	0.802	-0.084	-0.146	-0.015	-0.066
V134	0.951	-0.055	-0.163	-0.009	-0.052
V135	0.786	-0.174	-0.149	-0.017	-0.040
V136	0.946	-0.016	-0.161	-0.010	-0.062
V137	-0.066	-0.061	-0.083	0.983	-0.042
V138	-0.066	-0.061	-0.083	0.983	-0.042
V139	-0.066	-0.061	-0.083	0.983	-0.042
V140	-0.066	-0.061	-0.083	0.983	-0.042
V141	0.753	0.592	0.211	-0.068	-0.131
V142	0.531	0.441	0.693	-0.116	-0.015
V143	0.753	0.592	0.211	-0.068	-0.131
V144	0.781	0.512	0.266	-0.063	-0.181
V145	0.539	0.665	0.450	-0.177	0.006
V146	0.560	0.446	0.669	-0.112	-0.026
V147	0.539	0.665	0.450	-0.177	0.006
V148	0.632	0.569	0.476	-0.084	-0.136
V149	0.524	0.636	0.498	-0.134	0.124
V150	0.792	0.550	0.190	-0.084	-0.105
V151	0.536	0.477	0.662	-0.117	-0.027
V152	0.792	0.550	0.190	-0.084	-0.105
V153	0.815	0.492	0.211	-0.058	-0.173
V154	-0.082	-0.070	0.438	-0.048	-0.133
V155	0.748	0.593	0.242	-0.093	-0.100
V156	0.559	0.462	0.657	-0.113	-0.035
V157	0.748	0.593	0.242	-0.093	-0.100
V158	0.784	0.513	0.268	-0.064	-0.173
V159	0.748	0.593	0.242	-0.093	-0.100
V160	0.559	0.462	0.657	-0.113	-0.035
V161	0.748	0.593	0.242	-0.093	-0.100
V162	0.784	0.513	0.268	-0.064	-0.173
V163	0.776	0.527	0.290	-0.116	0.011
V164	0.200	0.799	-0.098	-0.008	-0.111
V165	0.940	0.213	-0.180	-0.012	-0.080
V166	0.200	0.799	-0.098	-0.008	-0.111
V167	0.658	0.554	-0.156	-0.008	-0.101

V168	0.139	0.795	-0.083	-0.007	-0.110
V169	0.940	0.213	-0.180	-0.012	-0.080
V170	0.139	0.795	-0.083	-0.007	-0.110
V171	0.589	0.591	-0.142	-0.007	-0.103
V172	-0.161	-0.175	-0.033	-0.069	0.816
V173	-0.087	-0.273	0.281	-0.047	0.506
V174	-0.161	-0.175	-0.033	-0.069	0.816
V175	-0.101	-0.219	0.202	-0.037	0.635
V176	0.840	0.500	0.071	-0.046	-0.154
V177	0.781	0.538	0.212	-0.048	-0.153
V178	0.737	0.419	-0.158	-0.016	-0.097
V179	-0.066	-0.061	-0.083	0.983	-0.042
V180	-0.066	-0.061	-0.083	0.983	-0.042
V181	0.527	0.690	0.084	-0.045	-0.283
V182	0.898	0.330	-0.110	-0.028	-0.162
V183	0.620	0.665	0.039	-0.042	-0.264
V184	0.620	0.665	0.039	-0.042	-0.264
V185	0.737	0.419	-0.158	-0.016	-0.097
V186	0.494	0.696	0.094	-0.046	-0.292
V187	-0.066	-0.061	-0.083	0.983	-0.042
V188	-0.066	-0.061	-0.083	0.983	-0.042
V189	-0.004	0.206	0.709	-0.163	0.091
V190	0.032	0.226	0.702	-0.169	0.089
V191	-0.243	-0.452	0.426	-0.144	0.416
V192	-0.243	-0.451	0.425	-0.144	0.418
V193	-0.005	0.205	0.709	-0.164	0.091
V194	0.031	0.225	0.702	-0.169	0.090
V195	-0.243	-0.452	0.426	-0.144	0.416
V196	-0.243	-0.451	0.425	-0.144	0.418
V197	0.081	0.714	0.374	-0.255	-0.008
V198	0.928	0.117	0.291	-0.059	-0.028
V199	0.035	0.687	0.380	-0.262	-0.004
V200	0.872	0.247	0.317	-0.062	-0.054
V201	0.077	0.715	0.368	-0.259	0.003
V202	0.928	0.117	0.290	-0.059	-0.027
V203	0.031	0.688	0.374	-0.267	0.007
V204	0.872	0.247	0.316	-0.062	-0.054
V205	0.081	0.714	0.374	-0.255	-0.008
V206	0.928	0.117	0.291	-0.059	-0.028
V207	0.035	0.687	0.380	-0.262	-0.004
V208	0.872	0.247	0.317	-0.062	-0.054
V209	0.427	0.814	0.269	-0.151	-0.036
V210	0.427	0.814	0.269	-0.151	-0.036

V211	0.426	0.815	0.266	-0.153	-0.031
V212	0.426	0.815	0.266	-0.153	-0.031
V213	-0.608	-0.736	-0.139	0.045	0.050
V214	-0.608	-0.736	-0.139	0.045	0.050
V215	-0.608	-0.736	-0.139	0.045	0.050
V216	-0.608	-0.736	-0.139	0.045	0.050
V217	-0.175	-0.154	0.122	-0.066	0.805
V218	0.949	0.126	0.167	-0.048	-0.080
V219	-0.175	-0.154	0.122	-0.066	0.805
V220	0.142	-0.098	0.434	-0.034	0.535
V221	-0.197	-0.156	-0.067	0.080	0.854
V222	0.951	0.122	0.215	-0.052	-0.057
V223	-0.197	-0.156	-0.067	0.080	0.854
V224	-0.092	-0.140	0.207	-0.024	0.764
V225	-0.185	-0.102	-0.193	-0.049	0.883
V226	0.933	0.161	0.075	-0.057	0.038
V227	-0.185	-0.102	-0.193	-0.049	0.883
V228	-0.112	-0.049	-0.076	-0.014	0.904
V229	-0.197	-0.140	-0.104	0.023	0.887
V230	0.961	0.117	0.186	-0.058	-0.012
V231	-0.197	-0.140	-0.104	0.023	0.887
V232	-0.094	-0.099	0.087	-0.021	0.890
V233	-0.197	-0.140	-0.104	0.023	0.887
V234	0.961	0.117	0.186	-0.058	-0.012
V235	-0.197	-0.140	-0.104	0.023	0.887
V236	-0.094	-0.099	0.087	-0.021	0.890
V237	0.844	-0.317	0.136	-0.059	0.031
V238	0.809	0.443	0.309	-0.065	-0.163
V239	0.851	-0.302	0.150	-0.062	0.032
V240	0.965	-0.070	0.036	-0.028	-0.068
V241	0.252	0.445	0.070	-0.272	-0.297
V242	0.854	0.396	0.286	-0.062	-0.127
V243	0.296	0.480	0.136	-0.267	-0.262
V244	0.789	0.409	0.191	-0.060	-0.153
V245	0.054	0.016	0.708	-0.050	0.076
V246	0.900	0.295	0.272	-0.061	-0.116
V247	0.069	0.028	0.716	-0.058	0.072
V248	0.721	0.125	0.421	-0.063	-0.145
V249	0.173	0.107	0.694	-0.133	0.227
V250	0.481	0.344	0.020	-0.271	-0.300
V251	0.876	0.351	0.286	-0.073	-0.065
V252	0.515	0.378	0.085	-0.263	-0.264
V253	0.886	0.284	0.137	-0.064	-0.116

V254	-0.091	0.041	0.346	-0.043	-0.164
V255	0.491	0.235	0.481	-0.244	-0.174
V256	0.879	0.360	0.270	-0.068	-0.097
V257	0.511	0.265	0.508	-0.237	-0.147
V258	0.898	0.249	0.200	-0.063	-0.129
V259	0.491	0.235	0.481	-0.244	-0.174
V260	0.879	0.360	0.270	-0.068	-0.097
V261	0.511	0.265	0.508	-0.237	-0.147
V262	0.898	0.249	0.200	-0.063	-0.129
V263	-0.066	-0.061	-0.083	0.983	-0.042
V264	0.732	0.615	0.229	-0.069	-0.120
V265	0.490	0.675	0.475	-0.189	0.046
V266	0.773	0.572	0.209	-0.089	-0.093
V267	0.725	0.615	0.263	-0.098	-0.083
V268	0.725	0.615	0.263	-0.098	-0.083
V269	0.142	0.552	0.675	-0.147	0.331
V270	0.920	0.250	0.262	-0.071	-0.070
V271	0.142	0.552	0.675	-0.147	0.331
V272	0.872	0.330	0.324	-0.073	-0.073
V273	0.233	0.515	0.667	-0.148	0.369
V274	0.920	0.250	0.262	-0.071	-0.070
V275	0.233	0.515	0.667	-0.148	0.369
V276	0.870	0.331	0.328	-0.070	-0.070
V277	0.193	0.535	0.675	-0.148	0.354
V278	0.920	0.250	0.262	-0.071	-0.070
V279	0.193	0.535	0.675	-0.148	0.354
V280	0.871	0.331	0.326	-0.072	-0.072
V281	0.193	0.535	0.675	-0.148	0.354
V282	0.920	0.250	0.262	-0.071	-0.070
V283	0.193	0.535	0.675	-0.148	0.354
V284	0.871	0.331	0.326	-0.072	-0.072
V285	-0.036	0.238	-0.174	-0.002	-0.090
V286	-0.036	0.238	-0.174	-0.002	-0.090
V287	0.737	0.595	0.260	-0.111	-0.029
V288	0.873	0.318	0.338	-0.082	-0.011
V289	0.737	0.596	0.256	-0.110	-0.031
V290	0.930	0.316	0.105	-0.046	-0.084
V291	-0.356	-0.455	0.349	-0.121	0.145
V292	0.873	0.318	0.338	-0.082	-0.011
V293	-0.355	-0.454	0.349	-0.121	0.145
V294	0.203	-0.144	0.713	-0.100	0.080
V295	0.787	0.154	-0.328	0.036	-0.102
V296	0.873	0.318	0.338	-0.082	-0.011

V297	0.788	0.158	-0.326	0.035	-0.103
V298	0.953	0.178	-0.030	-0.034	-0.045
V299	0.742	0.590	0.255	-0.110	-0.030
V300	0.873	0.318	0.338	-0.082	-0.011
V301	0.742	0.592	0.251	-0.109	-0.031
V302	0.931	0.313	0.105	-0.046	-0.084
V303	0.742	0.590	0.255	-0.110	-0.030
V304	0.873	0.318	0.338	-0.082	-0.011
V305	0.742	0.592	0.251	-0.109	-0.031
V306	0.931	0.313	0.105	-0.046	-0.084
V307	0.713	0.613	0.273	-0.114	-0.027
V308	0.266	0.779	-0.114	-0.011	-0.113
V309	0.940	0.213	-0.180	-0.012	-0.080
V310	0.266	0.779	-0.114	-0.011	-0.113
V311	0.754	0.441	-0.173	-0.013	-0.096
V312	-0.066	-0.061	-0.083	0.983	-0.042
V313	-0.066	-0.061	-0.083	0.983	-0.042
V314	0.116	0.057	-0.312	-0.260	-0.089
V315	0.849	0.407	-0.111	-0.027	-0.168
V316	0.170	0.125	-0.285	-0.247	-0.104
V317	0.942	0.067	-0.179	-0.015	-0.077
V318	0.433	0.485	0.174	0.001	0.582
V319	0.857	0.365	0.305	-0.064	-0.136
V320	0.464	0.533	0.187	0.014	0.534
V321	0.884	0.371	0.218	-0.057	-0.110
V322	0.907	0.049	-0.276	-0.005	-0.062
V323	0.828	0.279	0.343	-0.057	-0.076
V324	-0.444	-0.650	-0.291	-0.161	0.352
V325	0.908	0.058	-0.269	-0.002	-0.066
V326	0.946	0.086	-0.105	-0.016	-0.046
V327	-0.470	-0.373	-0.547	-0.286	0.365
V328	0.873	0.296	0.318	-0.060	-0.132
V329	-0.469	-0.361	-0.548	-0.288	0.373
V330	0.801	0.308	0.404	-0.086	0.069
V331	-0.058	0.099	0.087	-0.181	0.755
V332	-0.109	0.075	0.007	-0.009	-0.296
V333	-0.103	0.093	0.012	-0.006	-0.299
V334	-0.174	-0.153	-0.382	-0.217	-0.361
V335	0.076	0.092	0.155	-0.722	0.165
V336	-0.167	-0.144	-0.377	-0.217	-0.364
V337	-0.035	0.011	-0.286	-0.260	-0.073
V338	0.014	0.079	-0.262	-0.249	-0.088
V339	0.506	0.331	-0.173	-0.070	0.585

V340	0.849	0.403	0.277	-0.066	-0.135
V341	0.547	0.403	-0.135	-0.048	0.529
V342	0.891	0.379	0.170	-0.057	-0.098
V343	-0.036	-0.193	0.406	-0.037	-0.042
V344	0.843	0.017	-0.411	-0.089	0.093
V345	0.761	0.422	0.441	-0.073	-0.143
V346	-0.468	-0.676	-0.284	-0.165	0.196
V347	0.856	0.046	-0.390	-0.079	0.081
V348	0.957	0.201	0.020	-0.035	-0.060
V349	-0.163	-0.116	-0.529	-0.314	0.576
V350	0.864	0.362	0.284	-0.062	-0.143
V351	-0.471	-0.671	-0.273	-0.160	0.151
V352	-0.116	-0.045	-0.525	-0.314	0.591
V353	0.890	0.366	0.218	-0.062	-0.078
V354	0.920	0.280	-0.168	-0.015	-0.105
V355	0.919	0.282	-0.168	-0.015	-0.105
V356	0.116	0.057	-0.312	-0.260	-0.089
V357	0.433	0.485	0.174	0.001	0.582
V358	0.907	0.049	-0.276	-0.005	-0.062
V359	-0.470	-0.373	-0.547	-0.286	0.365
V360	0.506	0.332	-0.173	-0.070	0.585
V361	0.843	0.017	-0.411	-0.089	0.093
V362	0.516	0.743	0.131	-0.047	-0.290
V363	0.415	0.459	0.419	-0.060	-0.322
V364	0.517	0.744	0.129	-0.047	-0.289
V365	0.533	0.633	0.200	-0.053	-0.302
V366	0.516	0.743	0.131	-0.047	-0.290
V367	0.415	0.459	0.419	-0.060	-0.322
V368	0.517	0.744	0.129	-0.047	-0.289
V369	0.533	0.633	0.200	-0.053	-0.302
V370	0.450	0.728	-0.028	-0.204	0.178
V371	0.779	0.272	0.539	-0.089	-0.038
V372	0.438	0.752	-0.029	-0.193	0.168
V373	0.840	0.447	0.220	-0.063	-0.054
V374	0.417	0.725	-0.071	-0.193	0.233
V375	0.792	0.245	0.534	-0.090	-0.036
V376	0.397	0.749	-0.090	-0.178	0.229
V377	0.855	0.413	0.255	-0.069	-0.035
V378	0.417	0.725	-0.071	-0.193	0.233
V379	0.792	0.245	0.534	-0.090	-0.036
V380	0.397	0.749	-0.090	-0.178	0.229
V381	0.855	0.413	0.255	-0.069	-0.035
V382	-0.048	0.786	0.045	-0.044	0.052

V383	0.735	0.605	0.237	-0.113	-0.035
V384	0.888	0.298	0.318	-0.076	-0.031
V385	0.735	0.605	0.236	-0.113	-0.035
V386	0.934	0.301	0.094	-0.044	-0.087
V387	0.354	0.463	0.025	-0.153	0.539
V388	0.914	0.212	0.303	-0.068	-0.058
V389	0.366	0.482	0.056	-0.174	0.486
V390	0.876	0.181	0.086	-0.053	0.003
V391	-0.159	-0.066	-0.090	-0.050	0.901
V392	0.949	0.185	0.198	-0.053	-0.051
V393	-0.159	-0.065	-0.088	-0.050	0.902
V394	-0.071	-0.071	0.056	-0.043	0.916
V395	0.614	0.640	0.049	-0.157	0.348
V396	0.910	0.209	0.330	-0.068	-0.058
V397	0.618	0.643	0.072	-0.150	0.343
V398	0.951	0.236	0.088	-0.045	-0.034
V399	-0.291	-0.247	-0.374	-0.194	0.069
V400	-0.291	-0.247	-0.374	-0.194	0.069
V401	0.211	0.178	-0.269	-0.305	0.524
V402	0.874	0.348	0.287	-0.071	-0.104
V403	0.396	0.312	-0.105	-0.322	0.270
V404	0.890	0.286	0.132	-0.067	-0.042
V405	0.723	0.619	0.210	-0.129	0.112
V406	0.890	0.290	0.319	-0.073	-0.053
V407	0.726	0.618	0.215	-0.127	0.093
V408	0.938	0.295	0.095	-0.045	-0.074
V409	0.732	0.619	0.217	-0.122	0.015
V410	0.891	0.290	0.320	-0.074	-0.041
V411	0.732	0.617	0.221	-0.121	0.009
V412	0.938	0.296	0.094	-0.044	-0.082
V413	-0.066	-0.061	-0.083	0.983	-0.042
V414	-0.066	-0.061	-0.083	0.983	-0.042
V415	-0.066	-0.061	-0.083	0.983	-0.042
V416	-0.066	-0.061	-0.083	0.983	-0.042
V417	-0.066	-0.061	-0.083	0.983	-0.042
V418	-0.066	-0.061	-0.083	0.983	-0.042
V419	-0.066	-0.061	-0.083	0.983	-0.042
V420	-0.066	-0.061	-0.083	0.983	-0.042
V421	-0.066	-0.061	-0.083	0.983	-0.042
V422	-0.066	-0.061	-0.083	0.983	-0.042
V423	-0.066	-0.061	-0.083	0.983	-0.042
V424	-0.066	-0.061	-0.083	0.983	-0.042
V425	-0.066	-0.061	-0.083	0.983	-0.042

V426	-0.066	-0.061	-0.083	0.983	-0.042
V427	-0.066	-0.061	-0.083	0.983	-0.042
V428	-0.066	-0.061	-0.083	0.983	-0.042
V429	-0.066	-0.061	-0.083	0.983	-0.042
V430	-0.066	-0.061	-0.083	0.983	-0.042
V431	0.888	0.298	0.319	-0.076	-0.030
V432	0.935	0.301	0.093	-0.043	-0.087
V433	0.880	0.331	0.298	-0.065	-0.119
V434	0.909	0.337	0.190	-0.057	-0.088
V435	0.850	0.214	0.421	-0.091	0.090
V436	0.935	0.269	0.085	-0.039	-0.107
V437	0.924	0.261	0.246	-0.061	-0.080
V438	0.932	0.248	0.200	-0.056	-0.020
V439	0.861	0.382	0.279	-0.068	-0.123
V440	0.901	0.367	0.160	-0.058	-0.096
V441	0.870	0.274	0.379	-0.084	0.016
V442	0.936	0.297	0.107	-0.045	-0.086
V443	0.897	0.310	0.288	-0.069	-0.070
V444	0.935	0.303	0.111	-0.046	-0.082
V445	-0.066	-0.061	-0.083	0.983	-0.042
V446	-0.066	-0.061	-0.083	0.983	-0.042
V447	0.705	0.634	0.221	-0.131	0.117
V448	0.175	0.829	-0.059	-0.018	-0.098
V449	0.765	0.322	0.058	-0.041	-0.146
V450	0.174	0.828	-0.061	-0.017	-0.101
V451	0.674	0.580	-0.119	-0.014	-0.135
V452	0.175	0.829	-0.059	-0.018	-0.098
V453	0.765	0.322	0.058	-0.041	-0.146
V454	0.174	0.828	-0.061	-0.017	-0.101
V455	0.674	0.580	-0.119	-0.014	-0.135
V456	0.175	0.829	-0.059	-0.018	-0.098
V457	0.765	0.322	0.058	-0.041	-0.146
V458	0.174	0.828	-0.061	-0.017	-0.101
V459	0.674	0.580	-0.119	-0.014	-0.135
V460	0.037	0.794	-0.065	-0.006	-0.105
V461	0.037	0.794	-0.065	-0.006	-0.105
V462	0.095	0.202	0.769	-0.156	0.031
V463	0.208	0.203	0.745	-0.156	0.023
V464	-0.158	-0.210	-0.245	0.717	-0.200
V465	-0.066	-0.061	-0.083	0.983	-0.042
V466	-0.158	-0.210	-0.245	0.717	-0.200
V467	-0.066	-0.061	-0.083	0.983	-0.042
V468	-0.187	-0.156	-0.115	0.021	0.856

V469	-0.131	-0.284	0.561	-0.055	0.329
V470	-0.187	-0.156	-0.115	0.021	0.856
V471	-0.103	-0.155	0.121	-0.007	0.766
V472	-0.166	-0.072	-0.119	-0.051	0.884
V473	0.187	0.253	0.600	-0.064	0.078
V474	-0.166	-0.072	-0.119	-0.051	0.884
V475	-0.150	-0.095	-0.008	-0.037	0.904
V476	-0.254	-0.005	-0.089	-0.058	0.801
V477	0.456	0.253	0.471	-0.050	0.059
V478	-0.254	-0.005	-0.089	-0.058	0.801
V479	-0.018	0.119	0.175	-0.035	0.752
V480	-0.178	0.053	-0.009	-0.069	0.856
V481	-0.074	0.086	0.225	-0.031	-0.129
V482	-0.172	-0.074	-0.120	-0.048	0.893
V483	0.436	0.273	0.474	-0.055	0.082
V484	-0.172	-0.074	-0.120	-0.048	0.893
V485	-0.146	-0.092	0.004	-0.036	0.914
V486	-0.237	-0.088	-0.112	-0.005	0.870
V487	0.450	0.238	0.482	-0.053	0.074
V488	-0.237	-0.088	-0.112	-0.005	0.870
V489	-0.071	-0.033	0.163	-0.022	0.848
V490	0.059	0.210	0.775	-0.155	0.033
V491	-0.057	-0.122	0.352	-0.015	-0.048
V492	-0.057	-0.129	0.364	-0.013	-0.046
V493	-0.056	-0.111	0.324	-0.018	-0.038
V494	-0.057	-0.123	0.354	-0.015	-0.048
V495	-0.058	-0.124	0.355	-0.015	-0.046
V496	-0.172	-0.037	0.300	-0.078	0.243
V497	-0.172	-0.037	0.300	-0.078	0.243
V498	0.616	0.541	0.005	-0.034	-0.215
V499	0.839	0.456	-0.078	-0.025	-0.180
V500	0.616	0.541	0.005	-0.034	-0.215
V501	0.839	0.239	-0.087	-0.022	-0.128
V502	0.938	-0.077	-0.164	-0.007	-0.041
V503	0.939	-0.079	-0.164	-0.008	-0.041
V504	0.491	0.698	0.095	-0.046	-0.292
V505	0.507	0.690	0.091	-0.045	-0.291
V506	0.491	0.698	0.095	-0.046	-0.292
V507	0.737	0.605	0.227	-0.121	-0.038
V508	0.888	0.298	0.319	-0.076	-0.030
V509	0.935	0.301	0.093	-0.043	-0.087
V510	0.737	0.617	0.223	-0.069	-0.079
V511	0.646	0.466	0.564	-0.094	-0.134

V512	0.806	0.487	0.256	-0.063	-0.167
V513	0.702	0.601	0.318	-0.078	-0.147
V514	0.195	0.037	0.682	-0.172	0.594
V515	0.465	0.577	0.439	-0.325	0.286
V516	0.792	0.393	0.425	-0.081	-0.116
V517	0.832	0.412	0.340	-0.072	-0.076
V518	0.690	0.600	0.366	-0.109	0.005
V519	0.427	0.693	0.529	-0.103	-0.081
V520	0.778	0.567	0.212	-0.091	-0.075
V521	0.654	0.496	0.526	-0.092	-0.135
V522	0.834	0.471	0.202	-0.059	-0.160
V523	-0.070	0.044	0.432	-0.052	-0.077
V524	0.734	0.609	0.254	-0.127	-0.020
V525	0.811	0.392	0.408	-0.082	-0.093
V526	0.896	0.384	0.170	-0.053	-0.116
V527	0.182	0.222	0.826	-0.070	0.167
V528	-0.278	-0.025	0.026	-0.314	0.759
V529	0.780	0.399	0.466	-0.093	-0.013
V530	0.734	0.609	0.254	-0.127	-0.020
V531	0.811	0.392	0.408	-0.082	-0.093
V532	0.896	0.384	0.170	-0.053	-0.116
V533	0.737	0.605	0.227	-0.121	-0.038
V534	0.741	0.618	0.211	-0.067	-0.002
V535	0.377	0.401	0.344	-0.417	0.487
V536	0.786	0.556	0.217	-0.094	-0.043
V537	0.656	0.581	0.382	-0.135	0.175
V538	0.737	0.601	0.246	-0.147	0.026
V539	0.766	0.570	0.223	-0.090	-0.126
V540	0.096	-0.025	-0.368	0.045	0.165
V541	0.096	-0.025	-0.368	0.045	0.165
V542	-0.066	-0.061	-0.083	0.983	-0.042
V543	-0.066	-0.061	-0.083	0.983	-0.042
V544	0.565	0.726	0.158	-0.045	-0.272
V545	0.755	-0.174	-0.149	-0.020	-0.040
V546	-0.196	-0.303	0.885	-0.074	-0.024
V547	0.290	0.151	0.846	-0.069	-0.193
V548	0.924	0.242	0.262	-0.064	-0.075
V549	0.290	0.151	0.846	-0.069	-0.193
V550	0.892	0.323	0.065	-0.037	-0.180
V551	0.515	0.668	0.331	-0.068	-0.240
V552	0.184	-0.008	0.906	-0.105	0.036
V553	0.711	0.379	-0.166	-0.017	-0.078
V554	0.680	0.159	-0.212	0.205	-0.136

V555	0.490	-0.094	0.558	-0.044	-0.178
V556	0.579	0.722	0.146	-0.045	-0.268
V557	0.912	0.251	0.291	-0.067	-0.075
V558	0.895	0.362	-0.081	-0.026	-0.161
V559	0.586	0.730	0.038	-0.039	-0.245
V560	0.567	0.705	0.264	-0.060	-0.248
V561	0.858	-0.090	-0.195	0.053	-0.080
V562	0.935	0.069	-0.166	-0.010	-0.064
V563	0.859	-0.109	-0.162	-0.020	-0.047
V564	-0.143	-0.298	0.898	-0.075	-0.039
V565	0.485	0.259	0.520	-0.189	0.451
V566	-0.122	-0.058	0.877	-0.080	-0.120
V567	-0.146	0.029	0.846	-0.078	-0.152
V568	-0.046	-0.338	0.859	-0.083	0.107
V569	0.185	-0.011	0.928	-0.077	-0.154
V570	0.922	0.326	0.126	-0.063	-0.027
V571	0.892	0.300	0.136	-0.045	-0.187
V572	0.137	-0.006	0.938	-0.080	-0.150
V573	0.953	0.269	0.082	-0.058	-0.033
V574	0.880	0.322	0.153	-0.046	-0.193
V575	0.275	0.801	0.088	-0.031	-0.260
V576	0.619	0.636	0.003	-0.033	-0.239
V577	0.275	0.801	0.088	-0.031	-0.260
V578	0.325	0.745	0.081	-0.030	-0.255
V579	0.427	-0.132	-0.102	-0.014	-0.047
V580	0.427	-0.132	-0.102	-0.014	-0.047
V581	0.427	-0.132	-0.102	-0.014	-0.047