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List of Acronyms

AMI	Advanced Metering Infrastructure
CAPEX	Capital Expenditures
CIS	Customer Information System
CMS	Commercial Management System
DISCOM	Distribution Company
EML	Electricity Market Law
EMRA	Energy Market Regulatory Authority
EUAŞ	Electricity Generation Company
IP	Implementation Period
IPP	Independent Power Producer
IT	Information Technology
IRMS	Incidents Recording and Management System
Loss	Technical and non-technical losses (theft) which is defined as the difference between the total amount of electricity supplied to the distribution network minus the energy billed.
LV	Low voltage (below 1 kV)
MAIFI	Momentary Average Interruption Frequency Index
MENR	Ministry of Energy and Natural Resources
MIS	Management Information System
MV	Medium voltage (1–36 kV)
O&M	Operation and Maintenance
OIZ	Organized Industrial Zone
OMS	Outage Management System
OPEX	Operational Expenditures
PA	Privatization Administration
PBR	Performance-based Revenue
RAB	Regulatory Asset Base
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control And Data Acquisition
SQR	Service Quality Regulation No. 28504 (December 21, 2012) which is amended by the regulation No. 28790 (October 09, 2013)

TEAŞ	Turkish Electricity Generation and Transmission Company
TEDAŞ	Turkish Electricity Distribution Company
TEIAŞ	Turkish Electricity Transmission Company
TEK	Turkish Electricity Authority
TETAŞ	Turkish Electricity Trading and Contracting Company
TNI	Total Number of Interruptions
TOOR	Transfer of Operating Rights
TV	Threshold Value
WACC	Weighted Average Cost of Capital

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Executive Summary

In the early 1980s, Turkey initiated efforts to reform the energy sector. The reform process gained momentum after the enactment of the Electricity Market Law (EML) in 2001, which launched liberalization of the electricity market and has had remarkable success with enabling a legal and regulatory environment to establish a competitive market. One of the important milestones of this reform process was the privatization of electricity distribution and supply activities. The 2004 Strategy Paper prioritized distribution privatization over generation to ensure a reliable distribution sector for generation investors. Except for one region, which was served by a private company since the 1990s, companies serving other regions were privatized through consecutive tenders from 2008. After 6 years, in 2013, the distribution privatization process was successfully completed.

The objective of this review is to analyze the current status on achievement of targeted benefits from distribution privatization and identify the gaps between expectations and realizations, with a key task of proposing concrete procedures and methodologies to ensure that EMRA and other government agencies involved in monitoring and enforcing quality in electricity distribution and retail have timely access to reliable information on service actually provided by the DISCOMs to their customers.

To reach these objectives, this report follows the following approach: section 1 presents an overview of the distribution sector and distribution privatization process; section 2 analyzes the existing regulatory framework related to DISCOM performance and provides expected performance targets in respective investment periods; section 3 analyzes the current status of DISCOMs' performance targets; section 4 identifies key issues and barriers in measuring and monitoring service quality in DISCOMs; and lastly, based on the global experience, section 5 recommends an approach for improving measuring and monitoring of service quality by the regulator.

Electricity Distribution in Turkey: Service Quality Perspective

The expectation from the distribution privatization was to ensure efficiency in operations and investments in the infrastructure, increasing the service quality for the benefit of consumers. Accordingly, the distribution privatization program was pursued to attain sustainable long-term benefits, such as:

- reducing costs through effective and efficient operation of electricity distribution assets;
- increasing supply quality and security in the electricity sector;
- decreasing technical losses to the level of Organisation for Economic Co-operation and Development (OECD) countries and preventing non-technical losses;
- ensuring distribution network efficiency and expansion investments are performed by the private sector without creating any liabilities on the state budget; and

- transferring benefits obtained through efficiency improvements to electricity consumers.

To reach the expected benefits, there was wide acceptance of the following principles:

- The legal and regulatory framework should clearly state the responsibilities and rights of service providers and consumers and incentivize DISCOMs.
- Carefully determined targets on quality, efficiency, and loss reduction should be set and a reasonable implementation time should be allowed.
- The operators should be equipped with tools and systems required for real-time operation, monitoring, and supervision of the distribution infrastructure, management of customer relations, and following standardized reporting procedures.
- There should be means, tools, and institutional capacity in the authorities responsible for supervision of services provided by DISCOMs.
- The performance of DISCOMs should be monitored and evaluated on time.
- Allowed revenues for operating expenditures (OPEX) and investments capital expenditures (CAPEX) of DISCOMS should be set applying incentive-based regulation, which implies considering targets on efficiency, loss, and service quality.

The Turkish distribution system consists of networks operating below 36 kV. Turkey's electricity distribution networks have been divided into 21 distribution regions within the context of the reform process, taking into account the operational constraints resulting from the geographical structure, technical and financial characteristics, energy demand, the existing contracts, and the legal process in Turkey. All regions are currently operated by private companies (DISCOMs). The existing number of customers is more than 38 million and the electricity sold to customers is more than 155 GWh. After the legal unbundling of supply and distribution (wire business) activities, there are two companies for each region, under the same ownership, with the following roles and scope of work:

- **DISCOMs.** Operate and maintain the distribution grid, carry out the necessary grid investments, and provide nondiscriminatory electricity distribution and connection services to all system users connected to the distribution system.
- **Assigned supplier companies (incumbent retailers).** Sell electricity and/or capacity both to captive consumers located in the authorized regions and to eligible consumers countrywide. They are also the last resort supplier of consumers in their regions.

From the service quality perspective, the main players in ensuring the service quality performance are DISCOMs; therefore, this report mostly focuses on DISCOM activities.

The obligations of DISCOMs and sanctions to be applied in case of failure to fulfill their obligations are defined in the EML, related secondary legislation, and under the Transfer of Operating Rights (TOOR) contracts with TEDAŞ (the owner of distribution assets).

The legislation aims at improving performance and the quality of service through the use of indicators and preset targets as benchmarks in setting the revenue cap for each DISCOM, and the tariffs applied by the company are determined accordingly. That is, an incentive-based (or performance-based) tariff methodology is applied to set a cap on allowed revenues, and tariffs are determined according to that 'revenue cap'. If a DISCOM fails to achieve those targets, then the revenue is adjusted downward.

According to legislation, there are three specific indicators and targets considered in the implementation of the performance-based revenue cap regulation:

- Efficiency target X, which is an indicator of operational efficiency, is used to incentivize DISCOMs to catch up with the most efficient companies. The X factor is used to adjust the OPEX component of the revenue setting and therefore influences the tariff level of a DISCOM.
- Loss target, which aims to decrease technical and non-technical losses gradually in a tariff implementation period (IP). Tariffs are calculated according to these targets and if a DISCOM fails to meet the target loss ratios, its actual revenue will be less, because that revenue is collected through the energy distributed and billed. In case of better DISCOM performance, the actual revenue will be higher, creating an incentive for outperformance.
- Service quality indicators and targets, which are described under the Service Quality Regulation (SQR), entitle the sector regulator, EMRA, to monitor the quality of the distribution service under three main headings: continuity of supply, commercial quality, and technical quality. When monitored and evaluated, a combination of actual realizations on those quality indicators is supposed to be used in determination of the total revenue cap.

The CAPEX portion of the revenue cap is determined according to the investment programs approved by EMRA. Therefore, in addition to the abovementioned monitoring and inspection requirements, the actual realization of investments needs to be monitored. The detailed audit of actually executed investments may be needed to check the harmonization of new investments with the technical specifications pointed out by the asset owner, TEDAŞ, and also to make corrections and revisions related to CAPEX allowances. However, if effectively measured and monitored, quality assessment is also a powerful tool for the evaluation of impact of investments. As underinvestment or inappropriateness of investments will result in a deterioration of service quality, systematic monitoring and supervision of service quality will provide strong signals for timely and appropriate investment.

Efficiency factors were applied in the revenue cap setting process in the previous two tariff IPs (IP1 [2006–2010] and IP2 [2011–2015]). The new targets for the next IP (IP3 [2016–2020]) were announced in January 2016. Except for the three DISCOMs (Vangolu, Dicle, and Aras) which are excluded through a legislation[1] in January 2016, the average efficiency increase expectation is 0.91 percent in IP3.

1 Regulation on 'Measures to Reduce Losses in the Distribution System', December 2015.

Similarly, loss reduction targets have been set for previous tariff IP. For seven regions, targets used in IP1 were revised in 2011 and 2013. One of the reasons for revision was the delays in the privatization process. Finally, the loss evaluation mechanism was revised in 2015 to take into account the specific conditions of lately privatized regions in southeastern and eastern Turkey with high loss ratios. When compared with the pre-privatization status, it can be concluded that a reduction in loss rates was achieved and targets were nearly met, with the exception of three DISCOMs. When IP2 performance is evaluated, it can be said that almost all DISCOMs have met 2015 targets, except four of them. If these DISCOMs can maintain the same rates in 2016, they will be able to meet 2016 targets.

The 2012 SQR requires regular reporting of quality indicators. However, the level of reporting practices varies considerably among DISCOMs. Neither the desired reporting methodology nor the data quality level is fully reached, with many DISCOMs failing to meet the regulation's requirements. Furthermore, there are concerns on the transparency, completeness, accuracy, comparability, and consistency of the information reported. This is largely because not all DISCOMs have made the necessary information technology (IT) investments. As a result, sufficient, comparable, and reliable data is not available to evaluate the technical and service quality performance of most DISCOMs.

Furthermore, because the required infrastructure for monitoring has not been installed uniformly in all DISCOMs and EMRA, to date, quality targets have neither been set nor evaluated and used for tariff setting.

Identified Gaps

As a result of assessment of the legislative framework, target setting, and implementation related to service quality, various gaps are identified and presented in section 4 in detail. These gaps can be summarized under two major categories.

1. **Incomplete implementation of SQR.** The SQR is comprehensive and adequate. However, implementation is not uniform among 21 DISCOMs, primarily reflecting the respective local conditions of different regions. DISCOMs' performance, monitoring, data handling, and feasibility/necessity of their planned investments differ considerably. However, it is uncertain how all DISCOMs will implement the SQR with a transparent quality measurement and monitoring system. At present, the data related to quality indicators are collected and recorded manually in most companies and open to manipulation. DISCOMs need to improve their capacity to collect, compile, aggregate and analyze, and report the data in a satisfactory and prompt manner, by incorporating IT systems and applications needed for that specific purpose.
2. **Comprehensive installation of information systems to monitor and record service quality.** The service quality targets need to be determined and effectively implemented. This means that they need to be measured transparently and monitored regularly. At present, there are no concrete procedures and methodologies in place to ensure that EMRA and other government agencies (involved in monitoring and enforcing quality in electricity distribution and retail) have timely access to reliable information on service actually provided by DISCOMs to their customers. To move forward, all DISCOMs must implement adequate

management information systems (MIS) for service quality management and monitoring.

Recommendations

To improve the service quality and implementation of the SQR through effective monitoring and evaluation the following is recommended:

1. **DISCOMs provide electricity services to their captive customers under monopolistic conditions which necessitates establishing norms and defining parameters characterizing the quality of electricity supply (frequency and duration of the interruptions, voltage perturbations, and so on) and commercial attention of customers by assigned suppliers (maximum time for resolution of complaints on billing, attention through call centers and commercial agencies, and so on) by EMRA.** In addition, the regulator must also monitor that the service actually received by captive users meets the standards on quality defined in these norms and reflected in the current tariffs. In fact, it will not be possible to make an assessment whether the electricity tariff is fair or not, if the quality of the service received by users is not clearly defined and effectively measured and monitored. This aspect is of critical importance when a 'performance-based regulation' (PBR) approach is adopted for tariff setting, with a cap either in overall revenues or in individual tariffs. Thus, it is needed to set up a regime where EMRA and other relevant agencies will be able to have timely access to MIS records managed by each DISCOM to carry out their regulatory oversight functions.

2. **Systematic monitoring of the quality of service provided by DISCOMs to their customers and the application of the regime on penalties is the most important permanent task to be accomplished by the regulator in the period between the periodic tariff revisions.** Failing to implement those tasks presents a situation that is highly risky for the proper performance of the distribution sector. Under a PBR regime, the regulated companies get their profits based on the reduction they can achieve in actual costs in relation to the values determined by the applied regulation, against which they 'compete'. One of the obvious modalities to obtain this cost reduction is to minimize investments and operating costs (operation and maintenance [O&M] of networks and commercial management). This leads to a progressive deterioration of the quality of service received by users. It is therefore essential to define and effectively apply a regime on the quality of service, including values of penalties that in practice discourage and eliminate the possibility of this kind of behavior from DISCOMs.

3. **DISCOMs should be equipped with the necessary IT infrastructure and MIS to support the efficient execution of operations in all business areas.** In particular, commercial functions (Commercial Management System [CMS]) and effective management and resolution of customers' complaints related to outages and other incidents in the electric supply received from customers (Incidents Recording and Management System [IRMS]). Those systems will allow DISCOMs to effectively manage the quality of service provided to their customers. At the same time, through real-time access to the information systems' records, EMRA will be able to measure and monitor the quality of service received by DISCOM customers, thereby enabling the fulfillment of this essential role of the sector regulator.

4. **Supervisory control and data acquisition (SCADA) systems are powerful tools for reliable system operation and will also contribute to improving service quality.** Therefore, as required by EMRA, SCADA systems should be installed by each DISCOM and linked to the MIS, to enable real-time monitoring of system parameters.

The content of the recommended MIS and tailor-made functional specifications were shared and discussed widely with the stakeholders during the workshop organized in the World Bank's Ankara offices in October 2015. A summary of the recommended MIS is presented in section 5 and detailed functional specifications are included in annexes I and II of this report.

1. Overview of the Electricity Distribution Sector in Turkey

1.1 General Overview

In the early 1980s, Turkey changed course through a set of radical decisions and embarked on a path to move toward a liberal market economy, both in domestic markets and international trade. After a severe banking crisis in 2000–2001, the country embarked on a concerted path of structural reforms supported by strong fiscal consolidation, strengthened banking supervision, and a shift to a flexible exchange rate regime with an independent central bank responsible for inflation targeting. Today, Turkey is an upper-middle-income country with the world's 17th largest economy.

The electricity sector is also influenced by these developments and, since 1984, Turkey has undertaken reforming its electricity industry. Until 2001, several legal and structural changes were made to demolish public monopoly in electricity generation and distribution activities and enable private sector participation in the electricity sector. In addition to the implementation of various investment models such as 'Build Operate Transfer' and 'Build Own Operate' to attract the private sector for generation investments, the TOOR model has been used for distribution privatization. However, only a moderate level of private capital inflow into the generation segment could be achieved and privatization attempts in the 1990s were unsuccessful because of legal issues and regulatory uncertainties.

In line with the comprehensive structural reforms, which were launched after the deep economic crises in 2000–2001, the EML was enacted which aimed at an ambitious program for the creation of a competitive liberal electricity market and restructuring in 2001. The purpose of the EML was stated as: *"ensuring the development of a financially sound and transparent electricity market operating in a competitive environment under provisions of civil law and the delivery of sufficient, good quality, low cost, and environment-friendly electricity to consumers and to ensure the autonomous regulation and supervision of this market."*

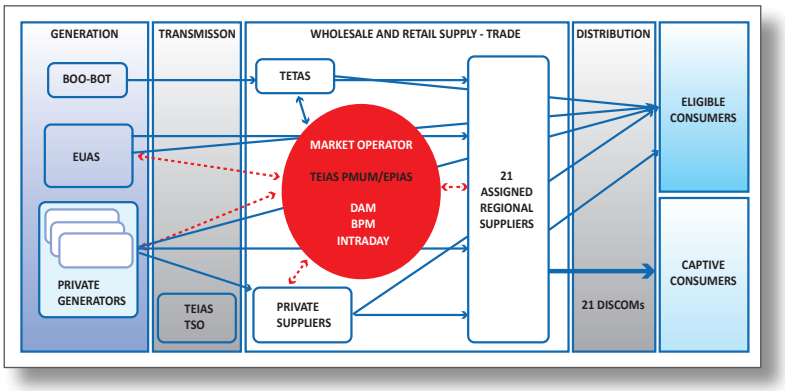
The EML set the legal framework for the sector, defined institutional structures, market activities, the roles and responsibilities of market players, and established EMRA to ensure the independent regulation and supervision of this market. Furthermore, the EML and its secondary legislation set forth principles for unbundling, licensing, establishing tariffs for regulated activities, market opening and eligibility, electricity trading, and balancing mechanisms among others.

According to the EML, market activities are broadly classified as:

- **Regulated activities.** Transmission, distribution, and retail sale (supply) to captive consumers;
- **Competitive activities.** Generation, supply (wholesale and retail, except captive consumers).

The institutional structure of the electricity market is show in figure 1.

Figure 1. The Institutional Structure of the Electricity Market



Note: BOO = Build Own Operate; BOT = Build Operate Transfer; PMUM = Electricity Market Operator within TEIAS; TSO =Transmission System Operator

Source: World Bank Report.[2]

1.2 Overview of Distribution Sector

The Turkish distribution grid consists of assets that are energized below 36 kV. Until 1994, organization of the Turkish power sector consisted of a single state-owned vertically integrated company, the Turkish Electricity Authority (TEK). In 1994, the first unbundling took place, TEK was restructured, and two state-owned companies were established: the TEDAŞ, responsible for distribution and retail sale activities, and the Turkish Electricity Generation and Transmission Company (TEAŞ), responsible for generation and transmission activities.

With the enactment of the EML, the gradual unbundling of the sector continued in 2001. TEAŞ was separated into three state-owned companies: the Electricity Generation Company (EUAŞ), which is responsible for operating the state-owned power generation facilities; the Turkish Electricity Transmission Company (TEIAŞ), which is responsible for operating the national grid; and the Turkish Electricity Trading and Contracting Company (TETAŞ), which has a mandate to deal with purchasing the electricity from the producers who had long-term power purchase agreements with TEAŞ[3] and the sale of this electricity to DISCOMs. In 2013, the market operation function of TEIAŞ was also separated and the decision for establishing the Spot Market Operator was given.

TEDAŞ, which was operating 20 of the 21 distribution regions, underwent a privatization program, and separate DISCOMs were established in each of these 20 regions as affiliates of TEDAŞ (one regional company—Kayseri—was already private). In 2005, TEDAŞ, being one of the largest companies in Turkey before privatization, had approximately 28.5 million customers and 98 percent of the market share in electricity distribution across Turkey.

2 World Bank. 2015. *Turkey's Energy Transition- Milestones and Challenges.*

3 'Build Own Operate', 'Build Operate Transfer', TOOR, and EUAŞ producers. Here, independent power producers and autoproducers are selling directly to DISCOMs or eligible customers, without TETAŞ as an intermediary.

Unbundling of distribution and supply (retail) activities

Separation of distribution from retail was realized in two phases. Before 2013, distribution and retail were carried out by the same regional DISCOM through separate accounts ('account unbundling'). Each regional company had two licenses: a distribution license to operate the distribution system in its region and a retail sale license to supply electricity to non-eligible consumers in its region. As stipulated in amendments made in the EML of 2008 and in the 2009 Strategy Paper, those activities are legally unbundled at the recommendation of the Competition Authority. As of 2016, DISCOMs were legally separated into 'distribution' and 'assigned supplier' companies.

- DISCOMs operate and maintain the distribution grid, carry out the necessary grid investments, and provide nondiscriminatory electricity distribution and connection services to all system users connected to the distribution system.
- Assigned supplier companies can sell electricity and/or capacity both to captive consumers located in the authorized regions and to eligible consumers countrywide. They are also the last resort supplier of consumers in their regions.

Turkey's 21 distribution regions are shown in Figure 2. These are the group of companies that are the focus of this study.

Figure 2. Locations of 21 DISCOMs in Turkey and Relevant Provinces

Source: PA, 2016

According to the current institutional framework, in addition to DISCOMs, various entities, including Organized Industrial Zones (OIZs) are also eligible to receive a distribution license for their own regions and act as potential competitors to DISCOMs. For instance, some OIZs at present have a distribution license and are connected directly to the transmission grid. They actually have a very small, almost negligible, market share of the overall electricity delivery business.

Table 1 provides an overview of the key characteristics of DISCOMs in Turkey with regard to power sold, number of customers, area served, and the population.

Table 1. Key Characteristics of 21 DISCOMs in Turkey (2014)

Company	Power Sold (MWh)	Number of Customers	Area Served (km^2)	Population	Loss Rate (%)
1. Dicle (Iskaya-Doğu)	5.183.374	1.417.236	60.630	5.634.636	74,1
2. Vangölü (Türkerler)	1.499.282	573.184	41.755	2.111.068	61,0
3. Aras (Kiler - Çalık))	2.050.733	880.302	70.991	2.206.326	26,2
4. Çoruh (AKSA)	3.184.746	1.205.566	29.222	1.842.572	9,0
5. Fırat (AKSA)	2.688.474	828.301	37.323	1.690.843	9,5
6. Çamlıbel (Limak, Kolin, Cengiz)	2.340.285	877..003	52.714	1.653.596	7,7
7. Toroslar (EnerjiSA-e.on)	12.926.105	3.432.049	46.858	7.937.740	13,2
8. Meram (Alarko)	7.352.228	1.839.153	76.935	3.586.277	7,3
9. Başkent (EnerjiSA-e.on)	13.156.778	3.847.029	60.121	6.993.155	7,7
10. Akdeniz (Limak, Kolin, Cengiz)	7.429.204	1.876.289	36.797	2.898.240	8,5
11. Gediz (Elsan, Tümaş, Karaçay)	12.734.825	2.888.610	25.244	5.480.977	8,4
12. Uludağ (Limak, Kolin, Cengiz)	9.917.601	2.812.446	36.160	4.714.900	6,9
13. Trakya (İçtaş)	5.974.830	944.039	18.740	1.650.735	6,3
14. Ayedaş (EnerjiSA-e.on)	10.266.378	2.613.603	1.742	5.075.087	7,2
15. Sedaş (Akcez)	8.084.227	1.528.503	19.422	3.295.839	6,8
16. Osmangazi (Yıldızlar)	2.884.832	1.565.042	50.304	2.649.629	7,8
17. Boğaziçi (Limak, Kolin, Cengiz)	22.265.406	4.615.621	3.573	9.301.931	9,2
18. Kayseri	1.978.482	636.296	17.109	1.322.376	6,9
19. Aydem/Menderes (Bereket)	7.071.170	1.728.496	32.658	2.915.188	7,9
20. Akedaş/Göksü (Akedas)	3.390.714	610.127	22.063	1.686.873	6,8
21. Yeşilırmak (Çalık)	4.731.140	1.833.851	39.633	3.047.916	8,3
Türkiye total/average	**147.110.815**	**38.552.746**	**779.993**	**77.695.904**	**17,3**

Source: EMRA and TUIK data presented for the year 2014

It should be noted that, the power sold here refers to the amount which is billed by the DISCOM. The total power supplied to the distribution grid was roughly 178,000,000 MWh and total loss was accounted to 30,000,000 MWh (17.3 percent) in 2014. The total energy consumption of the country is larger because of consumption of some large eligible consumers and OIZs, which are directly connected to the transmission system and not accounted here.

Table 1 shows that Bogazici (European Istanbul) is the largest DISCOM with 21.5 TWh power sold and 4.5 million customers, followed by Baskent (12.6 TWh power sold and 3.3 million customers) and Gediz (12.5 TWh power sold and 2.7 million customers). These DISCOMs are located in the three most populated provinces in Turkey.

According to current arrangements, DISCOMs are responsible for procuring energy from TETAŞ to cover electricity consumptions by street lighting and loss.

1.3 Distribution Privatization Process

1.3.1 Benefits and Objectives

The liberalization policy aimed to reduce the public share in electricity generation, distribution, and supply. Distribution privatization was prioritized to enable required investments and achieve a sustainable long-term solution for satisfactory bill collection rates and distribution network efficiency. In line with this policy, the 2004 Strategy Paper[4] was adopted. This paved the way for addressing legal issues and placed top priority on privatization of the distribution system.

In fact, since the 1990s, distribution privatization was on the agenda, nevertheless the privatization attempts in the 1990s were not successful because of structural legal issues and regulatory uncertainties.

The primary expected benefits of privatization by the Government were:

- reducing costs through effective and efficient operation of electricity distribution assets (and generation assets);
- increasing supply quality and security in the electricity industry;
- decreasing technical losses in the distribution sector to the level of OECD and prevention of non-technical losses;
- ensuring that required rehabilitation and expansion investments in energy sector are performed by the private sector without creating any liabilities on the state budget; and
- transferring benefits obtained through efficiency improvements to final customers.

1.3.2 Implementation of Distribution Privatization Program

As discussed, TEDAŞ was included in the Government's privatization program and 20 new DISCOMs were formed. As a first step, the operational rights of distribution regions were transferred to regional public DISCOMs (TEDAŞ affiliates).

The privatization method was a TOOR-backed share-sale model. According to this model, the investor is the sole owner of the shares of the DISCOM—but with no ownership of distribution network assets or other items that are essential for the operation of distribution assets. The ownership of all distribution assets remains with TEDAŞ. Out of 21 regions, 18 of TEDAŞ-affiliated regional DISCOMs were privatized through consecutive tenders during 2008–2013 and the shares of these companies were sold by Privatization Administration (PA). Each investor, through its shares in the DISCOM, was granted the right to operate the distribution assets pursuant to the company's TOOR agreement with TEDAŞ and its share sales agreement with the PA.

4 High Planning Council. 2004. *Electricity Sector Reform and Privatization Strategy Paper.*

The regions operated by Aydem and Akedas were excluded from the privatization program as they had earned their privatization status from earlier legislation (through privatization tenders before 2001). Kayseri, whose mandate had expired in 1982, was appointed for the generation, transmission, and distribution of electricity to the entire Kayseri province and some districts of Sivas since 1990 for a period of 70 years. A new TOOR agreement was accepted by Kayseri in line with the EML, allowing the company to operate electricity distribution as a licensed DISCOM. In addition to Kayseri, the concession contracts of the other two distribution regions have also been amended. Aydem and Akedas earned their privatization status from earlier legislation and after amending their previous contracts according to the EML, they have also been licensed and these regions are transferred to the new owners. Hence, currently, all 21 DISCOMs are being operated under the same legal status.

Although the time for the completion of distribution privatization in the 2004 Strategy Paper was envisaged as 2006, this process could only be completed in 2013. The PA completed 4 tenders for privatization of electricity DISCOMs in 2008 and 3 tenders in 2009. The other 11 tenders were conducted in 2010. However, mainly because of the global financial crisis, seven of those tendering process could not be completed, as bidders did not fulfill the financial obligations of tender specifications. In addition, the Competition Authority implemented new rules to limit the percentage of electricity distributed by one group. Eventually these seven tender processes had to be cancelled by the Government and were re-tendered in 2011–2012. This time, all seven were privatized and the program was completed in August 2013 raising a total of about US$12.7 billion.

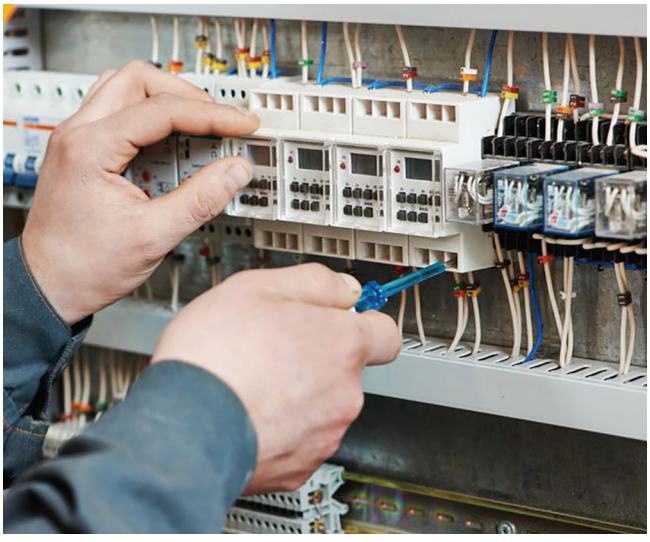


Figure 2. Overview of the Privatization Results of the 21 DISCOMs in Turkey

Company	Covered Provinces	Date of Takeover	Number of Customers (2014)	Sales Price (US$, million)
1. Dicle (İşkaya-Doğu)	Diyarbakır, Şanlıurfa, Siirt, Mardin, Batman, Şırnak	June 28, 2013	1.417.236	387
2. Vangölü (Türkerler)	Bitlis, Hakkari, Muş, Van	July 29, 2013	573.184	118
3. Aras (Kiler - Çalık)	Erzurum, Ağrı, Ardahan, Bayburt, Kars, Erzincan, Iğdır	June 28, 2013	880.302	128,5
4. Çoruh (AKSA)	Trabzon, Artvin, Giresun, Rize, Gümüşhane	September 30, 2010	1.205.566	227
5. Fırat (AKSA)	Elâzığ, Bingöl, Malatya, Tunceli	January 6, 2011	828.301	230,25
6. Çamlıbel (Limak, Kolin, Cengiz)	Sivas, Tokat, Yozgat	August 31, 2010	877.003	258,5
7. Toroslar (EnerjiSA-e.on)	Adana, Gaziantep, Hatay, Mersin, Kilis, Osmaniye	October 1, 2013	3.432.049	1.725
8. Meram (Alarko)	Nevşehir, Niğde, Konya, Karaman, Kırşehir, Aksaray	October 30, 2009	1.839.153	440
9. Başkent (EnerjiSA-e.on)	Ankara, Kırıkkale, Zonguldak, Kastamonu, Çankırı, Bartın, Karabük	January 28, 2009	3.847.029	1.225
10. Akdeniz (Limak, Kolin, Cengiz)	Antalya, Burdur, Isparta	May 28, 2013	1.876.289	546
11. Gediz (Elsan, Tümaş, Karaçay)	İzmir, Manisa	June14, 2013	2.888.610	1.231
12. Uludağ (Limak, Kolin, Cengiz)	Balıkesir, Bursa, Çanakkale, Yalova	August 31, 2010	2.812.446	940
13. Trakya (İçtaş)	Edirne, Kırklareli, Tekirdağ	January 3, 2012	944.039	575
14. Ayedaş (EnerjiSA-e.on)	İstanbul Anadolu Yakası	August 1, 2013	2.613.603	1.227
15. Sedaş (Akcez)	Sakarya, Bolu, Düzce, Kocaeli	February 11, 2009	1.528.503	600
16. Osmangazi (Yıldızlar)*	Eskişehir, Afyon, Bilecik, Kütahya, Uşak	May 31, 2010	1.565.042	485
17. Boğaziçi (Limak, Kolin, Cengiz)	İstanbul Avrupa Yakası	May 28, 2013	4.615.621	1.960
18. Kayseri	Kayseri	Since 1991	636.296	—
19. Aydem/Menderes (Bereket)	Aydın, Denizli, Muğla	August 15, 2008	1.728.496	—
20. Akedaş/Göksu (Akedaş)	Adıyaman, Kahramanmaraş	December 31, 2010	610.127	—
21. Yeşilırmak (Çalık)	Samsun, Amasya, Çorum, Ordu, Sinop	December 30, 2010	1.833.851	441,5

Note: * 75 percent of shares were to be purchased by public companies China Machinery Engineering Corporation and GUOXIN International Investment Corporation for US$384.6 million in February 2015. However, this transfer was cancelled in July 2015.

The total revenue from the privatization of DISCOMs was about US$12.75 billion. However, as stated in the Government's first and second Strategy Papers, the purpose of privatization was not to support the budget. Its main purpose was to improve DISCOMs' performance, reduce both losses and costs through efficient operation and investment, and reflect the gains to consumers by reduced electricity prices and increased service quality. Although considerable revenue was obtained from the privatization process, the high transfer fees have been creating difficulties for the new owners.[5]

The privatization of DISCOMs was completed in two rounds, with 8 DISCOMs being privatized recently (completed in 2013), and 11 DISCOMs privatized in an earlier phase, 2008–2010 (Baskent EDAS, Sedas, MERAM EDAS in 2008, Firat in 2011, and Tredas in 2012). The long process in privatization also implies that the duration of private sector experience in this field varies with the timing of privatization. Currently in Turkey, DISCOMs are operated by 14 different companies, of which large conglomerates like AKSA hold two, EnerjiSA-e.on three, Limak, Kolin, Cengiz four, and Bereket two (through Elsan). These companies operate in more than one distribution region and can benefit from cross-experiences among multiple DISCOMs.

Although the expected benefits were actually achieved in some areas, recent concerns over the completed DISCOM audit reports has led to the need to analyze factors affecting financial sustainability of DISCOMs and activities among policy makers and to monitor their activities and take necessary measures on time. Among the concerns, observed in the audit report, was the quality of and variation in the presented data. Moreover, the confiscation of the Osmangazi management[6] in August 2013, due to failure to fulfill their concessional obligations and violation of legislation, has led to a concern about DISCOMs' sustainability within the Turkish regulator and the Government.

5 World Bank. 2015. *Turkey's Energy Transition - Milestones and Challenges.*

6 EMRA appointed new managers and a Board for the management of the company.

2. Legislation on Service Quality and Revenue Requirements of DISCOMs

Under the PBR regime, the regulated companies should meet the efficiency and quality targets to get their revenues to cover their operational expenditures, CAPEX needs, and profits. Thus, the revenues of DISCOMs depend on their operational efficiency and service quality. For successful implementation of the PBR regime, the legislation should be complete, targets should be realistic, enforcement should be there, and indicators for the assessment of the performance should be actively monitored. In this section, the regulations on service quality and revenue setting are discussed and the interrelation between tariff (revenue setting) and performance is described.

2.1 Regulation on Service Quality

The legislation related to service quality in electricity distribution and retail sale is comprehensive and provides EMRA with sufficient tools to regulate DISCOMs toward achieving a high level of service quality. The main regulation about supply quality, 'Regulation on Supply Continuity, Commercial, and Technical Quality of Electrical Energy' (SQR) was put in force on September 12, 2006. The regulation instructed EMRA to monitor the quality of distribution service under three main headings: continuity of supply, commercial quality, and technical quality. The required infrastructure and output submission dates to EMRA and form of submission are summarized in table 3.

Table 3. Quality Obligations of DISCOMs and Annual Monitoring Requirements

Type of Quality	Recording Tool	Monitoring by EMRA
Supply Continuity	* Medium voltage (MV) and Low voltage (LV) Connection Model (GPS) * Supply Continuity Recording System	Monthly (SQR table 1) January 31 (SQR tables 2, 3, and 4) March 31 (SQR table 5)
Commercial Quality	* Documentation	April 30 (SQR tables 7 and 8)
Technical Quality	* Measurement and supervision systems (such as energy analyzer and SCADA systems, can also be used to monitor supply continuity purpose)	March 31 (Report)

If the difference between EMRA determined targets and the values realized for the subject IP exceed a predetermined limit, the regulation aims to reflect a bonus or deduction to the revenue cap set through tariff regulations.

DISCOMs which had the necessary investments in their IP2 investment plan would have completed the related investments by the end of 2012 and would automatically start to record all data related to supply continuity and technical quality indicators on December 1, 2013. However, delays in the privatization of some DISCOMs hindered the installation of the necessary infrastructure and prevented EMRA from starting to monitor quality indicators of all DISCOMs together.

The required infrastructure investment obligation was rephrased in the Regulation on Electricity Distribution and Retail Sale Service Quality enacted on January 1, 2013, which repealed the Regulation on Supply Continuity, Commercial and Technical Quality of Electrical Energy. In the new regulation, a supply continuity remote monitoring system and a supply continuity recording system were defined in detail and the dates of implementation of quality factor reflection to the revenue cap and the amount to be reflected are to be determined by the EMRA board decision.

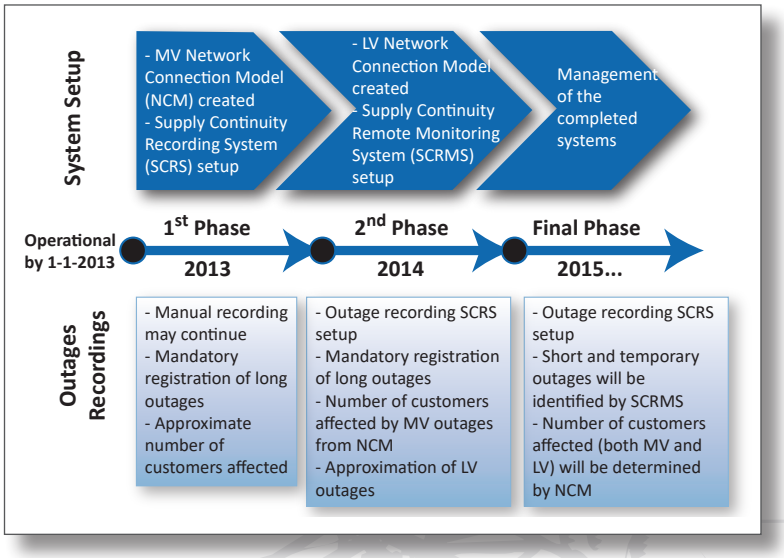
In addition, when the number of users affected by a supply discontinuity cannot be determined, the calculation method to be used to find the approximate number of MV users until 2014 and LV users until 2015 are given.

The targets for the required infrastructure are given as:

- the connection model for MV grid and supply continuity system installation will be installed by January 1, 2014;
- recording short and temporary discontinuities is not mandatory;
- the grid connection model is to be expanded to include the LV grid and the number of users affected by the supply discontinuities are to be determined and recorded by this system before 2014;
- supply continuity remote monitoring system up to the points of short and temporary discontinuities may occur;
- in 2014, DISCOMs submit their first quality reports containing 2013 results, to EMRA;
- technical quality measurement equipment have to be installed by the end of 2013 and, in 2014, the related data started to be sent to EMRA.

The abovementioned process is summarized in figure 3.

Figure 3. Process for Setting a System for Supply Continuity by DISCOMs in Turkey



Kaynak: Mutlu 2015.

Recording of Service Quality Data

According to SQR, to monitor supply continuity, DISCOMs must register all interruptions with the following information:

(a) Location
(b) Reason for the interruptions (for long interruptions)[7]
(c) Source of the interruptions
(d) Date and time of the interruption
(e) Number of customers affected (MV and LV)
(f) Date and time of the reenergizing
(g) Duration of the interruption
(h) If restoration of power happens in phases, data for items a, c, d, f, and g for each phase.

The same regulation classifies the interruptions and obliges DISCOMs to register them as follows:

(a) According to the source

(i) Transmission
(ii) MV distribution
(iii) LV distribution

7 Temporary interruption: less than one second; short interruption: between one second and three minutes; long interruption: longer than three minutes.

(b) According to the duration of interruption

(i) Long
(ii) Short
(iii) Temporary

(c) According to the reason

(i) Force majeure
(ii) Safety
(iii) External
(iv) DISCOM

(d) Wheter it is planned or not

DISCOMs are allowed to disconnect power during planned maintenance, provided that disconnection is announced publicly through the media and on the DISCOM's website at least 48 hours in advance. However, EMRA has put a limit to planned disconnections per year. Once the DISCOM exceeds that limit, the additional number of interruptions and their durations will be added to unplanned interruptions and calculated accordingly. Continuity of supply is calculated using internationally standardized indices:

- System Average Interruption Duration Index (SAIDI)
- System Average Interruption Frequency Index (SAIFI)
- Momentary Average Interruption Frequency Index (MAIFI)
- Total Duration of Interruptions (TDI), which is the time sum of all long interruptions
- Total Number of Interruptions (TNI), which is the frequency sum of all long and short interruptions

Table 4 specifies the allowable annual interruptions under existing legislation.

Table 4: Allowable Annual Interruption Limit per Customer

		Urban Customers		Rural Customers	
Interruption	Benchmark	LV	MV	LV	MV
Unnotified	TDI (hours)	48	24	72	36
	TNI	56	56	72	72
Notified	TDI (hours)	24	16	32	24
	TNI	6	4	8	6

Source: SQR Table 9.

The current regulation on service quality in Turkey follows international standards to measure and address service quality. This relates, in particular, to the frequency and duration of power supply disruptions and the number of customers affected.

Concerning the penalties for non-compliance with the SQR, scheduled outages should be announced 48 hours in advance through media, text messages, or e-mail

to the customers. If this process is not followed appropriately by the DISCOM, an administrative fine is applied by EMRA, lowering the revenue ceiling by TL 1000 (approximately US$300) per event.

A transition from an on-paper manual system to an automatized system of sustainable supply quality is ongoing. This is completed by some DISCOMs and is still to be initiated by others.

Additional Obligations Related to Service Quality, Operational Efficiency and System Reliability

In addition to the SQR, DISCOMs are obliged to fulfil the following requirements related to technical quality, which are defined in relevant legislation.

Systems to be implemented for improving service quality operational efficiency and power system reliability include the following:

- DISCOMs are obliged to establish SCADA systems to collect total MW and MVAr information from generation facilities having 30 MW or more installed capacity and wind and solar energy generation facilities having 10 MW or more installed capacity and transform these data to TEIAŞ' SCADA system according to Article 29 of the Grid Code. Also, total MW and MVAr values, total energy consumption, information about the connection points of all generation facilities connected to the distribution grid and other information requested by TEIAŞ are transferred to TEIAŞ' SCADA system through the communication link constructed between DISCOMs' SCADA systems and TEIAŞ' SCADA system. To achieve this task, DISCOMs are obliged to commission their SCADA control centers by the end of 2015 according to temporary Article 3 of the Grid Code.
- Article 21 of the Electricity Market Distribution Regulation obliges DISCOMs, to establish the necessary communication infrastructure to monitor the real-time flow of electricity in the distribution region at all stages, from the distribution grid entrance points to the consumption points, to collect all notifications and finalize them and to plan and implement protective O&M services.
- The board decision numbered 5885-1, dated November 24, 2015, defined the method of determining efficiency parameters of DISCOMs. According to this legislation, the data envelopment analysis method is to be used to determine efficiency parameters.

Loss Reduction Obligations

Loss targets are determined for each IP and revenue requirement depends on the difference between actual and targeted loss. DISCOMs have to attain the loss targets to obtain their revenues. In case DISCOMs perform better, they are incentivized by additional revenue. The regulation on 'Measures to Reduce Losses in the Distribution System', (December 2015) introduced some exceptions for DISCOMs whose loss rates were over the country average in 2014. These exceptions include the following:

- Efficiency factor will not be applied to such DISCOMs in IP3 and 50 percent efficiency factor will be applied afterwards.

- Target loss rates for these DISCOMs can be determined using methods different from the methods used for other DISCOMs.
- Target loss rates may be revised during an IP.
- Cost of defaults resulting from overcurrent caused by illegal use will be considered under uncontrollable costs.
- Additional meters for the Automatic Meter Reading system or for control purposes may be installed.
- Such DISCOMs are exempted from installing supply continuity measurement and recording equipment, technical quality obligations, and compensation payments for low quality.
- When the capacity of a connection contract is exceeded, such DISCOMs are not obliged to pay penalties to TEIAŞ

Customer Service Center Obligation

- Article 17 of Consumer Services Regulation requires DISCOMs and assigned suppliers to establish consumer services center to respond to failure notifications, reports of illicit electric consumption, appeals to payment notifications, complaints, and so on. In such consumer services center, a call center should also be established, which is capable of serving consumers 24 hours a day.

Obligations Related to Ancillary Services

- Article 9 of the EML requires DISCOMs to obtain ancillary services in line with the related regulation. Ancillary services, on the other hand, are defined as the services supplied by system users, to operate the system and supply electricity with necessary quality conditions. Provisions about supplying ancillary services to meet the need of distribution system operators would be included in the Electricity Market Ancillary Services Regulation upon the application of distribution system operators and approved by the EMRA board by December 31, 2012 (Temporary Article 8 of Electricity Market Ancillary Services Regulation). However, the Electricity Market Ancillary Services Regulation was not amended to include such provisions because EMRA had not received any proposals from DISCOMs. Currently, DISCOMS are not able to request ancillary services from the generation facilities that are connected to their grid, to meet the required quality conditions of the energy that is distributed.
- All licensed generation facilities are obliged to contribute reactive power control by their automatic voltage regulator or upon the instructions given by the distribution system operator in the limits given in the regulation according to Article 42 of the Electricity Market Ancillary Services Regulation

2.2 Structure of End-User Electricity Tariffs

Tariffs paid by electricity consumers in Turkey are set by EMRA and include energy and distribution components that are explicitly specified in electricity bills issued by

DISCOMs. Costs of losses and transmission services are included in the distribution component. The energy component in the tariff reflects the cost of energy supplied to captive consumers by assigned suppliers and is determined according to a price cap methodology.

In addition to loss and transmission costs, the distribution component includes the costs related to distribution services, that is revenue requirement of DISCOMs to carry out their operations, which is computed following a revenue cap methodology.

Tariff tables issued by EMRA also show reactive power cost, meter reading charge, capacity charge, and availability charge. The tables also include energy sale price to last resort tariff customers.

According to the EML, a temporary price equalization mechanism will be applied until the end of 2020, to partially or fully protect consumers from the distribution cost differences across regions. In this mechanism, EMRA entails cross-subsidies between DISCOMs and consumer groups. Accordingly, under this mechanism, while DISCOMs and assigned suppliers receive their cost-based tariff, consumers in all distribution regions pay a uniform national tariff.

Table 5 shows the breakdown according to connection voltage and customer group, where the energy cost is assumed to be base load.[8]

Table 5. National End-user Tariff Cost Breakdown for 2016 Q1-Q2-Q3 (TL/MWh)

Connection to	Customer Group	Q1		Q2		Q3	
		Energy Cost	Distribution Cost	Energy Cost	Distribution Cost	Energy Cost	Distribution Cost
Transmission	Assigned supplier customer	205.219	0	205.219	0	205.219	0
Distribution MV	Industry	205.219	54.955	205.219	54.954	205.219	54.954
	Commercial	213.428	103.158	219.624	96.96	221.207	95.377
	Households	213.428	100.668	219.475	94.62	221.02	93.075
	Irrigation	194.959	84.61	200.042	79.526	201.341	78.227
	Lighting	194.959	99.077	202.28	91.754	204.15	89.884
Distribution LV	Industry	205.219	85.479	205.219	85.478	205.219	85.478
	Commercial	213.428	121.335	219.623	115.137	221.208	113.552
	Households	213.428	118.407	219.475	112.358	221.02	110.813
	Veterans	75.184	87.49	77	82.521	77	82.521
	Irrigation	194.959	99.519	200.042	94.435	201.34	93.137
	Lighting	194.959	116.535	203.57	107.921	205.77	105.721
	General lighting	181.722	116.535	167.3913	107.921	151.5224	105.721

8 It is also possible to become a subscriber with different tariffs with three periods per day, day (06–17), peak (17–22), and night (22–06). The tariffs for consumption during these hours vary too.

2.2.1 Performance-based Regulation for Setting Revenue Requirements of DISCOMs

PBR is used to set the revenue requirements (allowed revenues) for distribution activities. This methodology sets a cap for DISCOMs' allowed revenues, providing incentives to improve their operational performance as a way to increase their profit. In particular, because DISCOMs' revenues depend on the amount of energy they distribute, interruptions and other incidents related to the quality of service imply loss of revenue.

The parameters of the revenue cap are set to recover allowed OPEX, investments (CAPEX) depreciation,[9] together with a return on Weighted Average Cost of Capital (WACC) calculated over the average regulatory asset base (RAB) value and corporate tax requirements. The CAPEX revenue cap is subject to correction, depending on actual investment expenditures and actual realization time, at the end of each IP, while the OPEX revenue cap is not, except for the costs not controllable by DISCOMs. The regulation also has additional efficiency, quality, and loss targets that DISCOMs have to meet to avoid loss of revenue.

Revenue requirement is determined by the formula as follows:

Revenue requirement = System operation revenue cap − Quality factor X + Loss revenue cap
= Return (RAB*WACC) + OPEX + Depreciation and tax difference + Loss
(actual revenue − targeted revenue) − Quality factor X

EMRA uses a straight-line depreciation method and the depreciation span is 10 years for new assets invested in by the DISCOM. On the contrary, national accounting standards and rules set a 30-year depreciation period for electricity assets. WACC (capital asset pricing model) is used in calculations for return on investment. For the tariff period from 2011–2015, real and pre-tax WACC was determined at 10.49 percent. The same parameter was determined at 11.91 percent for IP3.

IP2 was a transitional period. Privatization had been completed as of 2013 and distribution and retail sale activities had started to be separated then. Hence, the cost allocation between distribution and energy sale activities in this period, which was used for IP3, might not have been done precisely.

There are two separate revenue caps, which are allowed to be collected through end-user tariffs:

- Distribution System Usage Revenue Cap, aims to cover remuneration of investments (depreciation) and on invested capital as by cost of capital as determined by EMRA over time, and OPEX incurred for maintaining and operating the distribution network (to be adjusted by the X factor).

9 In IP1, the amortization period was 5 years. In IP2 and in IP3 it is 10 years. The CAPEX allowance is for new investments in the distribution region and has no reservation to finance the privatization cost. The privatization cost was paid by the shareholders of the DISCOM; hence, the DISCOM is not the debtor. However, DISCOMs are expected to transfer this payment to their shareholders from their profits because of efficient operation.

- Loss Revenue Cap, compensates the distribution network operator for an allowed level of losses. The allowance varies from region to region and is dependent on both the network infrastructure and the sociopolitical environment and historic levels of losses.

2.2.2 The OPEX Component

The net OPEX allowance is part of the allowed regulated distribution revenue cap, which is set by EMRA on an ex ante basis for each year of the IP.

For IP2, EMRA has defined the following OPEX items:

- OPEX items
  - Personnel costs
  - Material to be used for O&M
  - Outsourced services
  - Insurance costs for network operations
  - Payments to other DISCOMs
  - OPEX for non-standard connections
  - OPEX for standard connections
  - Other OPEX
  - Regulatory costs
  - Operational costs
  - Ordinary and extraordinary costs
- Non-tariff income (regulated)
  - Income related with operations
  - Extraordinary income
- Meter reading costs
- Out-of-control costs

EMRA evaluates the OPEX submissions of DISCOMs; revises those submissions by using indicators such as past realizations, national and international benchmarks, and/or reference company models. The final revenue cap for OPEX is determined by using operational efficiency factor X.

2.2.3 The CAPEX Component

Before IP1, the allowance for CAPEX was usually kept stringent, and the main focus was on capacity increase. An extra amount was paid to DISCOMs under the 'Transfer of Operational Rights Fee' in IP1 to finance the required investments for that period. Because of the postponed privatization process and delayed transfer to new operators, those funds were mostly used by the public companies (TEDAŞ affiliates). Following privatization, DISCOMs are expected to modernize the distribution system following international best practices. To achieve this goal, the CAPEX allowances have been adjusted to enable investments in several areas, such as;

- capacity increase needed to keep pace with growing demand of system users;
- rehabilitation and replacement;
- operations technology, IT, and Advanced Metering Infrastructure (AMI); and
- quality management: SAIDI, SAIFI, MAIFI, voltage control, and so on

DISCOMs are obliged to prepare master plans with a 5–20 year time horizon and provide an updated revision every three years. Investment plans must give priority to:

- safety,
- supply security and technical quality, and
- cover new connection needs, because of the steadily increasing electricity demand

For the last year of an IP, DISCOMs are obliged to submit their investment plans for the next five years, detailing each relevant CAPEX category for EMRA's approval. The main principles of these plans are as follows:

- Meet the demand following their demand projections
- Flexibility toward new technologies and possible demand fluctuations
- Quality of service
- Provide a high service level at minimal cost
- Low loss rates, to the extent possible
- Coordination with TEIAŞ investment plans

In IP2, EMRA has not been able to actively monitor the justification and cost effectiveness of DISCOM investments. To get the required service quality in place, all DISCOMs should invest in facilities for reliable operation and increasing the service quality, including MIS and SCADA systems. In IP3, CAPEX realizations are going to be regulated on a yearly basis. Hence, from 2016 onward, for IP3, EMRA will have enhanced control over the situation.

2.3 Setting Targets for the Revenue Requirement of DISCOMs

There are three specific targets that DISCOMs have to meet to avoid reduction in allowed revenues.

- For OPEX, there is an efficiency target (X factor), providing incentives to inefficient DISCOMs to catch up with the more efficient ones.
- Loss targets are also DISCOM specific and based on past realizations. The future targets aim at a gradual convergence toward international standards.
- Service quality targets (still need to be implemented; a uniform monitoring system needs to be implemented by all DISCOMs). The trajectory to full enforcement of the SQR is the same for all DISCOMs even though they may have different starting points for reporting, practice, and performance as measured by typical quality key performance indicators such as SAIDI, SAIFI, and MAIFI. According to the SQR, all DISCOMs have to calculate these key performance indicators, which should be measured transparently and reported on time.[10]

2.3.1 Efficiency Allowance - OPEX X Factor

EMRA has provided the efficiency allowances (also known as the X factor) to 21 DISCOMs and reviewed them for benchmarking purposes. These aim to achieve adequate operational efficiency in electricity distribution. It is set as a percentage of controllable OPEX and decreases the annual OPEX allowance.

The net OPEX allowance is calculated with the following formula:

$$OPEX_{net} = (OPEX - \text{non-tariff income}) \times (1 - X)$$

Here, the non-tariff income consists of income from network assets and regulated income such as connection/disconnection costs, and so on. Moreover, each regulated income item has an approved tariff.

For IP1, X factors had been determined by TEDAŞ, using the benchmarking method. In this process, the allowed OPEX of DISCOMs of comparable countries were taken and compared with TEDAŞ' costs of grid development, O&M, general management, line length, and number of transformers. For each item and for the total, the cost reduction potential had been determined for each distribution region and TEDAŞ' total. Afterwards, an efficiency increase of 7.3 percent (calculated using average values) and 21.4 percent (compared with the best implementation) for TEDAŞ was foreseen to be realized in a 10-year period and it was expected that on TEDAŞ average, 0.8 percent–2.4 percent annual efficiency increase would be possible. Then, using the regional data, efficiency increase requirements were calculated for each DISCOM.[11]

For IP2, values of the most important parameters affecting the operational processes of DISCOMs were determined. In carrying out this task, partial efficiency analysis, data envelopment analysis, and total factor efficiency analysis were performed and models were established. Using the established models and the 2007–2009 data efficiency score, the efficiency potential of each distribution region was calculated. In this process, it was found that the line length has a big impact on the performance of DISCOMs. While calculating regional efficiency scores, efficiency of the sector was also considered and in this scope for 2007–2009, the total factor productivity of the distribution sector was also calculated. In the process of determining efficiency factors, considering that the privatization process had not yet been completed, the efficiency target was determined as 90 percent instead of 100 percent. Consequently, IP2 efficiency parameters were determined to reach 90 percent efficiency within 10 years.

For IP3, the data envelopment analysis method is used in line with the EMRA board decision (number 5885-1, dated November 24, 2015). In this process, the efficiency levels are calculated using analyzed costs of operational cost components in the scope of the Communique on Regulation of Distribution System Revenue. In the efficiency model, operational cost components, line length, transformer capacity,

10 In the process of enforcing the SQR, changes in standards may be needed to adjust to the Turkish situation.

11 Efficiency Factor Implementation in Turkish Natural Gas and Electric Distribution Sectors - Mustafa Duzgun.

number of transformers, energy entering the distribution system, peak demand, geographical area, number of distribution system users, and so on are used while the uncontrollable costs are not used. In addition, variables such as density of distribution system users (users per km2), household consumer ratio, socioeconomic development ratio, and ratio of actual loss may also be used as peripheral factors.

The X factors for IP2 and IP3 are presented in table 6.

Table 6. Efficiency Allowances for the 21 DISCOMs in Turkey (X Factor)

Company	Date of takeover	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Aydem/Menderes (Bereket)	15.08.2008	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00
Başkent (EnerjiSA-e.on)	28.01.2009	%0,58	%1,44	%3,35	%3,35	%3,35	%1,28	%1,28	%1,28	%1,28	%1,28
Sedaş (Akcez)	11.02.2009	%0,45	%1,14	%2,64	%2,64	%2,64	%0,54	%0,54	%0,54	%0,54	%0,54
Kayseri*	15.07.2009	%0,78	%1,95	%4,53	%4,53	%4,53	%2,34	%2,34	%2,34	%2,34	%2,34
Meram (Alarko)	30.10.2009	%0,99	%2,46	%5,71	%5,71	%5,71	%0,79	%0,79	%0,79	%0,79	%0,79
Osmangazi (Yıldızlar)	31.05.2010	%0,14	%0,36	%0,83	%0,83	%0,83	%0,00	%0,00	%0,00	%0,00	%0,00
Çamlıbel (Limak, Kolin, Cengiz)	31.08.2010	%0,31	%0,77	%1,78	%1,78	%1,78	%0,00	%0,00	%0,00	%0,00	%0,00
Uludağ (Limak, Kolin, Cengiz)	31.08.2010	%0,07	%0,17	%0,39	%0,39	%0,39	%0,43	%0,43	%0,43	%0,43	%0,43
Çoruh (AKSA)	30.09.2010	%0,43	%1,09	%2,52	%2,52	%2,52	%0,00	%0,00	%0,00	%0,00	%0,00
Yeşilırmak (Çalık)	30.12.2010	%0,00	%0,01	%0,01	%0,01	%0,01	%0,53	%0,53	%0,53	%0,53	%0,53
Akedaş/Göksu (Akedaş)	31.12.2010	%0,73	%1,83	%4,25	%4,25	%4,25	%0,02	%0,02	%0,02	%0,02	%0,02
Fırat (AKSA)	06.01.2011	%0,53	%1,33	%3,08	%3,08	%3,08	%0,00	%0,00	%0,00	%0,00	%0,00
Trakya (İçtaş)	03.01.2012	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00
Akdeniz (Limak, Kolin, Cengiz)	28.05.2013	%0,00	%0,00	%0,00	%0,00	%0,00	%1,61	%1,61	%1,61	%1,61	%1,61
Boğaziçi (Limak, Kolin, Cengiz)	28.05.2013	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00
Gediz (Elsan, Tümaş, Karaçay)	14.06.2013	%0,00	%0,00	%0,00	0,00	0,00	%0,00	%0,00	%0,00	%0,00	%0,00
Dicle (İşkaya-Dogu)	28.06.2013	%0,33	%0,83	%1,93	%1,93	%1,93	–	–	–	–	–
Aras (Kiler - Çalık))	28.06.2013	%0,67	%1,68	%3,91	%3,91	%3,91	–	–	–	–	–
Vangölü (Türkerler)	29.07.2013	%0,90	%2,25	%5,21	%5,21	%5,21	–	–	–	–	–
Ayedaş (EnerjiSA-e.on)	01.08.2013	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00	%0,00
Toroslar (EnerjiSA-e.on)	01.10.2013	%0,10	%0,25	%0,58	%0,58	%0,58	%0,61	%0,61	%0,61	%0,61	%0,61

Note: * *0 percent means no reduction in OPEX because of satisfactory efficiency in operation.[12]
Kaynak: EMRA, Authors

According to the regulation on 'Measures to Reduce Losses in the Distribution System', Article 7, efficiency factor will not be applied to three DISCOMs (Dicle, Aras, and Vangolu) until the end of 2020,[13] with the assumption that their losses will remain higher than the national average.

12 For some DISCOMs, the X factor is kept as zero because their revenue proposals were already approved with a reduction.

13 Regulation on 'Measures to Reduce Losses in the Distribution System', January 2016. Because of socioeconomic and political reasons, such as immigration, political unrest, and lately refugees, three DISCOMs have exceptionally high losses and insufficient performance

2.3.2 Loss Targets

The methodology for meeting the lost energy cost altered through the last decade. In IP1, with the implementation of balancing and settlement principles, private generators were increasing their generation for eligible consumers to compensate for the technical losses determined by TEDAŞ and later approved by EMRA. DISCOMs, through their retail sales were compensating the rest of the losses assuming that there was no unmetered energy on the eligible consumers' side. As the eligibility limit decreased, the consumption of eligible consumers increased and consequently the burden on captive consumers increased. Then the method of meeting the loss was changed and, from December 29, 2010, loss is calculated using the difference between energy entering the distribution region and metered amount on consumers and energy leaving the distribution region.

Moreover, especially in IP1 and partly in IP2, loss values were not precise because street lighting was not metered then and some DISCOMs attributed part of the losses to this item. Some DISCOMs, after privatization claimed that the actual loss levels are higher than the declared level. If so, taking unreliable values as reference to determine loss targets would lead DISCOMs to have unreachable targets. The corrections during the IPs were signaling this could be the case. Hence, when evaluating loss, the decreasing performance of a DISCOM, comparing targeted and realized loss values may mislead the evaluation for those periods. In addition, for evaluation of this performance, the period following the privatization would give a better idea about the DISCOM.

Among the purposes of the privatization is the need to decrease the loss rate, especially in those regions with historically high rates. If a DISCOM achieves a lower or higher loss rate compared to the target, the extra gains or losses are retained by the DISCOM. Thus, reduction of the loss rates below the targets set by EMRA is especially rewarding, as the DISCOM can retain the difference as profits. The projected cost of loss for each DISCOM is determined by EMRA and is reflected in the distribution tariffs. Each DISCOM presents its demand forecast to EMRA and the latter uses these forecasts to derive the unit price from the attained revenue requirement.

Table 7 shows the loss rate (technical loss and theft) targets for 2011–2020 as formulated by EMRA for DISCOMs. According to the Regulation on Measures for Decreasing Distribution Losses, Article 8, the loss factor is determined differently for Dicle, Aras, and Vangolu, DISCOMs that have high loss rates.

Table 7. Loss Rate Targets for the 21 DISCOMs in Turkey

Company	Date of takeover	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Aydem/Menderes (Bereket)	15.08.2008	%12,77	%8,62	%8,32	%8,04	%7,78	%9,80	%9,34	%8,90	%8,49	%8,09	%7,92
Başkent (EnerjiSA-e.on)	28.01.2009	%11,64	%10,20	%9,49	%8,83	%8,22	%8,46	%8,07	%7,88	%7,88	%7,88	%8,00
Sedaş (Akcez)	11.02.2009	%12,96	%11,08	%10,24	%9,47	%8,77	%7,66	%7,31	%6,96	%6,64	%6,33	%7,42
Kayseri*	15.07.2009	%0,00	%0,00	%0,00	%10,27	%10,50	%10,01	%10,01	%10,01	%10,01	%10,01	%7,44
Meram (Alarko)	30.10.2009	%9,31	%8,93	%8,78	%8,63	%8,49	%8,59	%8,28	%8,28	%8,28	%8,28	%7,90
Osmangazi (Yıldızlar)	31.05.2010	%7,36	%7,22	%7,13	%7,04	%6,95	%7,21	%7,21	%7,21	%7,21	%7,21	%7,77
Çamlıbel (Limak, Kolin, Cengiz)	31.08.2010	%10,09	%9,80	%9,26	%8,75	%8,28	%7,72	%7,36	%7,02	%6,92	%6,92	%7,93
Uludağ (Limak, Kolin, Cengiz)	31.08.2010	%8,93	%9,23	%8,48	%7,79	%7,15	%6,96	%6,90	%6,90	%6,90	%6,90	%7,55
Çoruh (AKSA)	30.09.2010	%12,71	%13,38	%12,72	%12,11	%11,53	%10,90	%10,39	%10,15	%10,15	%10,15	%9,35
Yeşilırmak (Çalık)	30.12.2010	%17,71	%10,89	%10,30	%9,75	%9,23	%10,35	%9,87	%9,41	%8,97	%8,78	%8,50
Akedaş/Göksu (Akedaş)	31.12.2010	%12,65	%11,77	%11,51	%11,27	%11,05	%10,03	%10,03	%10,03	%10,03	%10,03	%7,46
Fırat (AKSA)	06.01.2011	%15,14	%12,59	%11,45	%10,41	%9,47	%12,59	%11,65	%11,11	%10,59	%10,09	%9,74
Trakya (İçtaş)	03.01.2012	%11,10	%9,24	%8,76	%8,30	%7,87	%7,70	%7,70	%7,70	%7,70	%7,70	%7,15
Akdeniz (Limak, Kolin, Cengiz)	28.05.2013	%11,74	%8,90	%8,75	%8,60	%8,45	%8,86	%8,45	%8,05	%8,02	%8,02	%9,66
Boğazici (Limak, Kolin, Cengiz)	28.05.2013	%17,39	%14,50	%13,30	%12,19	%11,18	%9,12	%8,69	%10,76	%10,26	%9,78	%9,60
Gediz (Elsan, Tümaş, Karaçay)	14.06.2013	%8,63	%6,82	%6,69	%6,56	%6,44	%8,48	%8,08	%7,70	%7,34	%7,00	%8,47
Dicle (İşkaya-Doğu)	28.06.2013	%53,97	%52,39	%46,35	%41,00	%36,27	%60,96	%50,63	%71,07	%59,03	%49,03	%71,62
Aras (Kiler - Çalık))	28.06.2013	%26,89	%25,82	%22,88	%20,27	%17,97	%22,92	%19,04	%25,70	%21,35	%17,73	%31,68
Vangölü (Türkerler)	29.07.2013	%55,11	%51,05	%45,21	%40,03	%35,45	%46,15	%38,33	%52,10	%43,27	%35,94	%60,16
Ayedaş (EnerjiSA-e.on)	01.08.2013	%11,34	%9,38	%8,61	%7,91	%7,27	%7,12	%6,79	%6,61	%6,61	%6,61	%7,61
Toroslar (EnerjiSA-e.on)	01.10.2013	%16,89	%11,59	%10,60	%9,70	%8,87	%9,38	%8,94	%11,80	%11,25	%10,72	%13,59

Source: EMRA 2016.

During IP1 and IP2, the loss and theft targets were determined for each year of the IP at the beginning of the IP. Although this methodology was implemented in all distribution regions during 2011–2015, the loss rates were re-determined[14] for Dicle, Vangolu, Aras, Toroslar, and Bogazici Regions in 2013, because these regions had not been privatized by then. However, for IP3, the loss targets were determined only for one year using the realizations in the last three years and the threshold value (TV) determined by the EMRA board for that IP.

With an amendment made on March 27, 2015, to the EML, the EMRA board is now authorized to handle DISCOMs whose losses are higher than the country average loss differently and to determine the targeted loss again, considering the actual loss ratios realized in the previous year according to the temporary Article 18 of the EML.

EMRA published a resolution[15] on December 15, 2015, which eases the gap between actuals and targets as summarized in the following equations.

14 Board decision number: 4128, dated November 15, 2012.
15 Principles and procedures to determine target L&NP ratios of DISCOMs.

(a) Regions which had loss levels in the last three years below the TV determined by the board as a percentage will have a target for the following year as:

$LT_t = (TV + \min [LR_{t-2}, LR_{t-3}, LR_{t-4}])/2$
t : Year in IP3
LT : Loss Target
LR : Actual Loss Rate

(b) Regions which had loss levels in the last three years greater than the TV but less than the last three years' national average, will have a target for the following year as:

LT_t = Weighted Average (LR_{t-2}, LR_{t-3}, LR_{t-4}) × 0,98
If the result of this equation is less than the TV, the target will be set at TV.

(c) Regions which had loss levels in the last three years greater than the last year's country average will have a target for the following year as:

LT_t = Weighted Average (LR_{t-2}, LR_{t-3}, LR_{t-4}) × 0,97

As discussed before, when a DISCOM performs with a higher loss level than its target, there will be an additional cost to the DISCOM and this difference will need to be purchased at the TETAŞ selling price, creating an incentive for lower loss levels.

2.3.3 Service Quality Targets

Historically, because the required systems for service quality monitoring have not been uniformly installed in all DISCOMs, the quality indicators have not been monitored. Therefore, quality targets have not been set for investment periods, including the existing period, IP3. However, with the board decision dated December 30, 2015, a general quality indicator is determined for IP3. Accordingly, for DISCOMs without fatal accidents (excluding the accidents caused by third parties) the system operation revenue cap will be increased by 0.5 percent, starting from IP3's third year.

3. Realization of Targets

3.1 Efficiency Allowance - OPEX X Factor

From the point of operational efficiency, the X factor values in table 6 show that OPEX allowances of Aydem, Trakya, Bogazici, Gediz, and Ayedas should not be reduced. Four DISCOMs (Osmangazi, Camlibel, Coruh, and Firat) with certain X factors implemented in IP2, will have X factors of 0 in their IP3.[16] According to the latest legislation, the X factor is not going to be applied to controllable operational costs of Dicle, Aras, and Vangolu DISCOMs during IP3. As discussed previously, the recent regulation on 'Measures to Reduce Losses in the Distribution System' differentiates distribution regions where the rate of technical and non-technical losses is above the national average and spares these three regions from service quality obligations, including on supply continuity, technical quality, and penalties. These high loss DISCOMs will not be responsible for efficiency parameters until 2020.

DISCOMs whose controllable operation costs are expected to decrease in IP3 are listed in table 8.

Table 8. DISCOMs Whose X Factors are Greater than 0 in IP3

Company	2011 (%)	2012 (%)	2013 (%)	2014 (%)	2015 (%)	2016 (%)	2017 (%)	2018 (%)	2019 (%)	2020 (%)
Başkent (EnerjiSA-e.on)	0,58	1,44	3,35	3,35	3,35	1,28	1,28	1,28	1,28	1,28
Sedaş (Akcez)	0,45	1,14	2,64	2,64	2,64	0,54	0,54	0,54	0,54	0,54
Kayseri	0,78	1,95	4,53	4,53	4,53	2,34	2,34	2,34	2,34	2,34
Meram (Alarko)	0,99	2,46	5,71	5,71	5,71	0,79	0,79	0,79	0,79	0,79
Uludağ (Limak, Kolin, Cengiz)	0,07	0,17	0,39	0,39	0,39	0,43	0,43	0,43	0,43	0,43
Yesilırmak (Çalık)	0,00	0,01	0,01	0,01	0,01	0,53	0,53	0,53	0,53	0,53
Akedaş/Göksu (Akedaş)	0,73	1,83	4,25	4,25	4,25	0,02	0,02	0,02	0,02	0,02
Akdeniz (Limak, Kolin, Cengiz)	0,00	0,00	0,00	0,00	0,00	1,61	1,61	1,61	1,61	1,61
Toroslar (EnerjiSA-e.on)	0,10	0,25	0,58	0,58	0,58	0,61	0,61	0,61	0,61	0,61

Source: Authors, EMRA

Although specific X factor targets are determined for DISCOMs shown in table 8, these should not be considered as low performance companies compared to other DISCOMs. This situation is the result of EMRA benchmarking, reflecting their operation costs for IP3 being higher than the reference values in the operational productivity benchmarking. Thus, EMRA applied a reduction to their costs. Except the three DISCOMS with high losses, the average efficiency increase expectation is 0.91 percent in IP3, compared to 1.75 percent in IP2.

16 X factors used in IP2 and IP3 are provided in table 6.

3.2 Loss

As discussed in section 2.3.2, the calculation method of loss rate and compensating energy loss has altered during the first two IPs. In IP1, the loss targets were calculated based on the difference between purchased energy and sold energy and accordingly the shifted eligible consumer' technical losses were compensated by their suppliers. Thus, the following resulting miscalculations were made when eligible consumers were shifted:

- The unmetered energy portion share of such eligible consumers increased the difference between purchased and sold energy and the loss seemed higher than it was.
- In DISCOMs with lower loss levels, the energy supplied by their private suppliers to meet the technical losses decreased the energy purchased by DISCOMs and the loss seemed lower than it was.

In IP2, a methodology based on the amount of distributed energy was used to overcome the miscalculations presented above. Therefore, for the purposes of this study, because of the difference in calculation methodologies, it would not be meaningful to compare the loss rates in IP1 and IP2. On the other hand, during the IP2 loss targets determination, nine DISCOMs were operated by private operators and three of these regions were transferred to the private sector recently. There were claims from some DISCOMs that the records of publicly operated regions were not reliable, which possibly resulted in unrealistic target setting. Accordingly, loss targets of some DISCOMs were revised by EMRA in 2013 (before the privatization of related DISCOMs) and the final targets are presented in Table 9. Table 9 shows the realized loss rates and 2016 targets.

Table 9. Realized Loss Rates and 2016 Targets of DISCOMs

Company	Date of Takeover	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)	2015 (%)	2016 Target (%)
Aydem/Menderes (Bereket)	15.08.2008	7,11	7,36	11,92	10,28	8,69	8,41	8,00	7,61	7,90	7,03	7,92
Başkent (EnerjiSA- e.on)	28.01.2009	9,56	8,63	8,48	8,88	8,55	9,17	8,67	7,90	7,70	7,00	8,00
Sedaş (Akcez)	11.02.2009	10,12	6,53	7,55	8,04	6,41	7,00	7,14	6,64	6,80	6,68	7,42
Kayseri*	15.07.2009		11,14	10,27	10,70	8,74	7,12	6,89	6,85	6,90	5,25	7,44
Meram (Alarko)	30.10.2009	7,83	8,27	8,80	9,01	9,64	8,93	8,98	7,14	7,30	7,30	7,90
Osmangazi (Yıldızlar)	31.05.2010	7,24	6,26	5,64	6,78	9,11	7,14	7,15	7,86	7,80	7,62	7,77
Çamlıbel (Limak, Kolin, Cengiz)	31.08.2010	8,55	8,76	9,21	8,10	7,31	9,20	8,32	7,58	7,70	7,06	7,93
Uludağ (Limak, Kolin, Cengiz)	31.08.2010	8,81	8,59	7,52	7,30	7,38	8,92	7,32	7,03	6,90	6,94	7,55
Çoruh (AKSA)	30.09.2010	12,27	11,98	10,63	11,44	11,57	11,24	10,19	9,42	9,00	9,28	9,35
Yeşilırmak (Çalık)	30.12.2010	9,47	9,09	9,24	10,86	12,89	7,80	7,26	10,46	8,30	7,90	8,50
Akedaş/Göksu (Akedas)	31.12.2010	9,33	7,95	7,84	8,44	8,17	8,33	7,22	6,70	6,80	4,98	7,46
Fırat (AKSA)	06.01.2011	11,68	10,99	10,44	13,61	12,24	11,11	10,85	9,49	9,50	10,44	9,74
Trakya (Ictas)	03.01.2012	9,34	7,61	7,18	7,11	6,80	8,26	6,46	6,14	6,30	7,39	7,15
Akdeniz (Limak, Kolin, Cengiz)	28.05.2013	8,87	9,72	9,40	9,29	8,30	8,47	9,78	11,32	8,50	7,02	9,66
Boğaziçi (Limak, Kolin, Cengiz)	28.05.2013	12,25	12,15	10,84	9,56	9,75	10,76	10,24	9,89	9,20	9,44	9,60
Gediz (Elsan, Tümaş, Karaçay)	14.06.2013	6,48	10,23	7,48	8,89	8,84	8,83	7,81	9,73	8,40	7,36	8,47
Dicle (İşkaya- Doğu)	28.06.2013	57,76	64,81	64,54	73,39	65,48	76,55	71,74	75,03	74,10	72,12	71,62
Aras (Kiler-Çalık)	28.06.2013	29,42	29,32	27,16	27,67	25,47	34,02	33,79	27,58	26,20	26,60	31,68
Vangölü (Türkerler)	29.07.2013	63,83	56,19	55,91	55,56	57,15	59,05	59,07	65,84	61,00	59,70	60,16
Ayedaş (EnerjiSA- e.on)	01.08.2013	10,24	9,14	8,71	7,47	6,92	6,91	6,88	7,59	7,20	7,00	7,61
Toroslar (EnerjiSA-e.on)	01.10.2013	10,85	10,61	9,85	9,84	8,92	13,77	13,22	15,24	13,20	12,50	13,59

Source: MENR and EMRA 2016.

One of the purposes of distribution privatization was to reduce technical losses to reasonable levels and prevent unmetered usage. Considering the limited number of DISCOMs which were privatized before IP2, it is evaluated that, comparing the realized loss rates with the targeted rates of IP2 would not lead to an accurate conclusion about the effect of privatization on loss reduction. That is why in IP2, the realized rates are compared considering the years following the takeover of the distribution region. In addition, the comparison between 2016 targets and 2015 realizations show that, most of the DISCOMs have already achieved 2016 targets in 2015. There are seven DISCOMs whose loss reduction performance after their privatization is more than 20 percent in IP2.

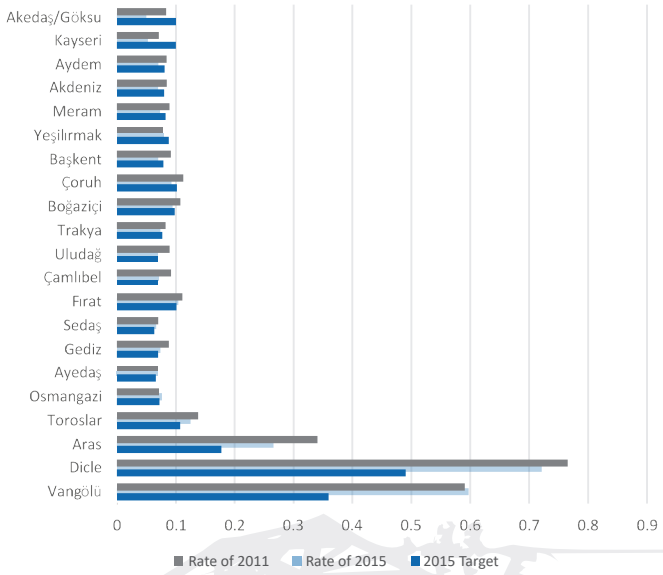
Table 10. Loss Ratio Realizations and 2016 Targets Comparison

Company	2011 (%)	2012 (%)	2013 (%)	2014 (%)	2015 (%)	2016 Target (%)	2015 Target -Rate (%)	2016 Target -2015 Rate (%)	Performance After Privatization (%)
Aydem/Menderes (Bereket)	8.41	8.00	7.61	7.90	7.03	7.92	1.06	0.89	16.41
Baskent (EnerjiSA-e.on)	9.17	8.67	7.90	7.70	7.00	8.00	0.88	1.00	23.66
Sedas (Akcez)	7.00	7.14	6.64	6.80	6.68	7.42	-0.35	0.74	4.57
Kayseri*	7.12	6.89	6.85	6.90	5.25	7.44	4.76	2.19	26.26
Meram (Alarko)	8.93	8.98	7.14	7.30	7.30	7.90	0.98	0.60	18.25
Osmangazi (Yildizlar)	7.14	7.15	7.86	7.80	7.62	7.77	-0.41	0.15	-6.72
Camlibel (Limak, Kolin, Cengiz)	9.20	8.32	7.58	7.70	7.06	7.93	-0.14	0.87	23.26
Uludag (Limak, Kolin, Cengiz)	8.92	7.32	7.03	6.90	6.94	7.55	-0.04	0.61	22.20
Coruh (AKSA)	11.24	10.19	9.42	9.00	9.28	9.35	0.87	0.07	17.44
Yesilirmak (Calik)	7.80	7.26	10.46	8.30	7.90	8.50	0.88	0.60	-1.28
Akedas/Goksu (Akedas)	8.33	7.22	6.70	6.80	4.98	7.46	5.05	2.48	40.22
Firat (AKSA)	11.11	10.85	9.49	9.50	10.44	9.74	-0.35	-0.70	6.03
Trakya (Ictas)	8.26	6.46	6.14	6.30	7.39	7.15	0.31	-0.24	-14.40
Akdeniz (Limak, Kolin, Cengiz)	8.47	9.78	11.32	8.50	7.02	9.66	1.00	2.64	37.99
Bogazici (Limak, Kolin, Cengiz)	10.76	10.24	9.89	9.20	9.44	9.60	0.34	0.16	4.55
Gediz (Elsan, Tümaş, Karaçay)	8.83	7.81	9.73	8.40	7.36	8.47	-0.36	1.11	24.36
Dicle (Iskaya-Dogu)	76.55	71.74	75.03	74.10	72.12	71.62	-23.09	-0.50	3.88
Aras (Kiler - Çalık))	34.02	33.79	27.58	26.20	26.60	31.68	-8.87	5.08	3.55
Vangolu (Turkerler)	59.05	59.07	65.84	61.00	59.70	60.16	-23.76	0.46	9.33
Ayedas (EnerjiSA-e.on)	6.91	6.88	7.59	7.20	7.00	7.61	-0.39	0.61	7.77
Toroslar (EnerjiSA-e.on)	13.77	13.22	15.24	13.20	12.50	13.59	-1.78	1.09	17.98

***Source*:** Authors, EMRA

Overall, it is possible to conclude that following privatization, in most regions, a reduction in loss rates was achieved following the handover, compared with the reported rates before privatization. As shown in Table 10 in the comparison of 2015 targets with 2015 realizations, the realizations are close to the targets except for the three DISCOMs, which are excluded from the evaluation under this report. In some DISCOMs, realizations are considerably better than the targets (that is Akedaş, Kayseri, Aydem, and Akdeniz), which is an indication that the incentive mechanism works when other factors favor implementation.

Figure 4. IP2 Loss Performance of DISCOMs



Source: Authors

3.3 Service Quality

The SQR is comprehensive and adequate for establishing the framework for service quality. However, implementation is at different stages among 21 DISCOMs. DISCOMs' performance, monitoring, data handling, and feasibility/necessity of their planned investments differ considerably. According to the SQR, the DISCOM is responsible for the 'Continuity of Supply', 'Technical Quality', and 'Commercial Quality', whereas the incumbent retailer is responsible only for 'Commercial Quality'. However, it is uncertain and there is no clear guidance on how all DISCOMs are going to implement the SQR, with a transparent quality measurement system, in time.

3.3.1 Reporting on Service Quality

A key item of the regulation is the regular reporting requirements of service quality indicators by DISCOMs. Table 11 provides an overview of the progress made on reporting by individual DISCOMs.

This table shows that the level of reporting varies considerably among DISCOMs. Moreover, there is no reliable assessment of the reporting methodology used or the quality level of the data. Some DISCOMs provided the required information in spreadsheets and others in PDF format. The transparency and accessibility of data is another issue. For instance, some data of Camlibel and Akdeniz are not accessible. Furthermore, the published information is also not always up to date. Late or no publication is a concern, as service quality management requires timely, if not immediate, action.

The general overview of the quality data from DISCOMs' websites shows that DISCOMs still have to develop mechanisms to collect the data required and report

to EMRA/MENR in a satisfactory manner. However, majority of DISCOMs need to improve their technical and staff capacity to collect, compile, aggregate, and analyze data meaningfully and on time.

DISCOMs regularly submitted the available data to EMRA. Nevertheless, there are some concerns over the completeness, accuracy, correctness, comparability, and consistency of the information, as well as on the transparency in the way it is publicly disclosed.

Table 11. Commercial Quality and Supply Continuity Quality Indicator Reporting by DISCOMs

Company	Table 1 Interruptions Details	Table 5 Interruptions Summary	Table 7 Complaint Details	Table 8a and 8c Complaint Summary
1. Dicle	From June 2014, 2015 monthly 'May 2016'	From June 2014 up to August 2015, monthly 'May 2016'	Not issued	Not issued
2. Vangolu	2014–2015 monthly 'May 2016'	2014–2015 monthly 'May 2016'	2013–2014–2015 monthly (pdf) 'May 2016'	Only table 8a: 2013–2014-2015 monthly (pdf) 'May 2016'
3. Aras	December 2013, 2014-2015 monthly 'May 2016'	2013 yearly, 2014–2015 monthly 'May 2016'	2013 yearly, 2014–2015 monthly 'April 2016'	2015 monthly 'April 2016'
4. Coruh	2011 yearly, 2013–2014–2015 monthly 'May 2016'	2011 yearly, 2013–2014–2015 monthly 'May 2016'	2011–2012 quarterly (last quarter is missing), 2013–2014–2015 monthly 'May 2016'	2011–2012 quarterly (last quarter is missing), 2013–2014–2015 monthly 'May 2016'
5. Firat	2011 yearly, 2013–2014–2015 monthly 'May 2016'	2011 yearly, 2013–2014(pdf)–2015 monthly 'May 2016'	2011–2012 quarterly, 2013–2014–2015 monthly 'May 2016'	2011–2012 quarterly, 2013–2014–2015 monthly 'May 2016'
6. Camlibel	2013–2014 monthly (2015 not accessible) 'December 2014'	2009–2010–2011–2012 yearly, 2013–2014 monthly (2015 not accessible) 'December 2014'	2009–2010–2011–2012 quarterly, 2013–2014–2015 monthly 'December 2015'	2009–2010–2011–2012 quarterly, 2013-2014–2015 monthly (pdf) 'December 2015'
7. Toroslar	2014–2015 monthly 'May 2016'	2014–2015 monthly 'May 2016'	2014–2015 monthly 'April 2016'	2014–2015 monthly 'April 2016'
8. Meram	2011–2012 yearly, 2013-2014-2015 monthly (pdf) 'May 2016'	2011–2012 yearly, 2013–2014–2015 monthly (pdf) 'May 2016'	2013–2014–2015 monthly (pdf) 'May 2016'	2013–2014–2015 monthly (pdf) 'May 2016'
9. Baskent	2013–2014–2015 monthly 'May 2016'	2011 yearly, 2012-2013-2014-2015 monthly 'May 2016'	2013–2014–2015 monthly 'April 2016'	2013–2014–2015 monthly 'April 2016'
10. Akdeniz	2013 monthly, for 2014, after March not accessible, 2015 up to August	2013 monthly, for 2014, after March not accessible, 2015 up to August	2013–2014–2015 monthly 'December 2015'	2013–2014–2015 monthly 'December 2015'

Company	Table 1 Interruptions Details	Table 5 Interruptions Summary	Table 7 Complaint Details	Table 8a and 8c Complaint Summary
11. Gediz	2013 partly,2014–2015 monthly 'December 2015'	2013 yearly (Izmir is missing)	2013 quarterly, 2014–2015 monthly (pdf) 'December 2015'	2014–2015 monthly (pdf) 'December 2015'
12. Uludag	2011 pdf, 2013,2014 yearly	Only 2011 (pdf)	2012 Quarterly pdf, 2013 (October, November, December), 2014 monthly, 2015 monthly pdf 'May 2016'	Only table 8a:2012 Quarterly pdf, 2013 (October, November, December),2014 monthly, 2015 monthly (pdf) 'May 2016'
13. Trakya	2013–2014–2015 monthly 'May 2016'	2013–2014–2015 monthly 'May 2016'	2011 4th quarter, 2012–2013–2014–2015 monthly 'May 2016'	Table 8a: 2011 4th quarter, 2012–2013–2014–2015 monthly 'May 2016'
14. Ayedas	2013–2014–2015 monthly 'May 2016'	2013–2014–2015 monthly 'May 2016'	2013–2014–2015 monthly 'April 2016'	2013–2014–2015 monthly 'April 2016'
15. Sedas	2012 yearly,2013–2014 monthly, 2015 from April monthly 'May 2016'	2011 yearly, 2015 from April (pdf) 'May 2016'	2011–2012 quarterly, 2013 different format, 2014–2015 monthly 'May 2016'	2011–2012 quarterly, 2015 yearly 'May 2016'
16. Osmangazi	2013–2014–2015 monthly 'December 2015'	2013–20l4–2015 monthly 'December 2015'	2011 quarterly, 2013–2014–2015 monthly 'February 2016'	Only table 8a: 2011 quarterly, 2013–2014–2015 monthly 'February 2016'
17. Bogazici	2013 yearly, 2014-2015 monthly 'April 2016'	2013–2014–2015 yearly 'April 2016'	2011-2012 partly, 2013 quarterly, 2014–2015 monthly 'April 2016'	2011–2012 Quarterly, 2014–2015 monthly 'April 2016'
18. Kayseri	2012 yearly, 2013,2014,2015 monthly 'May 2016'	2012 yearly, 2013,2015 monthly 'May 2016'	2013–2014–2015 monthly 'May 2016'	Only table 8a : 2013–2014–2015 partly 'May 2016'
19. Aydem	2012 yearly (pdf), 2013–2014–2015 monthly 'May 2016'	2012 yearly, 2013 monthly (pdf), 2014 yearly, 2015 monthly 'May 2016'	2013–2014–2015 monthly (pdf) 'December 2015'	Only table 8a: 2013–2014–2015 monthly (pdf) 'December 2015'
20. Akedas	2011–2012 yearly, 2013–2014–2015 monthly 'May 2016'	2011 yearly, 2012–2013–2014–2015 monthly 'May 2016'	2011–2012 quarterly, 2013–2014–2015 monthly 'May 2016'	Only table 8a: 2011–2012 quarterly, 2013–2014–2015 monthly 'May 2016'
21. Yesilirmak	2012 yearly, 2013,2014,2015 monthly 'April 2016'	2013 yearly, 2013,2014,2015 monthly 'April 2016'	2013–2014–2015 monthly 'April 2016'	2012 Quarterly, 2013–2014–2015 monthly 'April 2016'

Note: 'pdf' shows that the data is provided in PDF format otherwise in Excel. In addition, the last month of availability is added to the table in red, as of July 2016.

Source: DISCOM websites, Authors

3.3.2 Performance

Tablo 12 presents some of the key quality indicators covering disruption time and frequency and the complaints in number and percentage of these handled within 30 seconds for 2013 and 2014.

Table 12. Disruption Time and Frequency, Number of Complaints and Percentage Replied to in 30 Seconds

SUPPLY CONTINUITY							SERVICE QUALITY (Table 8 c)					
Company	Average Interruption Time (h)			Average Interruption Frequency			Number of Complaints			Percentage Replied to in 30 seconds		
	2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
1. Dicle	110,23	72,54	38,94	104,53	81,79	41,33	3.840	N.A.	N.A.	100	N.A.	N.A.
2. Vangölü	69,86	84,81	129,90	58,54	60,22	78,94	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
3. Aras	9,38	22,22	30,20	15,73	23,45	26,07	N.A.	N.A.	227.059	N.A.	N.A.	83,74
4. Çoruh	36,78	0,47	28,07	7,5	0,16	10,44	43.548	17.376	41.383	65,53	72,22	64,19
5. Fırat	70,65	32,69	103,27	32,77	10,51	22,44	11.896	6.135	6.620	76,06	68,59	33,83
6. Çamlıbel	29,83	12,97	4,93	12,75	10,45	4,43	N.A.	203	228	N.A.	92,94	86,75
7. Toroslar	38,73	24,63	26,39	7,17	15,34	13,36	1.034	601	639	67,35	18,9	76,29
8. Meram	16,3	44,41	47,92	8,25	16,73	17,67	774.986	19.388	19.331	89,86	85,16	85,38
9. Başkent	10,24	9,38	13,87	9,44	8,58	8,01	2.617	1.242	815	86,5	72,05	81,54
10. Akdeniz	91,33	22,62	17,13	31,47	10,05	12,99	448.262	1.299.439	222.383	87,19	52,85	79,75
11. Gediz	10,47	8,27	31,62	9,23	5,6	16,20	814.899	N.A.	N.A.	32,3	N.A.	N.A.
12. Uludağ	55,96	24,94	39,52	24,54	14,53	11,44	2.929	1.039.425	N.A.	87,96	79,3	N.A.
13. Trakya	31,26	5,43	11,28	36,76	3,23	7,42	146.961	164.761	N.A.	84,08	79,03	N.A.
14. Ayedas	8,91	6,96	8,49	8,33	5,5	5,13	170.961	32.865	1.249	95,72	62,96	78,19
15. Sedas	34,54	24,01	20,55	24,43	18,64	25,29	246	166	361	92,97	85,94	84,77
16. Osmangazi	53,28	74,55	21,88	46,8	64,45	18,20	366.333	441.823	N.A.	86,56	N.A.	N.A.
17. Boğaziçi	26,04	22,19	24,96	15,06	12,71	13,02	YOK	2.712.300	N.A.	88,95	84,91	N.A.
18. Kayseri	12,27	12,04	14,16	0,7	0,66	8,78	278	654	N.A.	95,5	90,72	N.A.
19. Aydem	14,83	5,47	15,97	11,44	4,58	10,26	1.200	197.292	N.A.	79,02	87,04	N.A.
20. Akedas	0,67	1,49	8,35	21,87	1,89	10,64	409.518	1.193	N.A.	70	72,29	N.A.
21. Yeşilırmak	31,27	18,2	48,30	12,28	8,92	18,63	1.381.649	1.562.510	2.017.268	90,6	93,93	95,62
Türkiye toplam	36,32	25,25	32,65	23,79	17,99	18,13	4.581.157	7.497.373		82,01	74,93	

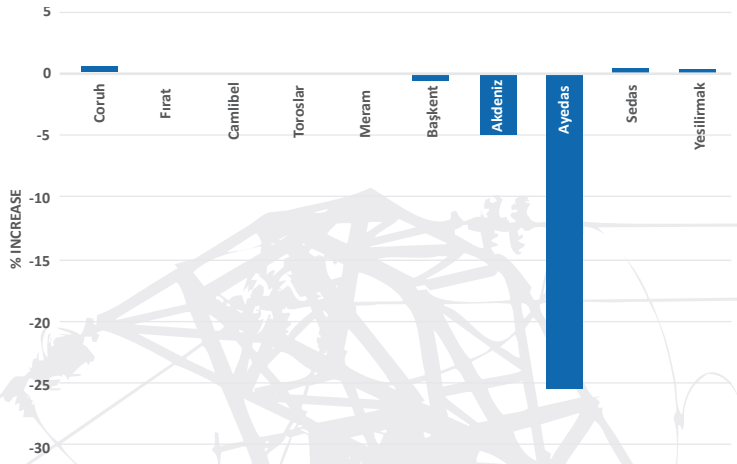
Note: Preliminary data are provided by DISCOMs but not verified by EMRA, for 2015, supply continuity data are taken from EMRA's 2015 Electricity Market Development Report and service quality data gathered from DISCOMs' websites.

According to available reported data, the duration and frequency of interruptions has slightly increased from 2014 to 2015 in Turkey. An average interruption time of 33 hours and an average frequency of 18 times shows that the limits set in Table 4 can be achieved in Turkey, but the average interruption time is close to the limit value (approximately 35 hours). For judging the exact performance, the breakdown by LV and MV and rural and urban is still needed; data which is unavailable at the moment. However, some details are given in the Electricity Market Development Report for 2015.[17]

17 Given in annex III.

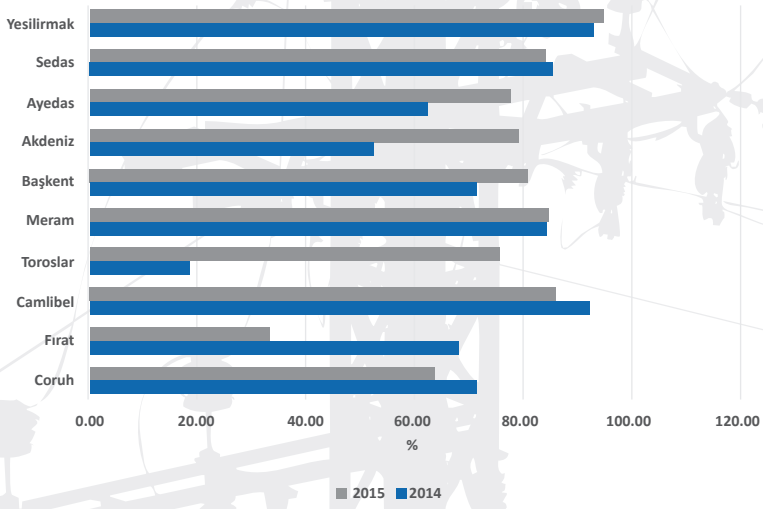
The number of complaints nearly doubled from 2013 to 2014. This indicates that customers know to find their way in filing a complaint and that there are functional helpdesks. This doubled number of complaints showed a decrease in the response rate within 30 seconds between 2013 and 2014 from 82 percent to 75 percent. We stress here that the observations are based on preliminary data from EMRA, which are yet to be verified. On the other hand, because of table 8c data is not available for all 11 DISCOMs, the 2015 benchmarking could not be performed. However, figure 6 allows a comparison between 2014 and 2015, using available reported data from DISCOMs.

Figure 5. Number of Complaints - Comparison of 2014 and 2015



Source: Authors

Figure 6. Percentage of Complaints Replied to in 30 Seconds



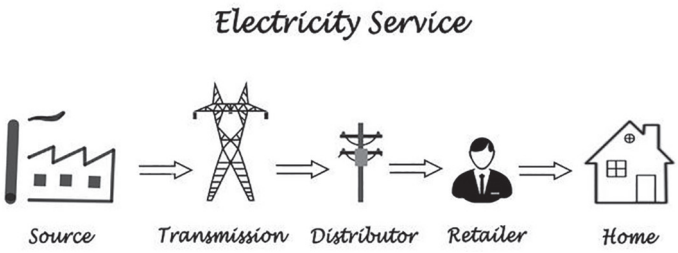
Source: Authors

The non-availability of reliable and comparable data for evaluating technical and service quality performance of DISCOMs restricts the full assessment of service quality. As discussed in previous sections, there is some data available on service quality. However, as also discussed, there are concerns over the reliability of available data.

3.3.3 Hardware Investments to Monitor Service Quality Indicators

The evaluation of EMRA in implementing quality legislation is as follows: For IP2, approximately TL 832 million (in November 2010 prices) was approved for investments for system operation of all DISCOMs in total. During 2011–2013, only 30 percent of this total was used for the purpose. The reason for the low realization can be attributed to delayed privatization in IP2. Because the privatization process is completed, an increase is expected in IP3. Because most of the DISCOMs are in the tendering stage and in the site audits, it was determined that, SCADA, CBS (GIS-Geographical Information Systems), and grid analyzer investments are about to be completed.[18]

It is evaluated that, if the subject expectations are realized, quality targets might be determined using the measurements completed in IP3 and then there would be a possibility to implement these targets in the next investment period. EMRA had instructed DISCOMs to complete their MV grid model by 2014 and the more-detailed LV grid model by 2015. However, a number of DISCOMs have not been able to gather sufficient data to complete their MV grid model, let alone their LV model.



18 Speech of Head of EMRA at the 2015 Smart Grid Conference.

4. Barriers and Key Issues in Implementing Service Quality in DISCOMs

The progress in meeting service quality requirements in DISCOMs is not at the desired levels. DISCOM's performance, monitoring, data handling, and feasibility/necessity of their planned investments differ considerably. Although there are some gaps, the regulatory framework in place is comprehensive and adequate for achieving targets. Service quality parameters and indicators are defined, and the revenue cap is determined according to performance indicators. **The main gap is in the implementation of the SQR requirements.** Although the parameters and indicators were set and the monitoring systems and reporting obligations were defined in the regulations, monitoring and assessment mechanisms are not sufficiently used. This is mainly due to lack of or at least incomplete data information systems to be used for measurement and monitoring.

This section contains the analysis of identified gaps between best practices in measuring and monitoring the quality of service in electricity distribution and the current situation of Turkey.

1. **The situation of DISCOMs is heterogeneous,** with regard to effective implementation of the outage management system (OMS) and customer information system (CIS) as specified in EMRA Regulations on Quality of Service in Electricity Distribution and Retail (28504-21/12/2012, amended by 28709-09/10/2013). At present data on indicators on quality of service are collected and recorded manually by most DISCOMs. Moreover, other contents of those regulations have not been effectively implemented so far.
2. **Regulations on service quality do not define mandatory functionalities** of the OMS and CIS to be incorporated by DISCOMs to manage outages in electricity supply and customer service in commercial aspects.[19]
3. **Regulations do not include specific provisions on access to the OMS and CIS records by EMRA and other competent government agencies.** There are currently no concrete procedures and methodologies to ensure that EMRA and other government agencies involved in monitoring and enforcing quality in electricity distribution and retail have timely access to reliable information on service actually provided by DISCOMs to their customers.
4. **Existing DISCOM audits remain a partial confidential assessment rather than full audits.** According to the new EML No. 6446, Article 15, MENR will audit DISCOMs for the main purpose of assessing effective execution of investments. At present, those audits are carried out by MENR with a team of experts and the findings are shared with EMRA

19 The MIS functional specifications are outlined in Annex to be in line with international best practices.

5. **MENR auditors and EMRA observe that the number of complaints over the quality of service provided by DISCOMs has been increasing over time.** This relates to both numbers (outages/unstable supply, low voltage) and delay in handling customer complaints or issues related to new connections.

6. **DISCOMs have difficulty in collecting and submitting data.** EMRA instructed DISCOMs to complete their MV grid model by 2014 and a more-detailed LV grid model by 2015. However, at present many DISCOMs have not been able to gather sufficient data to complete their MV grid model, let alone their LV model. In practice, it may take until 2017 for DISCOMs to complete this task.

7. **The major gap in service quality in comparison with global experience is that existing monitoring is ex post based on reporting by DISCOMs to EMRA.** At present, the data related to quality indicators are collected and recorded manually in most companies and open to manipulation. Comprehensive international experience shows that ex post monitoring is ineffective, as the monitoring agency has no way to carry out independent assessments of operational issues that occurred several days or months in the past. A financial performance review can be undertaken successfully ex post, as long as available data exists. However, good practice shows that issues on operational performance and service quality need to be addressed by DISCOMs and monitoring entities in a much shorter time frame, to be effective and meaningful.

5. Recommendations on Monitoring Service Quality

Based on the shortcomings of the current situation of electricity distribution and retail in Turkey described in section 4 and the identified gaps with international best practices in the matter, a proposed way forward to close those gaps is proposed in this section.

Systematic monitoring of the quality of the service provided by DISCOMs to their customers and the application of the regime on penalties is the most important permanent task to be accomplished by the regulator in the period between the periodic tariff revisions. Failing to implement those tasks presents a situation that is extremely dangerous for the proper performance of the distribution sector. Under a PBR regime, the regulated companies get their profits based on the reduction they can achieve in actual costs in relation to the values determined by the applied regulation, against which they 'compete'. One of the obvious modalities to obtain this cost reduction is to minimize investments and operating costs (O&M of networks and commercial management). This leads to a progressive deterioration of the quality of service received by users. It is therefore essential to define and effectively apply a regime on the quality of service, including values of penalties that in practice discourage and eliminate the possibility of this kind of behavior from DISCOMs.

DISCOMs should be equipped with the necessary IT infrastructure and MIS to support the efficient execution of operations in all business areas. In particular, commercial functions (CMS) and effective management and resolution of customers' complaints related to outages and other incidents in the electric supply received by customers (IRMS). Those systems will allow DISCOMs to effectively manage the quality of service provided to their customers. At the same time, through real-time access to the records of the information systems, EMRA will be able to measure and monitor the quality of service received by the customers of DISCOMs, enabling the fulfillment of this essential role of the sector regulator.

A well-designed PBR approach must include a clear definition and effective implementation of a regime on the quality of service (electricity supply and commercial aspects) received by users, comprising the following:

- Definition of the quality parameters and their respective values that reflect a minimum quality level for each individual user ('guaranteed values'). In the case of electricity supply, the most important parameters are the duration of interruption of each consumption unit (household, factory, and so on) and the frequency of the interruption at the consumption unit.
- Definition of a regime of penalties, whose values are established in accordance with the cost of energy non-supplied to affected users. The cost can be calculated through technical studies specific for each country or region. Typical values are 10 to 50 times the value of the regular service tariff. The values of this regime of penalties should represent a strong incentive for the DISCOM to effectively meet the required quality standards. Those penalties should be paid by the DISCOM to its customers affected by poor service quality.

- Establishment and effective implementation of procedures for systematic and accurate measurement and monitoring of parameters on the quality of service (electricity supply, commercial aspects) received by each individual user. Application of penalties is set in the regime, if service does not meet the required quality standards.

SCADA systems are powerful tools for reliable system operation and will also contribute to improving service quality. Therefore, as required by EMRA, SCADA systems should be installed by each DISCOM and linked to their MIS, to enable real time monitoring of system parameters.

The incorporation of information systems by an electric utility is a dynamic process, consisting of several phases to operationalize Integrated Distribution Management Systems that supports all the core functions in an integrated manner. The below approach intends to define the minimum contents of the first of those phases, with the purpose of supporting efficient development of top priority operations in customer service, both in electricity supply and in commercial aspects and recommending timely access to reliable records on performance in those areas, to enable effective supervision and monitoring.

5.1 Experience in Monitoring Quality of Service

As discussed, electricity DISCOMs supply electricity services to their captive customers under monopolistic conditions. The regulator of those services is responsible for establishing norms and standards with respect to parameters defining the quality of electricity supply (frequency and duration of the interruptions, voltage perturbations, and so on) and commercial attention of customers (maximum time for resolution of complaints, attention through call centers and commercial agencies, options for payment of bills, and so on). In addition, the regulator must also monitor that the captive users are effectively receiving a service of quality not below the level defined in these norms and reflected in the current tariffs. In fact, it is not possible to establish if the tariffs are fair or not and adequate, if the quality of service received by users is not clearly defined. This aspect is of critical importance when applied to a PBR approach, with a cap in either overall revenues or individual tariffs of the regulated company.

It is essential that a PBR approach includes a clear definition and effective implementation of a regime on the quality of service (electricity supply and commercial aspects) received by users, which comprises the following:

(a) determination of the quality parameters and their respective values that reflect a minimum quality level for each individual user ('guaranteed values'). In the case of electricity supply, the most important parameters are the duration of interruption of each consumption unit (household, factory, and so on) and the frequency of the interruption at the consumption unit;

(b) the systematic and accurate measurement of these parameters for each individual user with adequate levels of accuracy and reliability;

(c) the definition of a regime of penalties, whose values are established in accordance with the cost of the energy not supplied for the affected users. That cost is calculated through technical studies specific for each country or region. Typical values are 10 to 50 times the value of the regular service tariff. The values of this regime of penalties should represent a strong incentive for the DISCOM to effectively meet the required quality standards;

(d) the effective application of penalties in the regime in case the service does not meet the required quality standards. It is desirable that these penalties are paid by the DISCOM to users affected by that bad service.

The effective implementation of the issues described in items (a) to (d), that is, the monitoring of the quality of the service provided to consumers is the most important permanent task to be accomplished by the regulator in the period between the periodic tariff revisions.

It should be taken into consideration that failing to implement the tasks described above, presents a situation that is extremely dangerous for the proper performance of the regulated sector. Under a PBR regime, the regulated companies get their profits based on the reduction they can achieve in actual costs in relation to the values determined by the applied regulation, against which they 'compete'. One of the obvious modalities to obtain this cost reduction is to minimize investments and operating costs (O&M of networks and commercial management). This leads to progressive deterioration of the quality of service received by users. It is therefore essential to define and effectively apply a regime on the quality of service, including values of penalties that in practice discourage and eliminate the possibility of this kind of behavior from the regulated companies.

In the 1990s, several countries in Latin America (Argentina, Brazil, Chile, Colombia, El Salvador, Guatemala, Panama, and Peru) implemented comprehensive reforms of their power sectors based on vertical unbundling, incorporation of competition in generation and retail supply, and application of PBR for economic regulation of natural network monopolies (transmission and distribution). All these countries established specific regulations to address the topics mentioned above on service quality. In some cases (Argentina, Brazil, and Peru), the sector regulator was vested with the competence to monitor service quality and enforce compliance of the applicable standards and regime of penalties). In other cases (Chile and Colombia), new entities were created to carry out those specific tasks, in general, for several public services. The performance of those agencies is very closely related to the performance of the sectors they monitor.

5.2 Proposed Approach and Tools to Monitor Service Quality

The market of corporate software for utilities shows the existence of several well-proven MIS that support the efficient execution of operations in all business areas, in particular, commercial functions (CMS or CIS) and effective management and resolution of customers' complaints related to outages and other incidents in the electric supply received by customers (IRMS or OMS). At present, these MIS become important tools for efficient, transparent, and accountable management of the utility.

The CIS allows executing and monitoring of commercial activities efficiently, whereas the OMS does the same with management of complaints related to electricity supply that are received from customers. Both systems make it possible to permanently track activities carried out at the level of each individual customer.

Therefore, the effective implementation of the CIS and OMS allows effective measurement of the quality of service received by DISCOM customers, enabling the fulfillment of this essential role of EMRA. This fact must be specifically considered in the regulation applicable to the distribution segment, through the inclusion in the allowed tariff revenues of each DISCOM for the investment and operating costs incurred by the utility to efficiently procure, operate, and maintain the MIS.

Through the installation of terminals for remote access from its offices to the MIS incorporated by each DISCOM, EMRA can have permanent real-time access to the records of those systems (all incidents in electricity supply, commercial complaints, and so on) for all customers. This will allow EMRA to conduct its own independent monitoring without the need to ask the DISCOM specific questions about technical and commercial service quality received by users.

EMRA's access to MIS records should be exclusively for consultation (without the possibility to change any information). The access modalities should be defined (authorized staff and type of information available to them) in a way to preserve the confidential character of the commercial information that could have strategic value for the DISCOM. Notwithstanding, it should be taken into consideration that if the user is paying through the tariffs, the costs incurred by the DISCOM to incorporate and use the MIS and the information managed through those systems, the confidential character of the information should be understood as a right of each individual user, rather than that of the DISCOM.

It could be argued that the information contained in the MIS could be 'manipulated' by the DISCOM. EMRA should then verify the authenticity of this information. Experience shows that the MIS become tools that facilitate transparent management of the company and that it is very complex to make undue changes in the information contained in the systems. However, EMRA can audit the authenticity of the information through the use of sampling techniques. Representative samples should be defined through applicable national standards and audits should be executed by dedicated companies (working exclusively as auditors). EMRA must apply severe penalties to the utility, if the audited information is found to be incorrect. As proper use of the MIS allows the DISCOM to internally control the quality and authenticity of the information in the systems without significant difficulties, regulatory tolerance to bad quality of information in the MIS should be minimum or simply should not exist.

Annex I: Summarized Description of CMS and IRMS

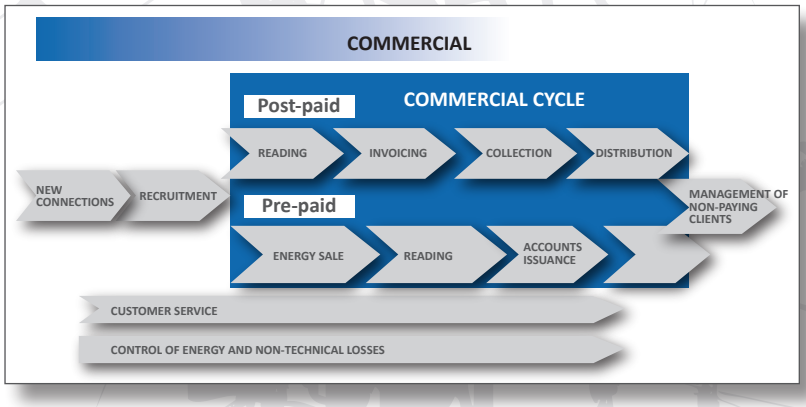
Commercial Management System (CMS)

There are five main groups of commercial processes in an electricity DISCOM:

1. Request of new connections.
2. Commercial or revenue cycle, including different stages depending on whether the clients have post-paid meters (reading, invoicing, distribution and bill`s collection) or pre-paid meters (the energy sales, reading, the issuance and distribution of the statement of accounts).
3. Management of customers' debts (unpaid bills).
4. Customer service (in person, by telephone, through the web and social networks, and so on).
5. Energy flows and balance and management of non-technical losses

These five main groups of the commercial cycle are depicted in the following chart:

Figure 7. Commercial Cycle



Standard modules of a CMS are shown in Table 13.

Table 13. Modules in CMS

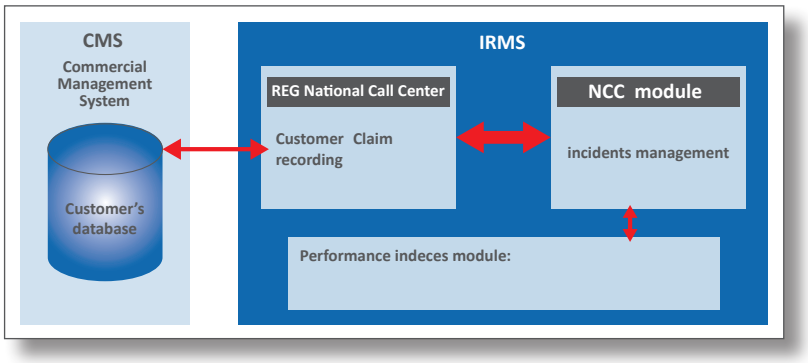
MODULE	BRIEF DESCRIPTION
Meter reading	Provides data on the productivity of meter readers and the quality of their performance, and field finding reports that automatically generate field orders.
Billing	Supports the computation of bills and related processes such as maintenance of rates and computation modules.
Service anomalies	Handles the maintenance and computation of cases on violation of contracts and irregular/illegal service connection.
Billing adjustments	Supports massive rebilling involving as much as 5 years' worth of bills.
Payments processing	Supports processes related to collection of bills and management if they remain unpaid.
Service Application	Module that supports the handling of customers applying for a new service or any modifications in their connectivity.
Customer assistance/ complaints	Allows full management of complaints received from customers. Complaints can be related to bills, payments, contracts, meters, service application, and others
Meter management system	Allows the tracking of meters and other devices from the time they are delivered to corporate meters until their installation and retirement.
Management information system	Provides a snapshot on the status of various customer-related performance indicators.
Energy sales	Handles energy sales to dealers. This module or functionality should have an interface with the finance module to handle all invoicing of energy sales, record payments from the dealers, and so on

Incidents Recording and Management System (IRMS)

IRMS supports management and resolution of customers' complaints and other incidents in electricity supply.

The system allows the DISCOM to keep permanent track of all customers' complaints from the time each call is received by the company, the progress for resolution of each complaint, and the actions taken by the Distribution Operation Centres to manage and monitor the crews responsible for field actions needed for service restoration.

Figure 8. The IRMS Concept



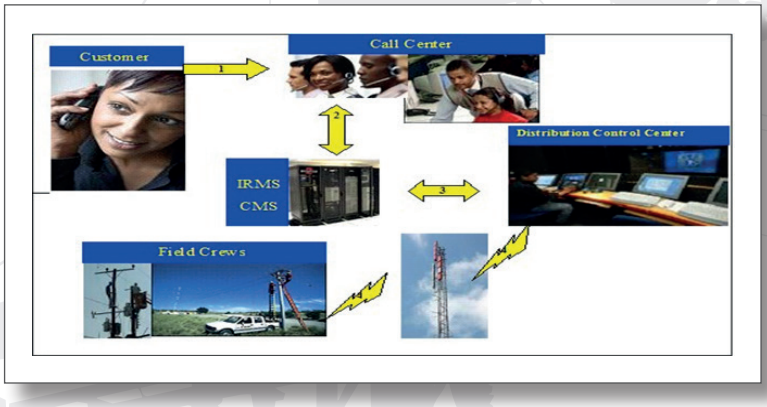
The IRMS is in general composed by three modules:

- Reception and automatic classification of customers' calls (complaints).
- Follow-up of complaints and actions on the distribution network for service restoration.
- Information to management to assist decision making and monitoring.

The system relies on a fully functional database that contains:

- The data on customers in the database of the CMS.
- The link of each customer to supplying MV/LV transformer and LV lines.
- The supply circuit 'upstream' each MV/LV transformer to the transmission substation.

Figure 9. Process to Attend and Solve a Customer Complaint



Annex II: Functional Specifications of a Commercial Management System (CMS) or Customer Information System (CIS)

General Requirements

1. The commercial system must be transactional, and the data must be captured online where it is originated and can be consulted by users. It may also use batch processing when dealing with massive information.
2. Can be parameterized, both at general level and modular or functional level, where users can control specific functions. Functions that belong to the system's manager can also be parameterized.
3. It allows to generate reports, tables, indicators and statistics in general on screen, in paper or exported to magnetic media or through office tools.
4. The system implementation should include a business procedure and parameterization model that allows to maintain the system. It will also need to have one or more user online help (various levels), in English (the correct Technical Terms in English).
5. The display should be in English (all screen, menus, and so on should use the correct Technical Terms in English).
6. It should be able to upgrade information system with new versions without the need for an overall new implementation project. Supplier MUST assure the software have adaptive, perfective, corrective and preventive maintenance. The change of version should not affect the regular functioning of the company.
7. The minimum technical documentation that is required to hand in when the implementation is completed, consists at least of: (a) Updated User's Manual; (b) Updated Data Model: (c) Updated Data Dictionary; (d) Updated Functional Specifications; (e) System Operation Guide; (f) System Support and Maintenance Manuals (configuration, error analysis, and so on); (g) documents of analysis and process redesign; (h) Manual of analysis and conceptual design of the system; (i) User's system administrator; (j) Data migration methodology; and (k) System Test Plan (implementation and acceptance).
8. It must allow the integration with other applications, internal and external, through Service's Oriented Architecture (SOA), thus allowing the exposure of its functionality through services or accessing other applications through the use of its services.
9. The supplier will have to make sure that when changing the version the regular functioning of the company is not affected.
10. It must allow the definition of security profiles in a simple and agile way that allows the permission assignment for group of users or individual users.
11. It must allow the control of the user's status (that is: active, blocked, expired, and so on).

12. It must allow the restriction of the application access, through the combination of the following authorization levels: (a) On a Module level (for example, Invoicing) and (b) On an Application level (for example, Invoicing/Reading's correction).
13. The systems must safely update and access the database.
14. It must allow the maintenance of user profiles and passwords validity. Passwords must be encrypted.
15. The users' interface must have access buttons to the most used functions (toolbar).
16. It must allow the automatic closing user's sessions because of inactivity.
17. The system must keep track of user, date and time of the last update of each record in the database.
18. It must allow export and download reports to other applications (Word, Excel, flat files, json, pdf, and so on).
19. It must have monitoring tools for the commercial calendar and the impacts that occur during commercial processes (reading errors, invoicing, collection).
20. If there are any kinds of delay in the commercial cycle, the system will have to notify accordingly to the person in charge of the activity, through a text message (SMS).
21. Ability to allow the customers' data entry and the related information, distinguishing people from companies. The system should be able to differentiated, depending on the rate category and the activity`s nature (health, education, defense ministry, and so on).
22. Ability to allow the required documentation entry for a request and the identification of the pending documents. The system should ensure that the signing of the contract is digital and that the foregoing can be electronically filed.
23. Ability to allow the entry of important notes of the new connections request and new point of connection terms.
24. It must be customized to allow the printing of the service request stipulated by law, and for its sending by Electronic means.
25. It must allow the collection of the carried out actions to close the request without having hired the service. It is also possible that such charges are paid together with the issued service's invoice (can be paid in instalments).
26. It must allow the printing of the supporting document stipulated by law.
27. The consecutive number of the service request must be automatically generated and the new customer's connection request.
28. The consecutive number of the service request must be unique to identify it with other system's options.
29. It must allow the realization of an enquiry by status request, modification date, and type of request.

30. A record of status' modifications must be kept with their corresponding dates of service request.

31. The service request can be cancelled at any desired time.

32. Ability to allow that a user possess several contracts in the same domicile or in different ones, or that they belong to diverse rate scales.

33. It must allow that a user with multiple contracts or services, funds the emission and management of collections in a unique global account. This decision can be made by the user in an individual way according to its interests or needs.

34. It must allow the generation of working orders for the realization of tasks that are required by the service's request. Such tasks can be carried out directly by the customer's service staff, based on the current availability of the field's team.

35. It must allow the selection of the types of work orders for the service's request exclusively.

36. The New Contracting Process Module must interface with prepaid energy sales systems in a way that such systems are updated, in relation to customer's information, subscriptions, cancellation, meter change, change of address, and so on.

37. It must allow the entry of the meter reading(s) (actual and/or estimated) to obtain the user's consumption.

38. It must allow to inquire meter's status (post-paid, pre-paid, or AMI) or update it (active, disconnected, retired) related to the involved business process (payment process and reconnection, for instant).

39. It must allow the modification or manual entry of the meter's readings, before the invoicing, to correct or regularize any reading inconsistency.

40. It must allow the processing of the meter's readings provided by the user.

41. It must allow the monitoring, through consultations, of the reading programs, with detailed performed , not performed, inconsistent and absent readings.

42. The system must keep record of the way in which the Reading was carried out: manually, with a portable terminals, AMI, or telemetry, and so on. In addition, the system must trace its source (clients' reading or company's).

43. Any irregularity related with the readings, must be automatically reported, validating the readings when processing them for invoicing.

44. There must be an interface with the portable terminals of the meter's reading routes, to upload and download the reading's information.

45. The validation of the introduced readings in the portable terminals must be checked.

46. The follow up the carried out readings must be visualized.

47. The necessary data for the installation of a meter must be stored.

48. It must allow the reinstallation of a disconnected meter in other service.

49. The installation, connection, and disconnection of the meters must be registered, and the required maintenance tasks, such as calibration.

50. Reports on the reading entry and consumption calculation should be done.

51. The chosen system must be able to receive information from Automatic Meter Reading (AMR) and/or AMI through an interface that allows the reception of the obtained meter readings for the relevant processes of the business management. Regarding AMI, it refers to processes such as power increase or decrease, disconnection and reconnections, and so on (apart from the remote reading processes).

52. It allows the realization of reading routes according to the scheduled dates and route types. In addition, all types of customers should be possible to be included in the reading itinerary (pre-paid customers, and so on).

Functionalities of the Commercial Cycle – Billing

53. The calculation process must have a minimum parameterizing level that allows the users to change their behavior without changing the software.

54. The system must have information in its database on each and every invoicing (simulated, real, and cancelled) in such a way that they can be visualized and printed at any time. In addition, the system should be able to create simulation of billing based on parameters being applied.

55. The billing calculation must be carried out through the definition of amount parameters, according to the existing tariff system. For example, if a given client exceeds the threshold allowed for social tariff in energy consumption the system should place him/ her in the next tariff level, the domestic tariff. The system should be parameterized to cater for this procedure. Billing should also considered the Time-of -Use Tariff, including flat tariff, block tariff, and so on.

56. It must allow the follow up of invoicing status from its origin to its current stage.

57. The system must allow the processing of invoicing in pre-printed form, through emitted forms, or by one or more software packages specialized in printing. Also the system should be able to send digital invoice/bill through electronic means (SMS and email, and so on).

58. The chosen system must keep a record of each rate's price, to be able to calculate or recalculate an invoicing at any time.

59. It must allow to record the average consumption according to rates, for its further use in invoicing when there is no record at all.

60. It must enable to accept the payment that was done in advance to include it in the invoicing or in the invoicing, that was previously agreed on with users belonging to places of difficult access. Afterwards, once the readings have been fulfilled, the modifications that are necessary to be carried out in the invoicing must be performed.

61. It must allow the calculation of invoices in line with the reading programs.

62. The system must have a highly configurable invoicing engine, that allows it adapt itself in any different tariff—in such a way that any change is recorded—and it performs correct invoicing and retroactive adjustments when needed, including the correct accounting entries.

63. Centralized invoicing must be carried out within the normal meter reading program or for fixed consumption.

64. The system must allow the conciliation of different kinds of billings of a specific point of connection.

65. Billings must be issued in hard copy, magnetic support or any other adequate format for transfer by electronic data exchange (banks, for instance).

66. The system must be able to manage client's current account in a way that allows for the grouping of a random number of invoices that belong to the same a customer so that they expire on the same date or have a same shipping address.

67. It must allow the calculation of invoice charges at the end of the contract.

68. It must allow the cancellation of an invoice from which a claim was received.

69. It must allow re-invoicing (to invoice again) based on estimated data or fixed consumptions, real data that comes from a work order and data provided by the user.

70. It must allow the invoicing through fraud and penalties related to irregular services.

71. It must allow for the tax calculation according to the national legislation and regulationsb

72. The system must allow the issuance of account summary or statement, of every customer's account.

73. It must allow the invoicing of period consumption, regarding it as an outstanding debt adding it to other possible pending debts.

74. The system must be able to display customer's records.

75. The system must be able to produce reports, statistics, and indicators of reading and billing processes based on: time, errors, anomalies, and so on. Such reports can be exported, published, or sent by different means.

76. It must control and manage the invoice adjustments.

77. The system must update online and on real time, the current account of each customer, according to the billing processes.

78. It must allow massive cancellation of invoices should any errors or inconsistencies occur.

79. Invoicing of Street Lighting It allows the invoicing of every consumption of public lighting and its related demand.

80. It must allow for the issuance of public lighting Invoices and their payment. It should also be able to issue DISCOM`s internal consumptions invoices and its payment (offices and other company's premises).

81. The system must generate massive processes for invoicing: hundreds or thousands invoices in an only process that updates online and on real time the customer's database and their current account.

82. The system must ensure that the financial information (accounting, budget, and costs) is permanently updated in an automatic and natural way, or through interfaces, with the incoming data from the Business System.

83. The prepaid power sales systems will invoice online the energy sold in the following way: the business system must interface with such systems so as to update the energy sold by this payment form.

84. The prepaid invoiced energy must be entered to the customer's account.

85. The system must issue account's statement of customers with prepaid meter, keeping in mind the energy sold and the reading done in the customer's meter.

86. All system users that are cashiers or external agents must be registered and identified.

87. Different formats for the additional charges, taxes, fees must be allowed according to applicable legislation.

88. Online payment must be allowed in the offices and in external collection centers. This includes payment through Banks, debit accounts, and so on.

89. Different forms of payment must be accepted: cash, checks, credit cards, and debit cards. The system should enable payments through electronic transfer of funds (Cash machine, mobile money, and internet).

90. Payment can be combined in different forms (cash and check, cash and credit card, and so on) with an only receipt or different receipts. The system should also carry out payments for financial compensation.

91. Payments that are done in the same day can be cancelled. Also the system should be able to send customer and acknowledgement of payment (SMS or email).

92. The cashiers must automatically shut down when the payment office is closed. For security reasons, the system should be able to limit the amount collected by the cashier and carry out a temporary closure so as to allow the deposit of the amount that was collected up to that moment.

93. Cash balances can be controlled through agencies and payment terminals.

94. It must be able to record complete historical information about collection for users and agents.

95. Cash balances must be controlled by the end of the day or in shift changes.

96. The external agents must trace returned checks and unreported payments.

97. It must allow the interface with bank systems to transmit and receive records related to users that have chosen automatic debit for payment of their invoices. Also should allow interface with Government authorities such as Revenue Administration.

98. It must allow the interface with credit systems to transmit and receive records related to payments through credit/debit cards.

99. Invoices from users that have chosen automatic debit in their bank accounts, must be sent to them.

100. The system must allow the connection with external payment agents both online and offline (from its own systems through the enabling enterprise services –SOA).

101. It must allow the correction and control of the wrong payments online.

102. The system has specific operations for the management of returned checks: (a) Charge generation (from the bank); (b) Status resulting from the paid invoices by the check or generation of a new charge of the corresponding amount (decision level configuration); and (c) Customer follow up (letters, messages, and so on).

103. It must allow the maintenance of charts and general parameters.

104. It must manage different types of agreements. The system should be able to register or send back the amount that was paid by the client`s joint participation in electricity grid construction activities.

105. It can handle attributes and official authorization levels.

106. It handles and integrates AMI meters in the following collection processes: (a) reactivation of disconnected customers; (b) update of balance meter (for prepaid meters); and (c) Tariff update (for prepaid meters), and so on.

107. The system must allow partial and complete payments. In addition, it will allow advance payment and customers' accounts should be treated as a 'balance account' (for advance payment future bills will be deducted from the balance). It must have a management module that allows a correct management of collections, with precise follow up reports, issued timely. The system should also be able to affect the payments of certain loans in the respective invoices.

108. The information regarding the payments carried out by the users will have to be available for reference.

109. Partial or total payments on account should be possible.

110. Once overdue invoices have been paid invoices, a reconnection order must be automatically issued.

111. According to DISCOM`s policies, partial payments and payment agreements will have to be accepted.

112. If the bank account's balance or the credit card isn't enough to cover the amount that must be paid, a payment notification must be automatically issued.

113. The operations that must be fulfilled regarding the users who have not paid all their debts must be automatically issued (orders for service cancellation, visits, calls, and letters).

114. To issue notifications concerning the guarantee expiry, as established by the company, it must be parameterized.

115. Following certain criteria established by the organization, it must allow to cancel power cut orders and to reinstall a service without the payment being fulfilled.

116. It must be able to control the number of activities that must be carried out, considering the operational capacity (for example: it must restrict the number of cancelation orders issued depending on the Technical Center's capacity, and parameterizing substitute activities such as the programming of phone calls, the issuance of letters, and so on).

117. It must be able to obtain debt information about different levels, types of users, areas. In the management of debts, the system should be able to identify debts corresponding to certain clients (the Government, hospitals, defense ministry, water companies, and so on).

118. It must enable to select all the users whose debt and number of invoices to be paid exceeds certain amount (parameter).

119. It must enable configuration and flexible definition of the rules that must be set, to determine the operations that must be carried out (for example, considering the debt's and rate's record, type of client, the debt's amount, and so on). The system should produce debit balance reports, taking into consideration the date, category, the nature of the activity (health, education, and so on), the type of customer (private or public), and the debt`s status.

120. In case of the payment being effected or the existence of a payment agreement, it must enable an automatic issuance of reconnection and working orders.

121. It must allow the issuance and download the orders for the management verification of the cancellations.

122. It must prepare statistics regarding the cancelled services and reconnections, which must be recorded in the system's data.

123. It must be able to issue individual disconnection request.

124. It must be able to issue several reports such as: summaries of reconnections, summaries of special disconnections, temporary disconnections, clients who have not been disconnected, clients who have been disconnected, and clients who do not have meter, clients with no electricity, and extra charges resulting from disconnections and reconnections.

125. It must be able to issue operational reports concerning: disconnection timing and reconnection processes, notified mistakes, statistics regarding the employee's performances, and so on

126. The system must be able to produce consolidated current accounts that allow management of large customers (such as the Government) through accounts that comprise certain services. These will allow the system to obtain overall statement of accounts. Furthermore, they will enable the possibility of paying individually or at a consolidated level to make this management task easier. The system should issue client`s statement of accounts with reference to the requested period.

127. The commercial system must include all the management of accounts that have not yet been paid by the client and this information must be transferred into the Financial System (ERP).

Functionality of Customer Service Process

128. If the user has many services, it must allow different ways of payment or various bank accounts.

129. An exclusive number of user's identification and contract must be assigned, enabling easy detection of possible debts.

130. It must be able to manage different kinds of client´s identification that are part of the contract: contract holder, the beneficiary of the service, the one responsible of payment, and so on.

131. It must be able to display information about: working orders that have not yet been carried out, complaints, irregularities, and various issues that have not been solved, and observations, readings done by telephone and the client's record.

132. It should allow the recording of user's complaints, enabling to have the type of complaints stipulated by law and according to the company's current needs. These should be classified based on the company's criteria.

133. The system should be able to carry out a precise and accurate follow up of the different stages that a complaint must go through. In addition, all these activities should be duly recorded.

134. Should there be a need, the operations that must be carried out when a complaint is presented; it should automatically issue working orders.

135. It should be able to update complaints depending on the activities that were carried out.

136. When there is a complaint regarding the invoices, this can be modified by canceling it and creating a new one with the adequate modifications.

137. It must be able to cancel complaints when there is no justifiable ground, for example, when the complaint is purposeless.

138. It must be able to consult the different complaints per branch so as to provide solutions to each branch.

139. It must be able to invoice, issue, modify, consult and bill and budget costs that are not provided for in the invoice.

140. The user can be the holder of various services under his/her name and may have the same account for all of them or one for each.

141. It must allow to make modifications when it is necessary. For example when it is required to: change the tariff, modify the address where the invoice is to be sent or change the name of the contract's holder.

142. he system must be able to send information in a normal way or through interfaces to systems such as IVR.

143. Regarding the Internet's functioning, the Client's Portal should be connected online and in real time to the system's central database. If the system does not operate in this manner, for example, with a replica of a database, it won't be accepted.

144. The system should be able to display information through the DISCOM's website: invoices, previous consumptions, changes in the client's data, the registration of a new contract or its canceling, and so on.

145. An interface should be available with the selling systems of pre-paid energy to record changes that have been effected in the client's contract to keep the system updated for efficiently carrying out the operation of the selling of pre-paid energy.

Operations for the Energy Control and the Management of Non-Technical Losses Processes

146. All the energy measures taken from delivering points (generation, transmission, and distribution) should be recorded in an integrated manner, respecting their periodicity to have accurate energy balance.

147. It should be able to display data and compare the different measures taken at the delivering points. Moreover, through these displays, it must be possible to understand the variations that take place at the daily load diagram.

148. It must be able to correct erroneous values of measures displayed in the carried out analysis.

149. It should allow the uploading of the measures that correspond to each delivery point and customer´s reading through interfaces or files.

150. In this uploading, the ratification of consistency and data format required should be fulfilled and issuing a log of errors.

151. The system must process all the measures uploaded to provide daily reports regarding measures and to further issue energy balances.

152. The system must be able to upload the forecast regarding the daily buying of energy in the delivery points to keep a daily control over the measure's reports.

153. It must be able to daily monitor the energy flow into the system in the different delivery points, differentiating the voltage level and comparing it with the forecast regarding the buying of energy.

154. The development of the company's total losses according to each geographic area can be checked. It should also be possible to perform an energy loss control depending on the branch, the geographic location, and MV/LV substations.)

155. It must be able to see detailed information concerning the different type of clients, poor and subsidized areas, which require a special follow up.

156. It should be able to produce charts about the invoiced energy versus the energy collected and charts depicting the energy flow through the different levels of the company.

157. It should be able to record all defined plans and its subject, actions to be done, duration estimate.

158. For each operation defined in the plan of the recovery of non-technical losses, it should be possible to identify people in charge, how it is measured, and the planned data.

159. Every month, the system should automatically issue the operations that must be carried out by the Commercial Technical Service or by the hired company, according to the established action plan. ENERGY SALES MODULE. System should be able to handle selling of energy to dealers. This will need to update prepayment systems with the energy that was bought, including all calculation on commission deductions. This module or functionality should have an interface with the Finance Module to handle all invoicing of energy sales, record payments from the Dealers, and so on.

Functionalities for the Management of Service Orders Process

160. It should provide an option for automatic issuance of working orders derived from any transaction of the system's operations (customer service, readings, invoices, collection, hiring, and complaints).

161. It should be possible to define the geographic areas that belong to branches for the automatic assignment of jobs according to the service's location, allowing integration with Geographic Information Systems (GIS) for the optimization of the resource's allocation.

162. The system should be able to transfer information regarding the service orders for the calculation of costs, into the ERP System by ordinary means or through interfaces.

163. All the activities fulfilled for the completion of the order and the duration and the details of the operations should be recorded.

164. It should record the technician who was assigned to service's installation.

165. The system must perform automatic checkings of consistency before issuing working orders.

166. The order that must be carried out in an installation should be printed and the system record that the printing was done.

167. It must be able to solve in large scale the working orders concerning: disconnections, reconnections, notification of disconnections, and everything related to the management of non-paying clients.

168. It must be able to enable to program the operations to be carried out in the installation with certain characteristics (geographic area, substations the user's tariff, the average consumption, pending debts).

Functionalities for Management Process

169. It must be able to issue different collection records, for example, for groups of tariffs and users and commercial branches.

170. It must allow the issuance of daily reports concerning the whole commercial cycle (reading, invoicing, and collection).

171. It should display all the indicators established to carry out a daily, weekly, monthly, or annual follow up.

172. The system should have a tool for the management control that interacts with the database model, allowing to obtain relevant management information.

173. Apart from the reports that the system has already incorporated, there should be the possibility of adding new reports that the company might consider convenient for future use without altering the system.

174. The system should provide reports through web to the company`s management.

175. The system should be able to provide mechanisms for reporting: (a) triggered automatically defined periodicity; (b) triggered automatically by events; (c) triggered manually. There should be website online services available for the customer to be able to inquire different information about its contracts, point of connections, and so on. Might also be able to request some changes in the information and also to make complaints about services, outages, and so on.

Annex III: Incident Recording Management System (IRMS) or Outage Management System (OMS)

Customer's Calls Reception

1. The screen, where are recorded the phone calls, should allow the call center agent to record, according to the situation, customer's claims or abnormalities seen and notified by a passer-by. In addition, customer's information should be automatically triggered from the customer phone number based on an IVR interface and DISCOM's Call Center system.
2. The daily phone calls history will be saved. Also it will be possible to enter complaints send through other sources like email, twitter, website, and so on.
3. All the information recorded, for each phone call, should be retrieved online. On the same customer calling several times for the same incidence it should be able to register all these calls in relation to the same incidence.
4. The total number of customer calls who still are without electricity should be available online. This information should be seen by waiting time and the process phase status (from customer call to resolution time).
5. System should control the duplicated recording of customer´s calls, insuring their unicity and the date and time registration of each call.
6. System should automatically monitor that customer is not current on payment of invoice or other reason which should justify his administrative disconnection by the utility.
7. Allow online feedback to Customer, on ongoing actions for energy restoration.
8. It is possible to characterize the information given by the customer which describes the situation (that is blackout, low voltage, phase missing, outage extent, free text for additional observations).
9. The identification of the call center agent is recorded for each phone call record.

Identification of Incidents Location and their Following by NCC Operators

10. The system displays the customer's claims, graphically or alphanumerically (or geo-referenced) representation of the Network, to facilitate the identification of the faulty point on it.
11. The incidents monitoring functionality allows the user to assign to each of them from categorized lists: the repair status; the voltage level of the unpredicted o programmed switch opening; the transfer of the work order, if necessary, to the Maintenance Department.

12. The incidents following functionality, allows to assign for each incident, within suitable lists: the cause and type of the faulty situation.
13. The incidents following functionality, allows to assign for each Incident Record, within suitable lists: one or more crews.
14. The incidents following functionality, allows to assign for each incident, within suitable lists: the individual interruption time of each equipment involved in the incident, the time of definitive restoration works ending and the list of non-energized transformers at any moment.
15. The system will automatically record the time of each change status.
16. The system allows the real time update of equipment reenergized and other changes on the incident status (that is Pending, Crew assigned, Default located, Partial recovery, Service recovered).
17. Comments can additionally be written in free text format for each incident.
18. The system allows retrieving and calculating the customer's daily average consumption, from the Commercial Database, to estimate the non-delivered energy during an incident.
19. Crew's composition and vehicle assigned should be seen with appropriate queries.
20. The crew's list should be modified as needed for each shift.
21. Incidents list can be sorted by assigned crew within a selected time interval.
22. The performance indices defined by DISCOM are calculated daily. Other indices defined by DISCOM should be programmed and calculated by the system.
23. It is possible to define the performance indices established in the present Technical Specifications (formula weighted per customer and per MV/LV transformer installed power).
24. The performance indices should be seen for any day of the year and summarized per month or for any date of the year (starting from January 1).
25. The Performance Indices should be seen discriminated by voltage, equipment (substation, circuit, branch line, MV/LV transformer, LV feeder), customer's type, time period, type of fault, type of faulty equipment, crew's ID, geographic or administrative area or other criteria defined during the categorization of the system.
26. The equipment should be listed by the quality of service delivered.
27. The interruptions history should be listed for each customer.
28. The claims history should be listed for each customer.
29. The interruptions history should be listed for each network facility defined within the Data Model.
30. Upstream feeding and downstream supply information of each facility should be displayed on-line.

Edition Capabilities of the Database, Tables, and History

31. Complete list of upstream facilities feeding a subscriber for a selected date should be displayed on demand.

32. The update or new recording of any element, defined in the Data Model (like transformers, feeders, branch lines, and so on), is allowed on-line.

33. The different tables listing the types of incidents, voltages, origins of the faults, equipment affected and crews can be modified on-line.

34. The system preserves the historical data, of all customers' electrical feeding changes, from their power meter to the higher level of voltage defined in the Data Model.

35. The system allows to record, on-line, the linking of a new subscriber to its feeding transformer (or whatever element defined in the Data Model like a MV or LV feeder).

36. The system allows the feeding change of an existing customer.

37. A feeding change of an existing MV circuit, branch line, transformer or LV line can be done without the need to register again all the data of these elements.

Technical Information

38. The Data Model can be categorized as required in 'Database model' paragraph.

39. Detailed description of the functional and technical characteristics of the system presented, including the optimal technical requirements of the Hardware needed to operate the system offered. The list of the hardware equipment needed for the implementation of the system is presented in the offer.

40. The User's manuals (Categorization, System Maintenance, Data Base edition, Call Centre agent, NCC Operator and Data queries for analysis) will be adapted to the DISCOM glossary and procedures and written in English language.

41. All the texts displayed, by the IRMS, on its screens or on printed reports must be in English (the correct Technical Terms in English).

42. The interface with SCADA allows the automatic creation of the related incident in the IRMS when SCADA controlled switches change their status.

43. The interface with the CMS allows online access to the relevant customer's data used for claim register and electrical association.

44. The interface with GIS allows online update of the IRMS Database.

45. The system has an open format access to develop an interface to an AMI for 'last gasp' reception.

46. The system has the ability for the customer to record customer service rating for each ticket opened.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Annex IV: Supply Continuity - Detailed Tables for 2015

Table 14. Average Interruption Duration per Customer (minute) – According to the Reason

DISCOMs	External	Safety	Force Major	DISCOM	Total
Dicle	8.17	13.35	269.22	2,045.85	2,336.58
Vangölu	0	0	0	7,794.01	7,794.01
Aras	0.02	0.45	0	1,811.27	1,811.74
Çoruh	16.42	0.52	19.06	1,648.49	1,684.48
Fırat	39.06	8.61	408	5,740.70	6,196.37
Çamlıbel	59.89	2.05	0	233.60	295.54
Toroslar	11.94	15.67	0	1,555.65	1,583.26
Meram	214.25	20.55	0	2,640.64	2,875.45
Başkent	51.95	6.83	0.26	772.98	832.01
Akdeniz	61.7	29.48	0.07	936.43	1,027.68
Gediz	0.86	0.51	0	1,895.68	1,897.05
Uludağ	77.99	14.13	466.58	1,812.52	2,371.21
Trakya	36.45	0.66	0	639.85	676.95
Ayedaş	4.5	0.06	0	504.72	509.28
Sedaş	20.2	308.24	0	904.85	1,233.28
Osmangazi	9.86	1.53	458.69	842.69	1,312.76
Boğaziçi	17.09	7.5	0	1,472.87	1,497.46
Kayseri	66.76	0.35	432.89	349.4	849.39
Aydem	22.09	0.92	283.72	651.48	958.21
Akedaş	157.66	7.9	22.08	313.29	500.93
Yeşilırmak	40.79	23.11	0	2,834.36	2,898.25

Table 15. Average Interruption Duration per Customer (minute)

DISCOM	Notified	Unnotified	Total
Dicle	325.31	2,011.27	2,336.58
Vangölu	619.00	7,175.01	7,794.01
Aras	80.60	1,731.14	1,811.74
Çoruh	70.93	1,613.55	1,684.48
Fırat	772.29	5,424.08	6,196.37
Çamlıbel	3.81	291.73	295.54
Toroslar	731.16	852.10	1,583.26
Meram	1,467.61	1,407.84	2,875.45
Başkent	138.61	693.40	832.01
Akdeniz	181.39	846.28	1,027.68
Gediz	302.09	1,594.96	1,897.05
Uludağ	1,225.03	1,146.18	2,371.21
Trakya	60.61	616.34	676.95
Ayedaş	219.36	289.92	509.28
Sedaş	434.20	799.08	1,233.28
Osmangazi	265.72	1,047.04	1,312.76
Boğaziçi	149.49	1,347.98	1,497.46
Kayseri	190.56	658.82	849.39
Aydem	228.50	729.71	958.21
Akedaş	69.49	431.44	500.93
Yeşilırmak	683.75	2,214.50	2,898.25

Table 16. Average Interruption Frequency per Customer

DISCOM	Notified	Unnotified	Short	Total
Dicle	2.36	37.37	1.60	41.33
Vangölu	1.75	74.21	2.98	78.94
Aras	0.58	24.24	1.25	26.07
Çoruh	0.74	9.70	0.00	10.44
Fırat	2.58	19.86	0.00	22.44
Çamlıbel	0.04	4.39	0.00	4.43
Toroslar	2.26	10.29	0.81	13.36
Meram	6.01	11.65	0.01	17.67
Başkent	0.48	7.45	0.08	8.01
Akdeniz	0.92	11.84	0.23	12.99
Gediz	2.36	13.64	0.20	16.20
Uludağ	3.59	7.44	0.42	11.44
Trakya	0.24	6.76	0.42	7.42
Ayedaş	0.88	4.22	0.03	5.13
Sedaş	2.49	20.48	2.33	25.29
Osmangazi	1.36	16.72	0.12	18.20
Boğaziçi	0.54	12.41	0.08	13.02
Kayseri	2.54	5.70	0.55	8.78
Aydem	1.30	8.75	0.21	10.26
Akedaş	0.86	9.78	0.00	10.64
Yeşilırmak	2.33	16.06	0.23	18.63

Table 17. Average Interruption Frequency per Customer – According to the Resason

DISCOMs	Short	External	Safety	Force Major	DISCOM	Total
Dicle	1.60	0.32	0.34	4.25	34.83	41.33
Vangölu	2.98	0.00	0.00	0.00	75.96	78.94
Aras	1.25	0.00	0.00	0.00	24.82	26.07
Çoruh	0.00	0.11	0.01	0.02	10.30	10.44
Fırat	0.00	0.12	0.05	0.10	22.18	22.44
Çamlıbel	0.00	0.55	0.05	0.00	3.82	4.42
Toroslar	0.81	0.14	0.14	0.00	12.28	13.36
Meram	0.01	2.90	0.20	0.00	17.71	20.82
Başkent	0.08	1.39	0.03	0.00	6.51	8.01
Akdeniz	0.23	0.65	0.33	0.00	11.78	12.99
Gediz	0.20	0.00	0.01	0.00	15.99	16.20
Uludağ	0.42	0.87	0.10	0.22	8.87	10.48
Trakya	0.42	0.36	0.00	0.00	6.64	7.42
Ayedaş	0.03	0.06	0.00	0.00	5.04	5.13
Sedaş	2.33	0.35	2.15	0.00	20.47	25.29
Osmangazi	0.12	0.13	0.02	1.68	16.24	18.20
Boğaziçi	0.08	0.13	0.02	0.00	12.79	13.02
Kayseri	0.55	1.16	0.00	0.89	6.18	8.78
Aydem	0.22	0.22	0.01	0.52	9.29	10.26
Akedaş	0.00	3.45	0.15	0.16	7.06	10.82
Yeşilırmak	0.23	0.27	0.15	0.00	17.98	18.63

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