# Impact of Demand Side Management on Spinning Reserve Requirements Designation

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**Abstract-** The most important responsibility of power system operators is to ensure the reliability of the system. Protecting the load-generator balance is an important part of reliability. There are some uncertainties in the power systems in this regard. In Turkey, the fact that renewable (both solar and wind) penetration, changing peak loads and production results can change unexpectedly must be taken into consideration. The country has more difficulty in operating the energy system, so there is a greater need for system reserves to be created. The demand side needs to be well examined to ensure that the amount of reserves to be kept is at optimum cost. The socioeconomic parameters affecting this cost are added to the account and the minimum cost is created. For this reason, this study shows that the support reserves must maintain the required amount, depending on the demand side conditions.

**Keywords** Spinning Reserve, Demand Side Management, Ancillary Services, Value of Lost Load, Expected Energy Not Served.

## 1. Introduction

The electricity industry and offer entry into a shop for electricity has needed the creation of Ancillary Services (AS). The aim of AS is to aid protect the quality and the security of the offer of electricity. Particularly, control of the frequency requirements that a set amount of active power should be hold in reserve to be able to reconstitute the level-between generation and load at all times. Operating reserves, which is used in AS, are provided by the units which are engaged in the periods determined by the System Operator. The reserves can contribute to correcting system frequency deviation and providing system stability. In this process, additional production capacity is not engaged. The amount of operating reserve is determined by Turkish Electricity Transmission Company (TEIAS) considering the supply, the inadequacy of the Spinning Reserve (SR) and disability of the unit and block with the highest load. Demand side management, by supporting the responsive and interaction ness of the customers.

Usually, this reserve can be describe as the quantity of generation capacity that can be used to generate active power upon a given period of time. The reserve has not yet been committed to the generation of energy during this time. Actually, several types of reserve services are Necessary to answer to different types of cases on different time frames. Especially, the term "SR" is widely used in the literature, this reserve can be describe in several methods. This may lead to some confusion. To help reduce this confusion, this document proposes a definition of SR. It also provides the amount of SR required for the state governor to determine the reserve capacity.

This reserve is run below their nominal levels and can be used if there is a particular need rapidly, in which the current power generating units of the turning. The raised quantity of the current reserve raises the power quality and system reliability when the system generation cost also raises [1], [2]. To obtain a general description of the SR, it seems Necessary to eliminate the idea of time. Actually, each system includes its own properties. But, there is a system operator, in any system. Thus, this concept can be used within the suggested description. As a result, referred to as "demand side" or "generator" it seems to be interesting to get divorced, which can present more uncertainty. For this reason, we suggest the following description: unused capacity is SR. This reserve is provided by devices synchronized to the network and it is able to affect the active power, which can be initiated on decision of the system operator [3]. The energy programs, to adopt different approaches for this problem, which are primarily based upon the stability and the knowledge of their systems [4], [5]. Synchronized to the grid, online generators, which can immediately the increased output in response to a large deduction and will reach full capacity in 10 minutes [6]. A synchronized unloaded portion that is fully available within ten minutes, and is able to respond immediately to serve load [7]. System frequency deviation must be corrected and contribute to is ensure system stability. For this purpose, additional production capacity in the circuit can be received from the units and / or not activated and, the period set by the System Operator that can be put in the reserve units are provided.

The amount of SR; demand side management, failure to order ready and with maximum load, the unit is Determined by considering TEIAS our block is disabled. SR consists of the following reserve. The power generation system reserves can be categorized into non-SR and SR according to North American Electric Reliability Corporation (NERC) [8]. In China, the reserves are allocated into contingency reserves, loader Following reserves and maintenance reserves, which are constitute the non-SR, and contingency reserves used for different time-scale power generation dispatch and control where the loader Following and contingency reserves constitute the SR. Over the past few years, a lot of research has been done to evaluate the SR requirements. A multi-time-scale reserve power dispatch method [9] and reserve allocation method [10] sectional area to accommodate the integration of power generation.

## 2. The System of Frequency Equalization

Figure 1 shows a simplified schematic of the frame, which is normally used for frequency control. This embodiment generally includes three parts of control. These parts are named Tertiary, Secondary and Primary control [11]. In big interconnected systems, three forms of control are usually available. In small isolated system may not be as secondary controller.

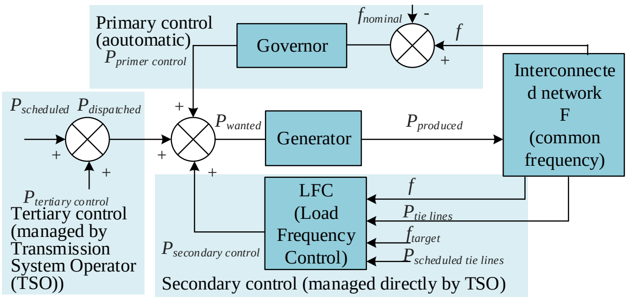

**Figure 1.** Frequency stabilization system [3].

In a simple manner, demand-side actions using the frequency adjustment is not included in this scheme is without conceptual changes could be considered.

Control of the three types can be defined as follows [12].

- *Primary Reserve:* It provides a power reserve against any frequency change, which is local automated control.
- *Secondary Reserve:* To provide in back-up power for frequency and bring it back to the target value of exchange programs, which is automatic control center.
- *Tertiary Reserve:* For the unit commitment and dispatch of the secondary reserve to repair, to control the final congestions, and to bring back the frequency of their target points if the secondary reserve is not enough.

The introduction sequencing of operating conditions is shown in Figure 2 [13].

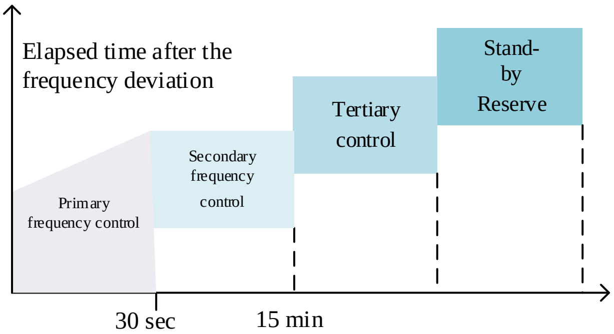

**Figure 2.** The activation sequence of operating reserves

The overall response time of the reserves is given below [14].

**Table 1:** The general response time of reserves

| Reserve | Primary Reserve | Secondary Reserve | Tertiary Reserve |
|---|---|---|---|
| Start | Immediate | > 30 second | |
| Full availability | < 30 second | <15minute | Usually > 15 minute to Hours |
| End | >15 minute | Until Tertiary Reserves is replaced | |

Phrases to be used in the equation (1). Therefore, frequency control systems, the governor Performed operations management and load shedding are provided. Overload is the variation between the active power demand ($P_{load}$) and active power generated ($P_{gen}$), the as a percentage of power generation. Governor control is shown in Figure 3 [15].

$$\frac{1}{\Delta_P} = \frac{P_{gen}}{(P_{gen} - P_{load})} \tag{1}$$

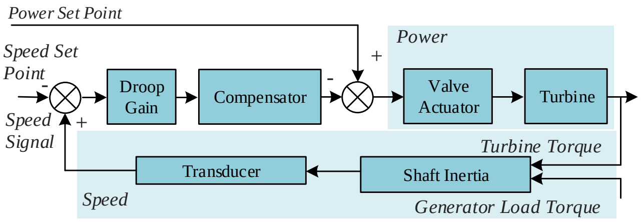

**Figure 3.** The control unit of the power frequency [16].

Great extreme loads, the ratio of the frequency disturbance is caused to grow. This effect is shown in Figure 4, as shown overload worthwhile to 10% of the value of the frequency is 49 Hz and 15% at the time of overload frequency down to 48,5 Hz is seen that value. The rotating plant of the system will tend to maintain its rotational speed due to its moment of inertia. Determines initial rate of decay of frequency for a given overload. The smaller the inertia of the rotating plant. Governor movement as a means of frequency control, load monitoring system automatically controls frequency and power generation to maintain. The total capacity of synchronized, the loader and minus the losses.

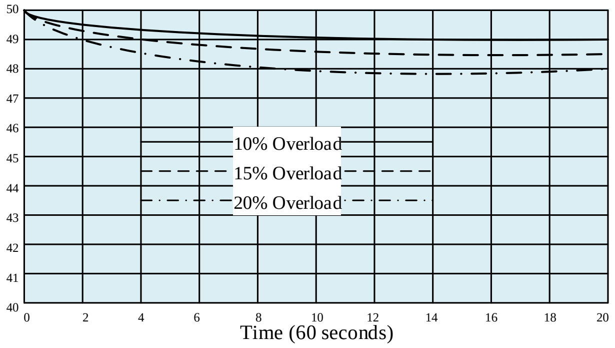

**Figure 4.** The effect on the frequency of overloading [17]

As decays system frequency, system demand decreases this effect due primarily to the dynamic behavior of the engine loads. Load Reduction Factor calculator in Eq. (2):

$$\frac{f_0}{P_{load}\,a} = \frac{\Delta f}{\Delta P_{load}} \times d \tag{2}$$

## 1. Optimal Planning of Spinning Reserve

In this study, the planned SR power system is defined as a broad demanding function. In different situations, the system operator adjusts the SR requirements according to off-line developed standards to achieve an acceptable risk level. These criteria are developed exclusively for each system, and consequently the SR requirements as well as acceptable risk vary from system to system. Table 2 shows the fixed criteria applied in the power systems of different countries.

SR is the supplementary production capacity that can be obtained from the units in the unit in order to contribute to the correction of the system frequency deviations and system stability and/or the redundancy provided by the units that are not in the circuit and can be replaced by the system operator. In an energy production system, in addition to meeting the demanded load of production, it is desirable to meet a certain amount of energy in terms of reliability of the system. It is called a gentle SR that is reserved for use when one or more of the units are disabled. SR amount; Demand is determined by TEIAS considering that the unit is inadequate inadequacy and the unit or block with the highest load is disabled. This amount is determined by the demand side management and enables more accurate quantification.

$$UC_{risk} = P\left[\sum_{i=1}^{N}\left(p_{i,t} + r_{i,t}\right) \leq p_{d,t}\right] \tag{3}$$

**Table 2**: SR requirements for different power systems

| **System** | **Criterion** $(r_{d,t})$ |
|---|---|
| Yukon Electricity | $\max(u_i^f P_i^{max}) + 10\% P_d^{max}$ |
| UCTE | $(10 P_{d,zone}^{max} + 150^2)^{\frac{1}{2}} - 150$ |
| Spain | $between\ 3(P_d^{max})^{\frac{1}{2}}\ and\ 6(P_d^{max})^{\frac{1}{2}}$ |
| Canada Hydro | $max(u_i^f P_i^{max})$ |
| Belgium | The UCTE rules are that at least 460 MW |
| US PJM (South) | $\max(u_i^f P_i^{max})$ |
| France | The UCTE rules are that at least 500 MW |
| California | $50\% \times \max(5\% \times P_{hydro} + 7\% \times P_{other\ gen}$ <br> $P_{The\ greatest\ possibility} + P_{Non-import\ company})$ |
| Canada Manitoba Hydro | $50\% \times \max(u_i^f P_i^{max}) + 20\% \left(\sum_{i=1}^{N} P_i^{max}\right)$ |
| ABD PJM (Kuzey) | $1.5\% P_d^{max}$ |
| US PJM (Other) | 1.1% peak value + Probabilistic calculation on normal days and hours |
| Netherlands | The UCTE rules are that at least 300 MW |
| Australia and New Zealand | $max(u_i^f P_i^f)$ |

Programmed and adequately reserve-capacity systems that help power systems resolve unscheduled energy interruptions without Ramp-up and Ramp-down forecast errors. This supply security creates a certain cost: the formation of reserve capacity significantly increases the cost of the operating system. Along with increased competition, this cost depends on a detailed examination and needs to be reassessed as a fundamental problem: then what should be the optimal amount of SR programmed? Many networks adopt decisive criteria for SR. According to the operating rules of the SRs, SR must be equal to or greater than the capacity of the largest generator, or a function of both of them [16]. Although it is easy to apply the defining criteria, this does not fit the predictive structure of the problem and the structural reliability of planned producers is not taken into account. Thus, probability techniques have been proposed for calculating the SR requirement [18]. These techniques determine the likelihood of failures to meet the "risk index" in equation (3) of a Unit Commitment (UC) and some immediate needs. This study describes how an UC can be integrated with an optimization technique [19].

Such a process will make it possible to prepare a daily or weekly production schedule, in addition to reducing the total fuel cost and re-negotiating the usual operating constraints, keeping the risk index at a certain level. These calculations are very helpful though "risk index" concept is intuitive and does not provide a basis to decide how much will be the amount of reserves. This study suggests the most appropriate risk index, which balances between achieving the most appropriate reserve requirement and the cost of Expected Energy Not Served EENS. In this cost / benefit analysis, the first factor is the by-product, the UC process, while the second factor is the only expected energy that cannot be provided by the Value of Lost Load (VOLL).

Suggests a market swap transaction pool including the determination of probability reserves [20]. The HP formulation contains two reliability criteria; Loss of Load Expectation (LOLE) and Loss of Load Probability (LOLP). LOLE the daily peak load is the average number of days for which the current production capacity is expected to be exceeded. LOLP is defined as the probability that the effective capacity of the system meets the load demand in equation (4). Under the assumption that the hourly loads are constant, it is the probability of the system load exceeding the current production capacity calculated using the hourly load curve [21].

$$\sum_{i=1}^{N} r_{i,t} \geq f(LOLP_{aim}) \tag{4}$$

This work is basically a function maximizing / minimizing social benefit / loss in the market. This function combines two conflicting goals. In one, reserve cost increases with common provision; On the other hand, the estimated cost of the interruptions, reserve provision is decreasing. The problem of minimizing the net price $\pi_{i,net}$ as objective function in equation (5) was formulated as follows:

$$min\left\{\pi_{i,net}\sum_{i=1}^{N_R} r_{i,t} + EC\right\} \tag{5}$$

In this form $N_R$ is a spare unit kit to provide SR. The optimum amount of SR is such that it costs the profit from it. This process is repeated in every period of optimization. However, the individual reliability of the generation units in this process has been ignored. EENS is the amount of energy that the generation system is expected to be unable to provide due to circumstances beyond the current generation capacity of the load case. This index is an even more important display because it measures the amount of inadequacy. It is becoming increasingly common. It is also assumed that the reserve market is independent of the energy market, which is why the bidder is limited to synchronized generation units. It is thought that ignoring the link between energy and reserve programming may result in lower value or unusable results [22].

In this study, the LOLE of the target function will be included in the calculations. By doing so, the need to implement a LOLE ceiling value is avoided. In addition, there are insufficient reserve resources to achieve such a ceiling value, or the inefficiencies that arise when these resources are not very reliable, as well as the difficulties in the LOLE limit. The formulation presented in these articles is a stochastic programming problem. Within this problem, there are dimensional problems due to possible permutations of the units in the optimization process.

VOLL represents the calculated average value when 1 MWh of consumers' electricity is accidentally interrupted [23]. This value is generally estimated on the basis of consumer surveys [24]. Since it is impossible to predict whether the interruptions will come to the scene, only one estimate cost can be calculated for a particular programming period. In this study, this value was calculated by the regression equation. This Expected Cost (EC) is equation (6) as follows:

$$EC_t = VOLL \times EENS_t \tag{6}$$

## 2. Application to Test System

The flow diagram for calculating the most basic SR value to be kept in generation unit is shown in Figure 5. This cycle is repeated t = 1: 24 hours and the SR for each time interval is calculated.

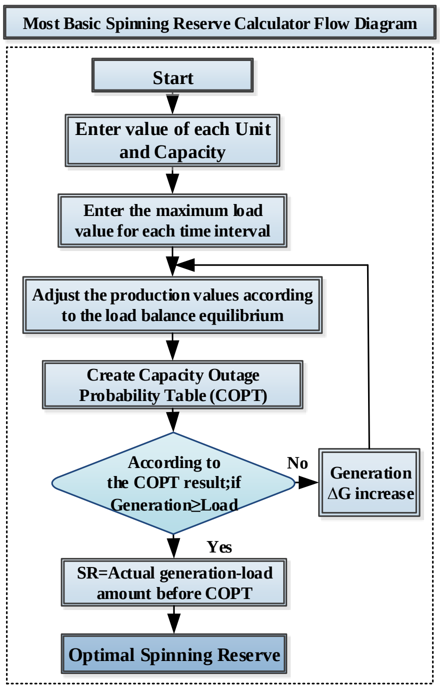

**Figure 5:** Flow diagram for the most basic SR Requirements

The failure probabilities of the transmission lines are neglected in the result obtained from the algorithm. By flow diagram, in the first step, generation information and capacity values of each unit in the system given in Table 3 should be entered. Then the hourly maximum load values must be determined for the 1:24 time interval. As it is in the day ahead market, the generation values are adjusted hourly according to the total load amount. The Capacity Outage Probability Table (COPT) table is created for the units. Table 4 shows the values of LOLP for the units. According to this table, if the value of total generation is smaller than the value of consumed load, equilibrium is increased by ΔG value according to the generation value of load amount. If the total generation amount is equal to or greater than value of the load according to the COPT table, the value of optimal SR for the system is obtained by subtracting the total load amount from value of the actual production before the COPT table. Utilizing the UC method, the optimal amount of SR achieved is the optimal allocation combination, so that the amount of SR required for power plants is distributed. UC is the most basic of the units; the most appropriate combination is created taking into account generation costs, start-up costs and constraints.

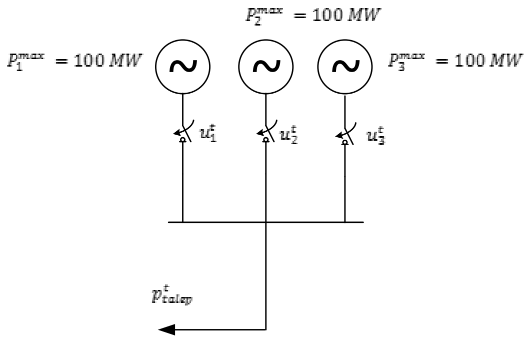

**Figure 6:** System model three generators and load

As shown in equation (5), in order to fully implement the formulation, all distribution outages must be included in the optimization. This is not possible in the real sense for the system, because the number of permutations of the units is of great value for the UC program. As a test system of IEEE, three generators and load is shown in Figure 6, in which system the offline states for the UC are calculated and then incorporated into the optimization process. This system consists of three generation unit at different capacities and the data for these units are shown in Table 3. In this table the probable coefficients have been determined taking into account the past deductions of the units [25].

**Table 3:** Information of test system model

| Unit *i-MW* | G1-42 | G2-64 | G3-45 |
|---|---|---|---|
| $P_i^{min}$ (MW) | 10 | 10 | 10 |
| $P_i^{max}$ (MW) | 100 | 100 | 100 |
| $a_i$ ($/MW²h) | 0.00623 | 0.00612 | 0.00598 |
| $b_i$ ($/MWh) | 18 | 18.1 | 18.2 |
| $c_i$ ($/h) | 217.895 | 218.335 | 218.775 |
| $c_i^{su}$ ($/h) | 100.00 | 100.00 | 100.00 |
| ORR | 0,05 | 0,02 | 0,03 |
| 1-ORR | 0,95 | 0,98 | 0,97 |

Table 4 shows the scenario-planned calculation for one day. The value of EENS is calculated as shown in equation (7).

$$\sum_{i=1}^{N} EENS^t = (ORR\ ) \times (LOLE) \times (Time) \tag{7}$$

**Table 4:** Value of Commitment Capacity (CC), Outage Replacement Rate (ORR), LOLE and COPT

| St | G1 (MW) | G2 (MW) | G3 (MW) | CC (MW) | ORR $(\lambda)$ | LOLE (MW) | EENS (MW) |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0,90307 | 120 | 108,3684 |
| 2 | 1 | 0 | 0 | 42 | 0,04753 | 78 | 3,70734 |
| 3 | 0 | 1 | 0 | 64 | 0,01843 | 56 | 1,03208 |
| 4 | 0 | 0 | 1 | 45 | 0,02793 | 75 | 2,09475 |
| 5 | 1 | 1 | 0 | 106 | 0,00097 | 14 | 0,01358 |
| 6 | 1 | 0 | 1 | 87 | 0,00147 | 33 | 0,04851 |
| 7 | 0 | 1 | 1 | 109 | 0,00057 | 11 | 0,00627 |
| 8 | 1 | 1 | 1 | 151 | 0,00003 | -31 | -0,00093 |
|  |  |  |  |  | 1 |  | 115,27 |

The value of EENS for the three generation unit; $\sum_{i=1}^{8} EENS^t = 115{,}27\ MW$ is obtained. Figure 7 shows the daily data of generation and load for the units.

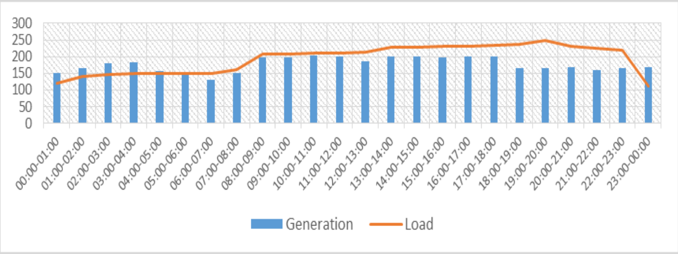

**Figure 7:** Information of Generation and load

The daily generation-consumption curve of the system given the generation and load information is shown in Fig 7.

**Table 5:** Value of Units, Load and SR for a day

| Unit | G1 (MW) |  | G2 (MW) |  | G3 (MW) |  | Load | SR |
|---|---|---|---|---|---|---|---|---|
| Hour | Plan | Real | Plan | Real | Plan | Real | (MW) | (MW) |
| 00:00 | 42 | 42 | 37 | 64 | 34,9 | 45 | 120 | 37,1 |
| 01:00 | 60 | 59 | 37 | 63 | 34,9 | 45 | 140 | 35,1 |
| 02:00 | 70 | 69 | 37 | 66 | 34,9 | 45 | 148 | 38,1 |
| 03:00 | 70 | 71 | 37 | 65 | 34,9 | 46 | 148 | 40,1 |
| 04:00 | 70 | 70 | 37 | 50 | 34,9 | 36 | 148 | 14,1 |
| 05:00 | 70 | 70 | 37 | 46 | 34,9 | 35 | 148 | 9,1 |
| 06:00 | 70 | 52 | 37 | 45 | 34,9 | 35 | 150 | -9,9 |
| 07:00 | 70 | 70 | 37 | 45 | 34,9 | 36 | 160 | 9,1 |
| 08:00 | 70 | 70 | 54 | 53 | 74,2 | 76 | 208 | 0,8 |
| 09:00 | 70 | 69 | 54 | 46 | 74,2 | 84 | 209 | 0,8 |
| 10:00 | 70 | 67 | 54 | 43 | 74,2 | 94 | 210 | 5,8 |
| 11:00 | 70 | 71 | 54 | 43 | 74,2 | 86 | 212 | 1,8 |
| 12:00 | 70 | 71 | 53 | 37 | 74,2 | 78 | 214 | -11,2 |
| 13:00 | 70 | 70 | 53 | 34 | 94,2 | 96 | 228 | -17,2 |
| 14:00 | 70 | 70 | 53 | 33 | 94,2 | 97 | 229 | -17,2 |
| 15:00 | 70 | 68 | 53 | 33 | 94,2 | 98 | 230 | -18,2 |
| 16:00 | 70 | 70 | 53 | 33 | 94,2 | 99 | 232 | -15,2 |
| 17:00 | 70 | 70 | 54 | 33 | 94,2 | 97 | 234 | -18,2 |
| 18:00 | 70 | 70 | 54 | 39 | 94,2 | 58 | 236 | -51,2 |
| 19:00 | 70 | 71 | 74 | 48 | 94,2 | 46 | 250 | -73,2 |
| 20:00 | 70 | 70 | 74 | 54 | 74,2 | 46 | 230 | -48,2 |
| 21:00 | 70 | 71 | 74 | 42 | 74,2 | 46 | 225 | -59,2 |
| 22:00 | 70 | 70 | 74 | 51 | 74,2 | 46 | 220 | -51,2 |
| 23:00 | 70 | 70 | 34 | 53 | 4,2 | 46 | 113 | 60,8 |
| Total | 1642 | 1621 | 1215 | 1119 | 1536 | 1516 | 4644 | 390 |

The generation capacities and the freight status allocated according to day ahead planning can show differences in real time. At some hours during the day generation can compensate for consumption, but it cannot provide at peak loads. If the value of capacity obtained from the COPT is larger than the load value, the difference between the value of actual production and the load amount is taken as the basic SR demand, which is 390 MW for 24 hours as shown in Table 5. This value is obtained by optimizing the equation (8) to distribute the optimal reserve.

**Table 6:** Numerical data used in countries

| Countries | VOLL $/kWh | GNP ($) | GDP ($) | Gini ($) | Electricity Consump. (kWh) | Populat. | Area (km$^2$) | Hum. Dev. Ind. |
|---|---|---|---|---|---|---|---|---|
| New Zealand | 41,27 | 38227 | 44229 | 33,5 | 9398,66 | 4317352 | 268021 | 0,936 |
| Ireland | 9,54 | 48517 | 48939 | 29,8 | 5701,15 | 4481430 | 70273 | 0,956 |
| Australia | 45,71 | 66984 | 51642 | 33,6 | 10712,18 | 24140800 | 7692024 | 0,935 |
| Austria | 6,01 | 50504 | 43546 | 27,6 | 8373,71 | 8662588 | 83879 | 0,885 |
| Netherla. | 5,13 | 51410 | 48223 | 30,9 | 7035,67 | 16919139 | 41528 | 0,964 |
| UK | 17,88 | 39604 | 43771 | 31,6 | 5472,14 | 65102385 | 242495 | 0,907 |
| Germany | 15,83 | 44558 | 43741 | 30,7 | 7080,96 | 81799600 | 357021 | 0,916 |
| Lebanon | 19,33 | 10474 | 14988 | 37 | 3499,37 | 4968914 | 10452 | 0,803 |
| Thailand | 1,50 | 5281 | 4116 | 42 | 2315,99 | 67091089 | 513120 | 0,783 |
| Turkey | ? | 10576 | 9562 | 40 | 2709,26 | 78741053 | 783562 | 0,761 |

Table 6 was generated by taking the indices affecting the VOLL parameter from 10 different countries. The data shown in Table 6 [25] are used as input in the regression equation. In addition to the economic parameters used, the Gini coefficient measures the inequality values of a frequency distribution. This coefficient measures the distribution of national income Values are between 0 and 1, and higher values correspond to greater inequality. Dependent variable from regression equation is VOLL. As a result of the regression equation created by these economic parameters, the VOLL value is calculated as shown in Table 7. VOLL is obtained as the result of the equation (8).

**Table 7:** Regression Equation Outcome Statistics and coefficients

| *Regression Statistics* | | | | |
|---|---|---|---|---|
| Multiple R | 0,999982845 | | | |
| R$^2$ | 0,99996569 | | | |
| Adjustable R$^2$ | 0,99972552 | | | |
| Standard Error | 0,259916165 | | | |
| Observation | 9 | | | |
| | *df* | *SS* | *MS* | *F* |
| *Regression* | 7 | 1968,930797 | 281,2758282 | 4163,569621 |
| Odds | 1 | 0,067556413 | 0,067556413 | *Signific. F* |
| Total | 8 | 1968,998354 | | 0,01193241 |
| | *Coefficients* | *Standard Error* | *t Standard* | *Value of P* |
| Intersection | 3,707559517 | 4,67498050 | 0,793064166 | 0,57314807 |
| Variable X 1 | -0,00288635 | 4,79151E-0 | -60,2389616 | 0,01056726 |
| Variable X 2 | 0,001595346 | 8,29347E-0 | 19,23617383 | 0,03306516 |
| Variable X 3 | -2,36282022 | 0,22350365 | -10,5717299 | 0,06004042 |
| Variable X 4 | 0,005035017 | 9,68226E-0 | 52,00251168 | 0,01224058 |
| Variable X 5 | 9,36184E-10 | 4,33141E-0 | 0,216138415 | 0,86448655 |
| Variable X 6 | 9,33217E-06 | 2,37462E-0 | 39,29957389 | 0,01619565 |
| Variable X 7 | 114,0068579 | 15,9589977 | 7,143735428 | 0,08854048 |

$$VOLL = \beta_0 + \sum_{j=1}^{p} X_{ij}\beta_j + \varepsilon_i \tag{8}$$

VOLL is dependent (result) variable and is assumed to have a certain fault. X is an independent (causal) variable and is assumed to be measured without error. $\beta_0$ is fixed when X=0 it is the value of VOLL. β is the regression coefficient and expresses the amount of change in the agent of VOLL in terms of its agent, whereas X changes by 1 agent in terms of its agent. $p$ is number of expressions, $\varepsilon_i$ is an error term and *i* sub-indices represent a set of possible observations. As a result of these calculations, VOLL for Turkey was approximately 4.71 $ / kWh. According to the calculation shown in Eq. (6), our socio-economic cost $EC_t$ is $ 197.11. This value is a socio-economic cost to be added to the UC process. According to the Energy Market Regulatory Authority, the electricity sales price is $ 0.52 per kWh. According to equation 5, the calculated optimum cost is 399.91.10$^3$ kW / $

Depend on the performance, aim and project, as well as on other factors, such as the structure of the system and the utilized enabling technologies. Demand may offer potential benefits series abroad on the operation and efficiency of the system and market expansion [26]. The advantages of Demand can be rated in terms of whether they rise directly to some or to participants or all groups of electricity user as follows:

- Incentive payments and electricity bill savings the user receives for accepting to change load in response to current incentives or supply costs.
- Inferior collectively market prices that based on variable usage to lower-priced hours, or from using less energy when prices are high.
- Attribute to user's advantages comprehended from decreased probability of being in willingly curtailed and incur- ring even higher financial costs and discomfort. Thus, socio-economics advantages according to which the user is satisfied from helping avoiding wide shortages.

## 3. Conclusion

In this study, the optimum planning SR requirements is determined considering the demand side management. This reserve capacity can be activated by the resolution of the system operator. Synchronized to the grid capable devices and active power effects are supplied by the reserve. By UCTE, SR is secondary (center and automatic) and tertiary synchronized control (center and manual) correspond. Therefore, in different regions, many methods are used to compare the SR. The low frequency case and the governor to perform a down-regulation of the system imposed upon inclusion scheduled compared to the energy of the exchange was calculated SR. Planning interval of the system is considered separately and the resulting failure to be retained for the greatest possible capacity is obtained SR.

Thus, frequency of imbalances occur is blocked and the system more convenient to work safely with the value of reserves is provided. Consumer value of consumption is taken into account and SR cost is calculated using socio-economic parameters. EENS, one of these parameters, used ORR and LOLE values when calculating this parameter. Where LOLE was obtained according to value of day ahead market. The other parameter is VOLL. This value has been obtained in such a way that the regression equation is established considering the economic indices of the different countries. The amount of SR needed is made preference to the unit starting from the lowest price according to the free market. The SR unit price of the selected exchange is multiplied by the required SR requirement. The socio-economic cost is added to the result obtained. Thus, the most cost-effective SR cost is achieved. Thus, SR cost is obtained at the most reasonable cost considering the demand side management.

According to the results obtained, SR changes depending on the EENS. In order to hold this energy in the lowest level, it is necessary to produce depending on the consumption. Therefore, demand control must be carried out and the energy production for this must mu taken into consideration. In this way, the production will be fulfilled regarding the consumption, and SR will be used with its highest capacity.

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