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Priority determination in strategic energy policies in Turkey using analytic network process (ANP) with group decision making

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SUMMARY

In developing countries, energy consumption is continuously increasing in parallel to the developing technology. Turkey is one of these countries with its increasing population and energy demand, which increases every year with a very high rate, that is, 8% annually. Moreover, along with the increasing energy demand, the strategic energy policies have to be analyzed scientifically including the geographical importance for the realization phase. It is necessary to prioritize the determined policies and plan them according to the economic situation of the country. Hence, alternative energy policies have been prioritized objectively with scientific methods including the related institutions' evaluation. In this study, a model based on analytic network process, a group decision-making technique, is proposed for evaluating strategic energy policies. The model is used to assign priorities to strategic energy policies of Turkey. With this model, various people are included in the decision-making process and the effectiveness of the process is increased. Copyright © 2008 John Wiley & Sons, Ltd.

KEY WORDS: energy policies; strategic planning; multi-criteria decision analysis; analytic network process (ANP); BOCR

1. INTRODUCTION

Energy is one of the basic inputs for planning the future of a country. The developed countries are intensively working on the energy policies and developing different ones to compensate the increase in energy demand. Turkey is one of the fast developing countries and energy demand is continuously increasing. Studies on forecasting the future energy requirement have shown that the energy requirement will rapidly increase in next years [1–5].

There are several studies in the literature that try to determine the energy policies of Turkey [6–9]. They mostly use previous years' evaluations about energy policies or evaluations based on products such as electricity, natural gas, coal, etc. The strategic energy policies are determined by State Planning Organization (DPT). DPT develops alternative policies to satisfy the increasing energy demand and performs some studies with the related institutions to realize them on the basis of determined priorities. The

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developed and prioritized energy policies about future are as follows [10]:

Policy 1: Evaluation of the native resources for the balancing of outresources in an acceptable level.

Policy 2: The privatization of electric transmission and distribution facilities in order to establish a competitive market.

Policy 3: Integrating the national electric system with European transmission systems in order to make potentially energy trade beyond borders possible.

Policy 4: Spreading the natural gas consumption over wide areas competitively and establishing seasonal supply security against the variations in demand.

Policy 5: Planning the connection of the regional energy production resources from Turkey to Europe as the main transit line.

DPT plans to realize these projects in given priorities with the related institutions working on energy sector such as Ministry of Energy and Natural Resources (ETKB), Turkish Electricity Distribution Company (TEDAŞ), Turkish Electricity Transmission Company (TEİAŞ), Turkish Treasury (HM), National Oil company (TPAO), Energy Market Regulatory Authority (EPDK), and Petroleum Pipeline Corporation (BOTAŞ).

In this study, a new model is proposed to determine the policy priorities objectively with the cooperation of related institutions. The aim of the model is to determine the priorities of energy policies on a scientific basis. Analytic network process (ANP) with benefits, opportunities, costs, and risks (BOCR), which is a practical multi-criteria decision-making method introduced by Saaty [11], is used to calculate the priorities. ANP approach has major advantages [12]: (a) with ANP, the criteria priorities can be determined based on pair-comparison rates by decision-maker's judgment rather than arbitrary scales; (b) with ANP, decision-makers can consider both tangible and intangible factors; (c) ANP can transform qualitative values into numerical values for comparative analysis; (d) ANP is such a simple and intuitive approach that decision-makers can easily understand and apply it even without professional or special knowledge; (e) ANP allows participation of all stakeholders and decision-makers to join in the decision process; (f) ANP differs from analytic hierarchy process (AHP) in that it allows feedback and interdependence among criteria. Because of these advantages ANP approach is preferred in this study.

The remainder of this article is structured as follows: In Section 2, brief information of ANP is given. In Section 3, proposed model for prioritization of strategic energy policies is presented and the stages of the proposed model are explained in detail. How the proposed model is used is explained in Section 4. In Section 5, conclusions and suggestions are discussed.

2. ANALYTIC NETWORK PROCESS

The initial study identified the multi-criteria decision technique known as the AHP to be the most appropriate method for solving complicated problems. AHP was first introduced by Saaty [13] and used in different decision-making processes related to production [14–16], energy [17–21], investment [22,23], location [24–26] and agricultural activities [27]. AHP is a comprehensive framework that is designed to cope with the intuitive, the rational, and the irrational when we make multi-objective, multi-criterion, and multi-actor decisions with or without certainty for any number of alternatives. An advantage of the AHP over other multi-criteria decision-making methods is that AHP is designed to incorporate tangible as well as intangible criteria especially where the subjective judgments of different individuals constitute an important part of the decision process [28]. The basic assumption of AHP is the functional independence of an upper part or cluster of the hierarchy from all its lower parts, the criteria and items in each level. Many decision-making problems cannot be structured hierarchically because they involve the interaction and dependence of higher-level elements on lower-level elements [11,29]. Structuring a problem involving functional dependence allows for feedback among clusters. This is a network system. Saaty suggested the use of AHP to solve the problem of independence on alternatives or criteria, and the use of ANP to solve the problem of dependence among alternatives or criteria [30].

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The ANP, also introduced by Saaty, is a generalization of the AHP [11]. As AHP represents a framework with a uni-directional hierarchical AHP relationship, ANP allows for complex inter-relationships among decision levels and attributes. The ANP feedback approach replaces hierarchies with networks in which the relationships among levels are not easily represented as higher or lower, dominant or subordinate and direct or indirect [31]. For instance, not only does the importance of the criteria determine the importance of the alternatives, as in a hierarchy, but also the importance of the alternatives may have an impact on the importance of the criteria [11]. Therefore, a hierarchical structure with a linear top-to-bottom form is not suitable for a complex system.

The ANP is a coupling of two parts [7]: the first consists of a control hierarchy or network of criteria and subcriteria that control the interactions in the system and the second is a network of influences among the elements and the clusters. The network varies from criterion to criterion and a supermatrix of limiting influence is computed for each control criterion [7]. As a result, a supermatrix is actually a partitioned matrix, where each matrix segment represents a relationship between two elements in a system. To obtain global priorities in a system with interdependent influences, the local priority vectors are entered in the appropriate columns of a matrix. As the supermatrix is built in this way, the sum of each column corresponds to the number of comparison sets. Finally, each supermatrix is weighted by the priority of its control criterion and the results are synthesized through addition for every control criterion. In addition, a problem is often studied through a control hierarchy or system of benefits, a second for costs, a third for opportunities and a fourth for risks [7].

The process of ANP consists of four major steps [32]:

Step 1: Model construction and problem structuring. The problem should be stated clearly and decomposed into a rational system similar to a network. This structure can be obtained by decision-makers through brainstorming or other appropriate methods.

Step 2: Pairwise comparison matrices and priority vectors. In ANP, like AHP, decision elements at each cluster are compared pairwise with respect to their importance towards their control criterion, and the clusters themselves are also compared pairwise with respect to their contribution to the goal. Decision-makers are asked to respond to a series of pairwise comparisons where two elements or two clusters at a time are compared in terms of how they contribute to their particular upper-level criterion [31]. In addition, if there are interdependencies among elements of a cluster, pairwise comparisons also need to be created, and an eigenvector can be obtained for each element to show the influence of other elements on it. The relative importance values are determined with Saaty's 1–9 scale (Table I), where a score of 1 represents equal importance between the two elements and a score of 9 indicates

Table I. Saaty's 1–9 scale [11].

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one over another
5	Strong importance	Experience and judgment strongly favor one over another
7	Very strong importance	Activity is strongly favored and its dominance is demonstrated in practice
9	Absolute importance	Importance of one over another affirmed on the highest possible order
2,4,6,8	Intermediate values	Used to represent compromise between the priorities listed above
Reciprocal of above non-zero numbers	If activity i has one of the above non-zero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i	

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the extreme importance of one element (row component in the matrix) compared with the other one (column component in the matrix) [31].

Step 3: Supermatrix formation and determining limit supermatrix. The supermatrix concept is similar to the Markov chain process [11]. To obtain global priorities in a system with interdependent influences, the local priority vectors are entered in the appropriate columns of a matrix. As a result, a supermatrix is actually a partitioned matrix, where each matrix segment represents a relationship between two nodes (components or clusters) in a system. Let the clusters of a decision system be C_k, $k = 1, 2, \ldots, n$, and each cluster k has m_k elements, denoted by $e_{k1}, e_{k2}, \ldots, e_{k_{m_k}}$. The local priority vectors obtained in Step 2 are grouped and located in appropriate positions in a supermatrix based on the flow of influence from a cluster to another cluster, or from a cluster to itself as in the loop. A standard form of a supermatrix is as follows [11]:

$$\mathbf{W} = \begin{array}{cc} & \begin{array}{ccc} C_1 & C_k & C_n \\ e_{11}\; e_{12} \ldots e_{1m1} & \ldots e_{k1}\; e_{k2} \ldots e_{kmk} & \ldots e_{n1}\; e_{n2} \ldots e_{nmn} \end{array} \\ \begin{array}{cc} C_1 & \begin{array}{c} e_{11} \\ e_{12} \\ \vdots \\ e_{1m1} \end{array} \\ \vdots & \vdots \\ C_k & \begin{array}{c} e_{k1} \\ e_{k2} \\ \vdots \\ e_{kmk} \end{array} \\ \vdots & \vdots \\ C_n & \begin{array}{c} e_{n1} \\ e_{n2} \\ \vdots \\ e_{nmn} \end{array} \end{array} & \begin{bmatrix} \mathbf{W}_{11} & \cdots & \mathbf{W}_{1k} & \cdots & \mathbf{W}_{1n} \\ \vdots & & \vdots & \vdots & \vdots \\ \mathbf{W}_{k1} & \cdots & \mathbf{W}_{kk} & \cdots & \mathbf{W}_{kn} \\ \vdots & & & \vdots & \\ \mathbf{W}_{n1} & \cdots & \mathbf{W}_{nk} & \cdots & \mathbf{W}_{nn} \end{bmatrix} \end{array} \qquad (1)$$

Raising a matrix to powers gives the long-term relative influences of the elements on each other. To achieve a convergence on the importance weights, the weighted supermatrix is raised to the power of $2k+1$, where k is an arbitrarily large number, and this new matrix is called the limit supermatrix [11]. The limit supermatrix has the same form as the weighted supermatrix, but all the columns of the limit supermatrix are the same. By normalizing each block of this supermatrix, the final priorities of all the elements in the matrix can be obtained.

Step 4: Synthesize the results. If the supermatrix formed in Step 3 covers the whole network, the priority weights of alternatives can be found in the column of alternatives in the normalized supermatrix. On the other hand, if a supermatrix is only composed of interrelated clusters, additional calculations must be made to obtain the overall priorities of the alternatives. The alternative with the highest overall priority should be the one selected. In application of ANP, software such as Ecnet, Super Decisions or mathematical programs such as Excel, MATLAB, Mathematica can be used [33]. In this study, Super Decisions software version 14.1 is used.

There are many studies in the literature using ANP to solve decision-making problems. Meade and Sarkis [31,34] used ANP in two of their studies. In the first study, alternative projects for agile manufacturing are evaluated using ANP and logistics, and supply chain management analysis is performed in the second. Also in two separate studies performed by Lee and Kim [35,36], ANP is used in the interdependent information system project selection process. Besides, Karsak *et al.* [37] and Partovi and Corredoira [38] used ANP in quality function deployment process, whereas Meade and Presley [39] used ANP to evaluate alternative research-development projects. Similarly, Sarkis [40] and Gencer and Gürpinar [33] employed ANP in supplier selection problem. ANP is used by Yüksel and Dağdeviren [30] for SWOT analysis and by Dağdeviren *et al.* [41] to determine faulty behavior risks in work systems. ANP is also utilized in a few studies in energy sector. ANP is used by Ulutaş [7] to evaluate energy resources suitable for Turkey, by Chen *et al.* [42] for lifespan energy efficiency assessment of intelligent buildings, by Erdoğmuş *et al.* [28] for evaluating alternative fuels for residential heating and by Köne and Büke [43] for evaluating alternative fuels for electricity production.

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3. THE PROPOSED ANP MODEL

The proposed ANP model to priority strategic energy policy is composed of the following steps:

Step 1: Setting up the expert team.

Step 2: Determining control hierarchy and strategic criteria. Control hierarchy is structured such that the objective is in the first level, strategic criteria are in the second level and the BOCR is in the third level.

Step 3: Determining subnetworks of BOCR. BOCR criteria, alternative strategic energy policies and participants are included in subnetworks. Besides, the dependencies among clusters are presented in these subnetworks.

Step 4: Determining weights of strategic criteria: After setting up the network model and required connections, pairwise comparisons for the priorities of the strategic criteria are performed by the expert team and the comparison results are combined by geometric mean. In the same manner, pairwise comparisons for the priorities of the policies are performed by the expert team. The elements in a cluster are compared by applying Saaty's 1–9 scale (Table I) according to their influence on an element in another cluster to which they are connected (or on elements in their own cluster). The inconsistency measure is useful for identifying possible errors in judgments as well as actual inconsistencies in the judgments themselves [44]. For example, if A is more important than B and B is more important than C, C cannot be important than A. Inconsistency ratio should be less than 0.1 [45]. While doing pairwise comparisons, the inconsistency value is considered in all stages.

Step 5: Determining weights of BOCR based on strategic criteria. Linguistic variables proposed by Cheng [46] are used in this step. The membership functions of these linguistic variables are shown in Figure 1, and the average numbers related with these variables are shown in Table II.

Step 6: Weights of BOCR criteria are determined by taking the dependencies in subnetworks (Step 3) into account. Super Decision Software is used in these computations.

Step 7: Priorities of strategic energy policies are determined according to the weights of strategic criteria, BOCR and BOCR criteria computed in previous steps. The alternative with the highest priority is chosen as the best alternative and remaining alternatives are ranked in decreasing order of priority.

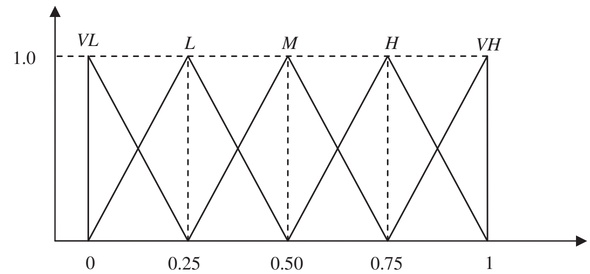

Figure 1. Membership functions of linguistic values for criteria rating.

Table II. Linguistic values and average numbers.

Linguistic values	Average numbers
Very high (VH)	1
High (H)	0.75
Medium (M)	0.5
Low (L)	0.25
Very low (VL)	0

4. APPLICATION OF THE PROPOSED MODEL

In this section, the proposed ANP model is explained with applications based on the steps given in the previous section.

Step 1: Setting up the expert team. In the first step of the proposed model, an expert team is formed with people who are experts in development and application of strategic energy policies. Expert team worked together to determine criteria and dependencies among them, to form pairwise comparison matrices and to analyze the results.

Step 2: Determining control hierarchy and strategic criteria. The proposed ANP model consists of two parts, namely control hierarchy and subnetworks. The first part control hierarchy is provided in Figure 2.

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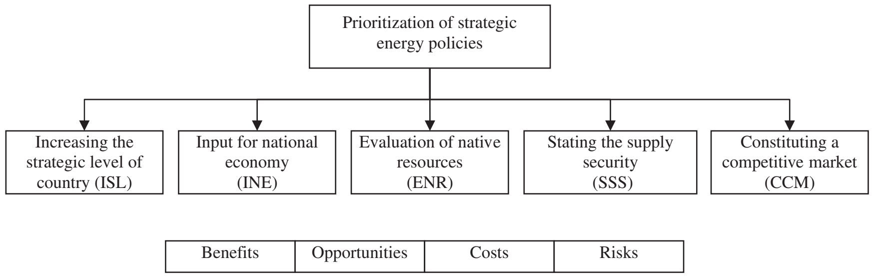

Figure 2. Control hierarchy of the proposed model.

The aim of the model, which is prioritization of strategic energy policies in this study, is placed in the beginning of control hierarchy. This control hierarchy consists of four kinds of subnetworks: BOCR, each of which represents the relationship of its own clusters and elements. Expert team decided that BOCR factors are not at the same importance level and five strategic criteria are added to model to determine the weights of BOCR. These criteria, given below, are determined by the expert team using brainstorming:

- Increasing the strategic level of country.
- Input for national economy.
- Evaluation of native resources.
- Stating the supply security.
- Constituting a competitive market.

Step 3: Determining subnetworks of BOCR. Criteria, alternative policies, the participants and subnetworks showing the dependencies among them are in the second part of the proposed model. There are four subnetworks called, BOCR, in this part and they are presented in Figure 3. Two types of connections between nodes contained in clusters in each subnetwork are represented in figures, as one-way and two-way dependencies. If there are one-way dependences between the two clusters, it is represented with directed arrows. The two-way dependences are represented by bi-directed arrows. The arrow over the cluster of control criteria represents a feedback within this cluster.

The benefits subnetwork includes evaluation of native resources, improvement of loss-leakage rate, stating the natural gas, increasing the system effectiveness, protecting the environment; the opportunities subnetwork includes evaluation native resources, balancing the outresources in an acceptable level, developing the new and renewable energy resources, decreasing the unemployment; the costs subnetwork includes investment cost, running cost, storage cost, maintenance cost, risk cost; finally, the risks subnetwork includes increasing the dependency of important, untapped capacity, problems of investments, embargo, tax and price policies. Each subnetwork contains two clusters. Five alternative strategic energy policies described in the introduction (policies 1–5) are in the first cluster, while participating institutions (ETKB, TEDAŞ, TEİAŞ, DPT, HM, TPAO, EPDK, BOTAŞ) are in the second cluster. The groups in participants cluster in all subnetworks are not weighted among themselves. This means that decision by clusters would have the same contribution to the final decision.

Step 4: Determining weights of strategic criteria. In this step, weights of strategic criteria are determined using pairwise comparison matrices. For this purpose, expert team members compared strategic criteria based on the aim of 'prioritization of strategic energy policies' and formed their own pairwise comparison matrices. From the geometric averages of these comparison matrices, the final pairwise comparison matrix is determined and is provided in Table III.

From Table III, it is seen that the most important strategic criterion is 'increasing the strategic level of country' (0.327). Other strategic criteria are ranked in decreasing importance levels as follows: stating the supply security (0.187), input for national economy (0.182), constituting a competitive market (0.176) and evaluation of native resources (0.128).

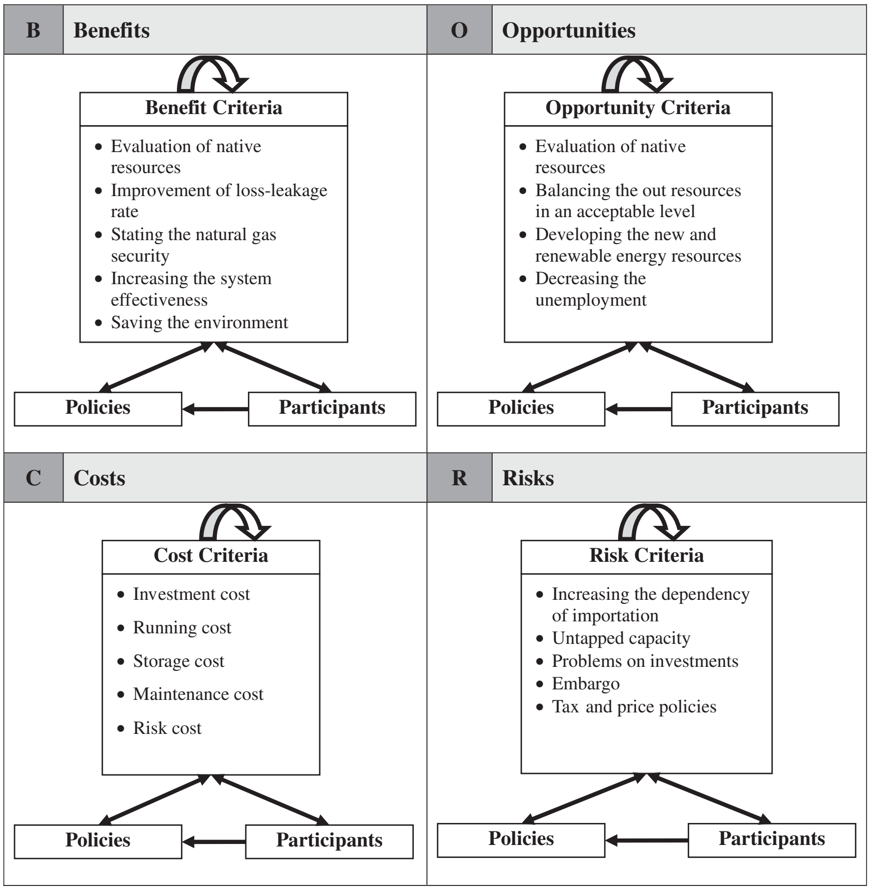

Figure 3. The subnetworks for BOCR.

Table III. Pairwise comparison matrix for strategic criteria and weights.

	ISL	INE	ENR	SSS	CCM	Weights
ISL	1	3.20	1.90	2.30	1.10	0.327
INE	0.31	1	2.10	1.30	0.90	0.182
ENR	0.53	0.48	1	0.72	0.85	0.128
SSS	0.43	0.77	1.39	1	1.85	0.187
CCM	0.91	1.11	1.18	0.54	1	0.176

Step 5: Determining weights of BOCR based on strategic criteria. After weights of strategic criteria are found, BOCR weights are determined as BOCR does not have the same importance in prioritization of energy policies. In this step, expert team evaluates BOCR based on each strategic criterion using linguistic values given in Table II through a group study. The questions about evaluation of BOCR according to strategic criteria were asked to all members of expert team at the same time and made them to be in consensus with their answers. These evaluations are given in Table IV.

The first step in calculating BOCR weights is to multiply the averages of linguistic values with strategic criteria weights. By normalizing them, BOCR weights are obtained. The results calculated by this operation are given in the last column of Table IV. According to these results, approximate weights of BOCR, which were obtained from the results of calculations, are 0.337, 0.307, 0.270 and 0.086, respectively.

Step 6: Determining BOCR criteria weights. In this step of the proposed model, weights of criteria included in BOCR subnetworks are determined. As done in the previous steps, expert team members formed their personal pairwise comparison matrices, and by taking geometric average of them, final pairwise comparison matrices are obtained. Using the weights from these comparison matrices, the supermatrix is formed and weights of criteria in BOCR subnetworks are determined using Super Decision software. The calculated final relative weights are given in Table V.

According to Table V, the most important BOCR criteria are, 'stating the natural gas security', 'balancing the outresources in an acceptable level', 'running cost' and 'increasing the dependency of importation' in this order.

Step 7: Determining priorities of alternative energy policies. In this last step of the proposed model, priorities of strategic energy policies are determined. Two formulas, additive and multiplicative, are used in the computation of policy priorities. The additive and multiplicative formulas can be given as $bB+oO-cC-rR$ and $\{B^bO^o[(1/C)_{\text{Normalized}}]^c[(1/R)_{\text{Normalized}}]^r\}$, respectively, where B, O, C and R represent the synthesized results; whereas b, o, c and r are BOCR rates [28,47,48]. Obtained results are given in Table VI. Alternative policies are given in the first column of Table VI, and priorities of alternative policies based on BOCR subnetworks that are computed by Super Decision Software can be found in the following four columns. In the last two columns, final relative policy priorities found by additive and multiplicative formulas are provided.

According to Table VI, policy 2, '*The privatization of electric transmission and distribution facilities in order to establish a competitive market*', has the

Table IV. BOCR weights.

	ISL (0.327)	INE (0.182)	ENR (0.128)	SSS (0.187)	CCM (0.176)	Weights
Benefits	VH	VH	VH	VH	VH	0.337
Opportunities	VH	VH	VH	H	H	0.307
Costs	VH	H	M	H	H	0.270
Risks	L	L	L	M	VL	0.086

Table V. Final relative weights of criteria in BOCR subnetworks.

BOCR	Criteria	Final relative weights
Benefit	Evaluation of native resources	0.2307
	Improvement of loss-leakage rate	0.1081
	Stating the natural gas security	0.3648
	Increasing the system effectiveness	0.1671
	Saving the environment	0.1293
Opportunity	Evaluation of native resources	0.1675
	Balancing the outresources in an acceptable level	0.3016
	Developing the new and renewable energy resources	0.2992
	Decreasing the unemployment	0.2321
Cost	Investment cost	0.2253
	Running cost	0.2345
	Storage cost	0.2050
	Maintenance cost	0.1875
	Risk cost	0.1477
Risk	Increasing the dependency of importation	0.3226
	Untapped capacity	0.1408
	Problems on investments	0.2347
	Embargo	0.1046
	Tax and price policies	0.1973

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Table VI. Priorities of alternative policies according to additive and multiplicative formulas.

Policy	B (0.337)	O (0.307)	C (0.270)	R (0.086)	Additive formula	Multiplicative formula
Policy 1	0.419	0.249	0.429	0.1081	0.0925	0.1979
Policy 2	0.285	0.258	0.056	0.1671	0.1457	0.2906
Policy 3	0.108	0.214	0.317	0.2307	0.0032	0.1205
Policy 4	0.083	0.175	0.064	0.1293	0.0532	0.1678
Policy 5	0.105	0.104	0.134	0.3648	0.0023	0.1160

Table VII. Comparative results.

	Policy 1	Policy 2	Policy 3	Policy 4	Policy 5
The priorities given from DPT	1	2	3	4	5
Final relative importance values based on additive formula in ANP model	0.0925	0.1457	0.0032	0.0532	0.0023
Ranking in additive formula in ANP model	2	1	4	3	5
Final relative importance values based on multiplicative formula in ANP model	0.1979	0.2906	0.1205	0.1678	0.1160
Ranking in multiplicative formula in ANP model	2	1	4	3	5

highest priority in both formulas. Final ranking is the same for both formulas and policy 2 is followed by policies 1, 4, 3 and 5, in this order.

Additionally, the priorities obtained from the proposed model and those determined by DPT, which are explained in the introduction, are compared. Comparative results are given in Table VII.

The priorities assigned by DPT and the priorities obtained from the proposed model are different. Only policy 5 has the same priority. Policy 1, which is determined as the policy with the highest priority by DPT, is given the second priority by our model.

5. CONCLUSION AND SUGGESTIONS

One of the most important tasks of governments is to make the plans according to energy demand of the country and prevent probable bottlenecks. Energy is very important as it is one of the basic needs of men. Therefore, developing strategic policies as well as satisfying the energy demand in a given period is a major task for governments. These policies should be developed based on strategic criteria such as using energy resources of the country efficiently, decreasing dependency to foreign resources and estimating and preventing possible bottlenecks in the long term. This planned work should be performed by all related institutions together, and scientific methods should be used instead of subjective decisions in this process.

In this study, a prioritization model for strategic energy policies with ANP is proposed. The model is used to prioritize the strategic energy policies of Turkey. In the model, we first determine strategic criteria to be used in prioritization of alternative energy policies, and a control hierarchy is developed based on these criteria. Alternative energy policies are analyzed based on this control hierarchy by the expert team. Alternative energy policies are evaluated for BOCR individually. There are two main reasons for the use of ANP method in the model. Firstly, ANP allows the simultaneous evaluation of qualitative and quantitative criteria in the decision process. Secondly, the dependencies among the alternative energy policies, participants and BOCR criteria are analyzed using ANP, and these dependencies are taken into account while determining the criteria weights. Especially, other ranking methods do not have the second property of ANP.

When the priorities obtained from the proposed model and those determined by DPT are compared (Table VII), it is observed that the

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results are different. Evaluating and prioritizing strategic energy policies based on BOCR criteria are important to estimate probable risks of the future. In this manner, precautions could be taken against probable risks. Another benefit of the proposed model is that it increases the effectiveness of the decision by allowing participation of related institutions. Multiple decision-makers are often preferred rather than a single decision-maker to avoid the bias and minimize the partiality in the decision process [49]. As decisions made in the energy area affect all societies, the decisions should not be made by the initiative of one man. Taking the comments of different people who are related to the problem improves the effectiveness and correctness of the decision. Besides, it is necessary to use scientific approaches in decision processes as the criteria are qualitative in most cases and it is not possible to determine related parameters correctly. Therefore, developing a group decision-making systems for energy policy are very useful. In this manner, ideas of different people are combined using a scientific method. Moreover, if all sectors affected from the decision participate in a decision-making process, future conflicts could be prevented.

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