2015 ANNUAL REPORT AND FINANCIAL STATEMENTS

Operador Nacional do Sistema Elétrico
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1 INTITUTIONAL INFORMATION

1.1 ONS's Associate Members

AES SUL Distribuidora Gaúcha de Energia S.A.
AES Uruguaiana Empreendimentos S/A
Afluente Transmissão de Energia S.A.
Agro Energia Santa Luzia Ltda.
Aliança Geração de energia S.A.
Alumar Consórcio de Alumínio S.A.
Alumínio Brasileiro S.A.
Amazonas Distribuidora de Energia S.A.
Amazônia-Eletronorte Transmissora de Energia S.A.
Ampla Energia e Serviços S.A.
Anglo American Barro Alto
Anglo American Brasil Ltda.
Anglo American Minério de Ferro Brasil S.A.
Anglogold Ashanti Brasil Mineração Ltda.
Anglogold Ashanti Córrego do Sítio Mineração S.A.
Araraquara Transmissora de Energia S.A.
Arcelormittal Brasil S.A.
Arcelormittal Inox Brasil S.A.
ATE II Transmissora de Energia S.A.
ATE III Transmissora de Energia S.A.
ATE Transmissora de Energia S.A.
ATE VII Foz do Iguaçu Transmissora de Energia S.A.
ATE VIII Transmissora de Energia S.A.
Atlântico Concessionária de Transmissão de Energia do Brasil
Baguari I Geração de Energia Elétrica S.A.
Barra Bioenergia S.A. – Filial Ipaussu
Berneck S.A. Painéis e Serrados
Bolognesi Participações S.A.
Bons Ventos Geradora de Energia S.A.
Borborema Energética S.A.
Borracha Vipal S.A.
Braskem UNIB–RS
Brasken S.A.
Brasnorte Transmissora de Energia S.A.
Brasventos Eolo Gerador de Energia S.A.
Brasventos Miassaba 3 Geradora de Energia S.A.
Breitener Jaraqui S.A.
Breitener Tambaqui S.A.
Brentech Energia S.A.

Brilhante II Transmissora de Energia Ltda.
Brilhante Transmissora de Energia Ltda.
Cachoeira Paulista Transmissora de Energia S.A.
Caetité 2 Energia Renovável S.A.
Caetité 3 Energia Renovável S.A.
Caiuá – Serviços de Eletricidade S.A.
Caldas Novas Transmissão S.A.
Campos Novos Energia S.A.
Campos Novos Transmissora de Energia S.A. - ATE VI
Candeias Energia S.A.
Canoas Duke
Caramuru Alimentos Ltda.
Carbocloro S.A. Indústrias Químicas
Castertech Fundição e Tecnologia Ltda.
Catxere Transmissora de Energia S.A.
CEB Distribuição S.A.
CELG Distribuidora S.A.
CELG Geração e Transmissão S.A.
Centrais Elétricas Brasileiras S.A.
Centrais Elétricas Cachoeira Dourada S.A.
Centrais Elétricas da Paraíba S.A.
Centrais Elétricas de Pernambuco S.A. – EPESA (Termomanaus Ltda.)
Centrais Elétricas de Rondônia S.A.
Centrais Elétricas de Santa Catarina S.A.
Centrais Elétricas do Norte do Brasil S.A.
Centrais Elétricas do Pará S.A.
Centrais Elétricas do Rio Jordan S.A.
Centrais Elétricas Matogrossenses S.A.
Central Eólica Acari Ltda.
Central Eólica Albuquerque Ltda..
Central Eólica Anemoi Ltda.
Central Eólica Apeliotes Ltda.
Central Eólica Arena Ltda.
Central Eólica Ilha Grande Ltda.
Central Eólica Palmas Ltda.
Central Eólica Praia do Morgado S.A.
Central Eólica Ribeirão LTDA.
Central Eólica São Cristóvão S.A.
Central Eólica São Jorge S.A.
Central Eólica Sto. Antônio de Pádua S.A.
Central Eólica Volta do Rio S.A.
Central Geradora Colônia S.A.
Central Geradora Eólica Icaraí II S.A.

Central Geradora Eólica Icaraí I S.A.
Central Geradora Eólica Taíba Águia S.A.
Central Geradora Eólica Taíba Andorinha S.A.
Central Geradora Termelétrica Fortaleza S.A.
Cia. Energética de Petrolina
Cia. de Transmissão Centroeste de Minas
Cia. Energética de Minas Gerais
Cia. Vale do Rio Doce
CMPC Celulose Riograndense Ltda.
Cocal Termelétrica S.A.
Companhia Brasileira de Alumínio
Companhia Brasileira de Alumínio - Canoas
Companhia de Desenvolvimento dos Vales do São Francisco e do Parnaíba
Companhia de Eletricidade do Acre
Companhia de Eletricidade do Amapá
Companhia de Eletricidade do Estado da Bahia
Companhia de Energia Elétrica do Estado de Tocantins
Companhia de Geração de Energia Elétrica Tietê
Companhia de Geração Térmica de Energia Elétrica
Companhia de Interconexão Energética
Companhia de Transmissão de Energia Elétrica Paulista
Companhia Energética Chapecó
Companhia Energética de Alagoas
Companhia Energética de Minas Gerais
Companhia Energética de Pernambuco
Companhia Energética de São Paulo
Companhia Energética do Ceará
Companhia Energética do Maranhão
Companhia Energética do Piauí
Companhia Energética do Rio Grande do Norte
Companhia Energética Manauara
Companhia Energética Potiguar S.A.
Companhia Energética Rio das Antas
Companhia Energética Santa Clara
Companhia Estadual de Distribuição de Energia Elétrica
Companhia Estadual de Geração e Transmissão de Energia Elétrica
Companhia Hidrelétrica Teles Pires
Companhia Hidroelétrica do São Francisco
Companhia Luz e Força Santa Cruz
Companhia Paraibuna de Metais - Sobragi
Companhia Paulista de Força e Luz
Companhia Piratininga de Força e Luz Ltda.
Companhia Siderúrgica do Pecém

Companhia Siderúrgica Nacional
Companhia Transirapé de Transmissão
Companhia Transleste de Transmissão
Companhia Transudeste de Transmissão
Consórcio Candonga
Consórcio Capim Branco Energia
Consórcio CEMIG-CEB
Consórcio Empresarial Salto Pilão
Consórcio EnerPeixe
Consórcio Estreito Energia
Consórcio Igarapava
Consórcio Jauru
Consórcio Paraibuna
Consórcio Porto Estrela Ltda.
Consórcio Serra do Facão
Consórcio UHE Guilman Amorim
Copel Distribuição S.A.
Copel Geração S.A.
Copel Transmissão S.A.
Coqueiros Transmissora de Energia Ltda.
Corumbá Concessões S.A.
Coteminas S.A.
CPFL Transmissão Piracicaba S.A.
Desa Eólicas S.A.
Dona Francisca Energética S.A.
DSM Elastômeros Brasil Ltda.
Duke Energy International – Geração Paranapanema
ECE Participações Ltda.
Eka Bahia S.A.
Elebrás Projetos S.A.
Elektro – Eletricidade e Serviços S.A.
Eletrobrás Termonuclear S.A.
Eletrogóes S.A.
Eletropaulo Metropolitana – Eletricidade de São Paulo S.A.
Eletrosul Centrais Elétricas S.A.
Empresa Amazonense de Transmissão de Energia
Empresa Bandeirante de Energia S.A.
Empresa Brasileira de Transmissão de Energia S.A.
Empresa Catarinense de Transmissão de Energia S.A.
Empresa de Eletricidade Vale Paranapanema S.A.
Empresa de Energia Cachoeira Caldeirão
Empresa de Transmissão de Energia de Mato Grosso S.A.
Empresa de Transmissão de Energia do Oeste Ltda.

Empresa de Transmissão de Várzea Grande S.A.
Empresa de Transmissão do Alto Uruguai S.A.
Empresa de Transmissão do Espírito Santo S.A.
Empresa de Transmissão Serrana S.A.
Empresa Elétrica Bragantina S.A.
Empresa Energética de Mato Grosso do Sul S.A.
Empresa Metropolitana de Águas e Energia S.A.
Empresa Norte de Transmissão de Energia S.A.
Empresa Paraense de Transmissão de Energia S.A.
Empresa Regional de Transmissão de Energia S.A.
Empresa Santos Dumont de Energia
Encruzo Novo Transmissora de Energia Ltda.
Enerbrasil – Energias Renováveis do Brasil Ltda.
Energest S.A.
Energética Águas da Pedra
Energética Barra Grande S.A.
Energética Suape II S.A.
Energia Sustentável do Brasil S.A.
Energisa Borborema Distribuidora de Energia S.A.
Energisa Minas Gerais Distribuidora de Energia S.A.
Energisa Paraíba
Energisa Sergipe
Eneva S.A.
Enguia Gen CE Ltda.
Enguia Gen PI Ltda.
Eólica Faísa I Geração de Energia S.A.
Eólica Faísa II Geração de Energia S.A.
Eólica Faísa III Geração de Energia S.A.
Eólica Faísa IV Geração de Energia S.A.
Eólica Faísa V Geração de Energia S.A.
Eólica Mangue Seco 2
Eólica Mangue Seco 3 Geradora e Comercializadora de Energia Elétrica S.A.
Eólica Mangue Seco 4 Geradora e Comercializadora de Energia Elétrica S.A.
Espírito Santo Centrais Elétricas S.A.
Espora Energética Ltda.
Estação Transmissora de Energia S.A.
Evrecy Participações Ltda.
Expansion Transmissão de Energia S.A.
Expansion Transmissão Itumbiara Marimbondo S/A
Extremoz Transmissora do Nordeste
Ferreira Gomes Energia S.A.
Fibraplac Chapas de MDF Ltda.
Foz do Chapecó Energia S.A.

Foz do Rio Claro Energia S.A.
Furnas Centrais Elétricas S.A.
Geração CIII S.A.
Geradora de Energia do Amazonas S.A.
Geradora de Energia do Maranhão S.A.
Gerdau Aços Especiais S.A.
Gerdau Aços Longos S.A. – Barra dos Coqueiros
Gerdau Aços Longos S.A. – Caçu
Gerdau Aços Longos S.A. – SP
Goiânia Transmissora de Energia S.A.
Goiás Transmissão S.A.
Guaraciaba Transmissora
Gusa Nordeste S.A.
GV do Brasil Ind. e Com. de Aço Ltda.
Ijuí Energia S.A.
Innova S.A.
Integração Maranhense Transmissora de Energia S.A.
Integração Transmissora de Energia S.A.
Interligação Elétrica de Minas Gerais
Interligação Elétrica do Madeira S.A.
Interligação Elétrica Garanhuns S.A.
Interligação Elétrica Norte e Nordeste S.A.
Interligação Elétrica Pinheiros S.A.
Interligação Elétrica Serra do Japi S.A.
Interligação Elétrica Sul S.A.
Investco S.A. – Lajeado
Iracema Transmissora de Energia S.A.
Itá Energética S.A.
Itapebi Geração de Energia S.A.
Itiquira Energética S.A.
Itumbiara Transmissora de Energia Ltda.
Jauru Transmissora de Energia Ltda.
Kinross Brasil Mineração S.A.
Klabin S.A.
Lanxess Elastômeros do Brasil S.A.
Light – Serviços de Eletricidade S.A.
Light Energia S.A.
Linde Gases
Linha de Transmissão Corumbá
Linha Verde Transmissora de Energia S.A.
Linhares Geração S.A.
Linhas de Macapá Transmissora de Energia Ltda.
Linhas de Transmissão de Montes Claros Ltda.

Linhas de Transmissão do Itatim Ltda.
Linhas de Xingu Transmissora de Energia Ltda.
Londrina Transmissora de Energia S.A. – ATE V
LT Triângulo S.A.
Lumitrans Companhia Transmissora de Energia Elétrica
Luziânia-Niquelândia Transmissora S.A.
Macaúbas Energética S.A.
Manaus Transmissora de Energia S.A.
Maracanaú Geradora de Energia S.A.
Matrinchã Transmissora de Energia
MC2 Camaçari 3 S.A.
MGE Transmissão S.A.
Mineração Maraca Indústria e Comércio S.A.
Mineração Paragominas S.A.
Mirabela Mineração do Brasil Ltda.
Monel Monjolinho Energética Ltda.
MS Participações Societárias S.A.
New Energy Options Geração de Energia S.A.
Nordeste Transmissora de Energia S.A.
Norte Brasil Transmissora de Energia S.A.
Norte Energia S.A.
Nova Era Silicon S.A.
NovaTrans / Enelpower do Brasil Ltda.
Novo Horizonte Energética S.A.
Onfa Geradora e Distribuidora Ltda.
Oxiteno Nordeste S.A. Indústria e Comércio
Parnaíba Geração e Comercialização de Energia S.A.
Pedras Transmissora de Energia Ltda.
Petróleo Brasileiro S.A.
Petróleo Brasileiro S.A. – Fábrica de Fertilizantes Nitrogenados – FAFEN-SE
Poços de Caldas Transmissora de Energia Ltda.
Porto do Pecem Geração de Energia S.A.
Porto Primavera Transmissora de Energia Ltda.
Refinaria Presidente Getúlio Vargas – Araucária – PR
Rei dos Ventos 3 Gerador de Energia S.A.
Retiro Baixo Energética S.A.
Ribeirão Preto Transmissora de Energia Ltda.
RIMA Indústria S.A.
Rio Amazonas Energia S.A.
Rio Branco Transmissora de Energia S.A.
Rio Canoas Energia S.A.
Rio Claro Agroindustrial S.A.
Rio Grande Energia S.A.

Rio Verde Energia S.A.
Rosal Energia S.A.
Sadia S.A.
Salobo Metais S.A.
Samarco Mineração S.A.
Santo Antônio Energia S.A.
São Gotardo Transmissora S.A.
São Mateus Transmissora de Energia S.A – ATE IV.
São Pedro do Lago S/A
SE Narandiba S.A.
Seabra Energética S.A.
Serra da Mesa Transmissora de Energia Ltda.
Serra Paracatu Transmissora de Energia Ltda.
Sete Lagoas Transmissora de Energia Ltda.
Siderúrgica Barra Mansa
Sistema de Transmissão Catarinense S.A.
Sistema de Transmissão Nordeste
Solvay Indupa do Brasil
Sul Transmissora de Energia Ltda.
Suzano Papel e Celulose S.A.
Tangará Energia S.A. – Guaporé
Termelétrica Pernambuco III S.A.
Termelétrica Viana S.A.
Termo Norte Energia Ltda.
Termo Pernambuco Ltda.
Termocabo Ltda.
ThyssenKrupp CSA Siderúrgica do Atlântico
Tijoa Participações e Investimentos S.A.
Toyota do Brasil Ltda.
Tractebel Energia Suez S.A.
Transenergia Goiás S.A.
Transenergia Renovável S.A.
Transenergia São Paulo S.A.
Transmissora de Energia Sul Brasil
Transmissora Delmiro Gouveia S.A.
Transmissora Matogrossense de Energia S.A.
Transmissora Porto-alegrense de Energia Ltda.
Transmissora Sudeste Nordeste S.A.
Transmissora Sudeste Nordeste S.A. – PATESA
Transmissora Sul Brasileira de Energia
Transmissora Sul Litorânea de Energia S.A.
Transnorte Energia S.A.
U.E.G. Araucária Ltda.

Uirapuru Transmissora de Energia
Usina Termelétrica de Anápolis Ltda.
Usina Termelétrica Norte Fluminense S.A.
Usina Xavantes S.A.
Usinas Siderúrgicas de Minas Gerais S.A.
UTE MC2 Camaçari 2 S.A.
UTE MC2 Governador Mangabeira S.A.
UTE MC2 Nossa Senhora do Socorro S.A.
UTE MC2 Santo Antonio de Jesus S.A.
UTE MC2 Sapeaçu S.A.
UTE Parnaíba Geração de Energia S.A.
UTE Parnaíba III Geração de Energia S.A.
Vale Potássio Nordeste S.A.
Vallourec & Sumitomo Tubos do Brasil Ltda.
Ventos da Lagoa S.A.
Ventos do Litoral Energia S.A.
Ventos do Sul Energia S.A.
Ventos dos Índios Energia S.A.
Veracel Celulose
Vila do Conde Transmissora de Energia Ltda.
Votorantim Cimentos Ltda.
Votorantim Metais Níquel S.A.
White Martins

1.2 Administration Board

Category: Production

- Holder: Valter Luiz Cardeal de Souza (ELETROBRÁS)

  Substitute: Luiz Henrique de Freitas Schnor (CGTEE)

- Holder: Cesar Ribeiro Zani (FURNAS)

  Substitute: Ricardo Daruiz Borsari (EMAE)

- Fernando Henrique Schuffner Neto (CEMIG) as holder, substituted by Mauro Borges Lemos (CEMIG) on 01/27/2015, and Alexandre Magno Firmo Alves (CDSA) as deputy, substituted by Claudia Maria Suanno (CDSA) on 06/22/2015;

- Holder: Maurício Stolle Bähr (TRACTEBEL)

  Substitute: Armando de Azevedo Henriques (DUKE)

- Holder: Xisto Vieira Filho (ENEVA)

- Substitute: José Alcides Santoro Martins (PETROBRÁS);

Category: Transport

- Holder: Mozart Bandeira Arnaud (CHESF) as holder, substituted by José Ailton de Lima (CHESF) on 08/18/2015, and Luciano Paulino Junqueira (NTE) as deputy, substituted by Jorge Raul Bauer (ABENGOA) on 04/17/2015;

- Holder: Ronaldo dos Santos Custódio (ELETROSUL)

  Substitute: Ramon Sade Haddad (STATE GRID);

- Holder: Celso Sebastião Cerchiari (CTEEP) as holder, substituted by Reynaldo Passanezi Filho (CTEEP) on 04/18/2015, and Augusto Francisco da Silva (CELG) as deputy;

- Lauro Sergio Vasconcelos David (TBE) as holder and José Aloise Ragone Filho (TAESA) as deputy, substituted by Magdiel Unglaub (TAESA) on 11/30/2015;

Category: Consumption

- Holder: Lindolfo Zimmer (COPEL), substituted by Luiz Fernando Leone Vianna on 01/16/2015, and Gustavo Cavalcante de Carvalho Rocha (CELESC) as deputy;

- Holder: Wilson Pinto Ferreira Junior (CPFL)

Substitute: Donato da Silva Filho (ESCELSA);

- Holder: Britaldo Pedrosa Soares (ELETROPAULO)

  Substitute: Paulo Roberto Ribeiro Pinto (LIGHT) – Until 12/07/2015;

- Holder: Solange Maria Pinto Ribeiro (NEOENERGIA)

  Substitute: Lucas Leandro Müller (REDE);

- Holder: Ricardo Batista Mendes (VALE)

  Substitute: Claudia Silvia Zanchi (GERDAU);

Ministry of Mines and Energy

- Francisco Romário Wojcicki as holder, substituted by Willamy Moreira Frota (MME) on 03/31/2015, and Ildo Wilson Grüdtner (MME) as deputy.

1.3 Fiscal Board

- Mauro Guilherme Arce (CESP) as holder and Pedro José Diniz de Figueiredo (ELETRONUCLEAR) as deputy, representing the Production Category;
- Wady Charone Junior (ELETRONORTE) as holder and Domingos Sávio Castro Horta (TAESA) as deputy, representing the Transport Category;
- Gerson Carrion de Oliveira (CEEE) as holder, substituted by Paulo de Tarso Gaspar Pinheiro Machado (CEEE) on 02/10/2015, and Marcus Sérgio Fontana (CEB) as deputy, representing the Consumption Category.

1.4 ONS's Board of Directors

- Hermes Chipp – CEO
- Álvaro Fleury Veloso da Silveira – Transmission System Services Administration Director
- Francisco José Arteiro de Oliveira – Operation Planning and Scheduling Director
- István Gárdos – Corporate Affairs Director
- Ronaldo Schuck – Operations Director

1.5 Administration Board Message

Overcoming the challenges posed to ONS

Once more, I make use of this message to acknowledge the Organization's performance both in relation to technical and corporate aspects. I would like, in particular, to highlight the supply guarantee obtained by managing the operation of the Brazilian Interconnected Power System in 2015, in a highly complex environment, which required lots of effort and commitment of ONS's board of directors and of all directly involved in the issue.

With storage levels affected by the ongoing water crisis, the operational measures implemented by ONS - recovery of headwater reservoirs, intensive use of exchanges between subsystems to take advantage of existing energy surplus, the use of the thermoelectric park and the flexibility of constraints regarding the multiple usage of water - were key to achieve supply security at the lowest cost possible.

Another highlight was the integration of the Isolated Systems in the Northern Region, Manaus and Macapá, and of large hydroelectric plants in the Northern Region to the BIPS, as well as the efforts to make the Madeira Complex Bipole 2 viable

Within its regulatory duties, the Administration Board took part in this integrated effort of the Operator, the Ministry of Mines and Energy, the Regulatory Agencies, the Associated Agents and other organizations that conduct electric power sector, so that the challenges posed by the BIPS would be once again surpassed.

In this highly complex environment of the BIPS (Brazilian Interconnected Power System), the efforts made by ONS in its corporate management related to human resources and the careful management of financial resources must also be recorded.

Knowing the future will continue to bring more complex challenges, training of ONS technical staff will continue to represent a priority of ONS's management.

Maurício Stolle Bähr

President of the Administration Board

1.6 CEO's Message

Every commitment to the management of the Brazilian Interconnected Power System - BIPS

Once more, the fulfillment of our duties in the management of the Brazilian Interconnected Power System operation required the total dedication of the technical staff of the operator and the intense relationship with all the institutions participating in the management of the Brazilian electric power sector.

Attention remained focused on the supply conditions in both short and mid-term. We faced the ongoing water crisis, seeking to ensure the supply to consumers with security and the lowest possible cost. Keeping this objective in mind, the operational policies considered the recovery of headwater reservoirs of the major river basins, the usage of the transmission network for the exchange of large energy blocks among the Southern and Northern Regions to the Southeastern / Midwestern and Northeastern Regions, full usage of the thermoelectric park existing most of the year and the need for relaxation of constraints system to face the shortage of resources and to ensure operating conditions of the hydroelectric park. In this context, the decisions involved the Ministry of Mines and Energy, the Ministry of Environment, IBAMA, the Ministry of National Integration, the regulatory agencies ANEEL and ANA, and all agents involved.

Among the long-term projects, it can be highlighted: the studies for complete usage of the Madeira River Complex energy availability, as well as the challenge to enable the field testing of this complex's Bipole 2; the studies for the integration of Teles Pires and Belo Monte plants to the BIPS; the operational measures implemented to improve the operation of the Tucuruí-Manaus-Macapá interconnection; the supply to Manaus and Macapá, Acre and Rondônia systems, more recently integrated into the BIPS, the continuity of the implementation of ONS's Electric Power Management Network (REGER); and the differentiated treatment of the installations considered strategic, in order to minimize the effects of multiple contingencies in the transmission system.

Still, it can also be highlighted the effort together with the Agents in order to receive phasor measurements data from the PMUs deployed in their installations. This integration between ONS and the Agents enabled to receive phasor measurements online, which served as input for the analysis of occurrences in the BIPS and solidified the usage of PMUs at ONS even more. Also in 2015, bidding process for the acquisition of data concentrators and associated applications was resumed.

ONS, as coordinator of the 2016 Olympics Task Force, in 2015, reviewed and updated studies and analyses to identify the actions needed to ensure the electric power supply to the host city of Rio de Janeiro and additional soccer games host cities, Brasília, São Paulo, Belo Horizonte, Salvador and Manaus, following

differentiated security standards, as the ones adopted at special events, in line with the criteria established by the International Olympic Committee - IOC.

It is important to highlight ONS's performance through the Working Groups on Supply to several States, with the involvement of local Authorities and the Agents involved in order to consider and analyze the entry into operation of the transmission works aiming at ensuring the supply to these States.

One of the key factors to achieve these results was the successful collaboration of all the institutions taking part in the energy power sector management: the Ministry of Mines and Energy, the Brazilian Electricity Regulatory Agency (ANEEL) and additional regulatory agencies, the Energy Research Company (EPE), the Chamber of Electric Energy Commercialization (CCEE), the State Energy Departments, each of the 363 associate members and the Associations that represent them.

In the corporate area, it was sought to ensure the sustainability of the Operator by investing in programs for the appreciation of technical knowledge, interpersonal relationships and improving the teamwork qualification. Careful management of the Operator's financial resources policy was continued, with the implementation of all activities and priority projects.

Finally, on behalf of ONS's Board, I thank all who make up ONS, for their valuable contribution to the results achieved by the organization.

Hermes Chipp

General Director and CEO

1.7 Highlights of 2015

Analysis of Congestion in the North-South Interconnection

The Brazilian electric power system is undergoing a major paradigm change in its electric power matrix, with the increasing share evolution of intermittent and inflexible renewable sources such as the run of river power plants in the Amazonian Region, wind plants and in the near future, the solar plants, in addition to the gradual loss of regulating capacity.

In the years to come, due to the high concentration of inflexible offer in the Northern and Northeastern Regions, mainly during the BIPS's rainy season, transmission constraints of interconnections may prevent the of energy surplus transfer from those regions to the Southeastern / Midwestern and Southern Regions, required for system optimization.

In the 2015/2019 Energy Operation Plan (PEN 2015) the degree of congestion of the interconnection between the Northern / Northeastern and Southeastern / Midwestern Regions was assessed, pointing out the need to assess the feasibility of reinforcements in the exchange capacity between these systems. This assessment supported the elaboration of an Article awarded with an honorable mention at the XXIII SNPTEE.

Validation and Implementation of the Equivalent Power Reservoirs – REE Methodology

The strategic model NEWAVE, until its computer program 20th version, did not allow the explicit representation of basins with different hydrological behavior in the same electric power subsystem, since only one equivalent energy reservoir was associated for each subsystem.

In other to obtain a better representation of the generation system, an extension of the traditional approach was implemented, in which it is allowed for a subsystem include several river basins with particular hydrological behaviors. Therefore, the representation of current BIPS subsystems is maintained, so that each one can have several Equivalent Power Reservoirs (REE).

When representing the BIPS topology with a larger number of REEs, it is possible to consider in more detail the physical constraints such as turbining and storage capabilities, in addition to explaining the spatial distribution of a same system REE's inflows, and enable that the hydrological behavior is represented more accurately.

Supply during the 2016 Olympic Games

As coordinator of the 2016 Olympic Games Task Force, ONS conducted in 2015 studies and analyzes to identify the necessary actions to ensure the supply of electric power to the host city of Rio de Janeiro and addition soccer games host cities, taking into account differentiated security patterns, in accordance with CMSE 001/2005 Resolution and the criteria set by the International Olympic Committee - IOC.

These analyzes identified the necessary actions - additional thermal generation, energy constraints and adjustments and / or new Special Protection Systems (SEP) - for Rio de Janeiro and additional soccer games host cities, so that they have their main loads preserved in adverse situations, and to ensure differentiated performance in case of double losses.

2 TECHNICAL RESULTS IN 2015

2.1 Pre-operational Studies of the Madeira River Complex

At Santo Antônio plant, from 2015's second semester, the first generating units located in the river bed were incorporated, reaching a total of 35 machines in commercial operation at the end of that year. At Jirau, the entry into operation of new units throughout the year increased to 37 the number of generators for operation.

In 2015, the energy generated at the Madeira Complex was flowed by Bipole 1 (3,150 MW), by the back-to-back converter station (2 x 400 MW) and during some periods of the year, also by the TF-13 500 / 230 kV - 465 MVA transformer.

The biggest challenge was enabling Bipole 2 field tests (3,150 MW), since the entry into operation of this second Bipole will ensure full expected generation flow for the Complex's plants in the years to come. Thus, several pre-operation studies were conducted, including real-time environment simulation analyzes (RTDS), considering the control and protection systems replicas of the two Bipoles and the back-to-back converter station.

ONS's and the transmission and generation agents main actions aimed at making the operation of the Madeira Complex HVDC system smoother, with regard to control and protection of the two DC Bipoles, supplied by different manufacturers.

Positive results were also obtained in tests carried out by generation agents to assess the effectiveness of black-start systems, designed to allow starting of plants without using external source.

2.2 Tucuruí – Manaus – Macapá Interconnection

Changes in the configuration of the 69 kV Manaus supply system, derived from Manaus and Mauá 3 substations, required adjustments in the Load Relief Regional Scheme (ERAC). Likewise, studies developed for Amapá were revised, since this system's new generation units changed significantly the area performance. Throughout the year, distribution companies implemented the new settings set by the studies, adding more security to areas, in order to face any contingencies resulting in islanding, separating them from the rest of the BIPS.

Pre-operational studies for the integration of the (3 x 73 MW) Cachoeira do Caldeirão hydro plant were performed in the state of Amapá. This plant's generation surplus and of additional hydro plants in the region (Santo Antônio do Jari, Ferreira Gomes and Coaracy Nunes) create scenarios in which energy exports in this state is high, requiring the definition of specific control and protection measures. This is the case, for example, of the generation dropping scheme to ensure the stable operation of the island composed by the power plants and by the

Manaus and / or Macapá system after double contingency in the region's 230 or 500 kV trunks.

2.3 Pre-Operational Studies for Telles Pires Plant's Interconnection

Teles Pires hydro plant, located on the Teles Pires River, on the border of Mato Grosso and Pará states, is part of Teles Pires and Apiacás rivers hydro plants, which formed by the 300 MW Colider, 400 MW Sinop, 700MW San Manuel and 230 MW Foz do Apiacás plants. These plants will be integrated into the BIPS by a 500 kV transmission system, which will interconnect the states of Mato Grosso, Goiás and Minas Gerais.

Although the generating units of the Teles Pires plant were made available in 2015, with a delay in the originally planned transmission system, formed by 500 kV two circuit between the plant and Ribeirãozinho (MT) substation, it was necessary to use a provisional configuration in the 230 kV Sinop SB for the interconnection to the BIPS. This configuration required specific pre-operational studies, including electromagnetic and electromechanical transient analysis, resulting in important control and protection actions, in order to ensure proper electric performance and the integrity of the transmission and generation equipment.

2.4 Interconnection of Belo Monte Transmission System

In 2015, ONS developed several activities related to the integration of the Belo Monte plant transmission system to the BIPs, with emphasis on the studies of compliance analysis of the first Bipole's main design project.

2.5 2016 Olympic Games

As coordinator of the 2016 Task Force, ONS, in 2015 reviewed and update studies and analysis to identify the necessary actions to ensure the supply of electric power to the host city of Rio de Janeiro and the additional soccer games host cities, Brasília, São Paulo, Belo Horizonte, Salvador and Manaus, observing different security standards, as the ones adopted at special events, in line with the provisions of Resolution CMSE 001/2005 and considering the criteria established by the International Olympic Committee - IOC .

These analysis take into account the works planned to be in operation in June 2016, as well as the consequences of delays, besides identifying the necessary actions, such as: additional thermal generation, energy constraints and adjustments and / or new Special Protection Systems (SEP) for Rio de Janeiro and additional soccer games host cities, so that they have their main loads preserved in adverse situations and to ensure differentiated performance in situations of double losses.

Upon the request of the Ministry of Mines and Energy, ONS elaborated the ONS RE-3-0057-2015 report - Strategic Installations for the 2016 Olympic and Paralympic Games, which identifies the most relevant systemic installations for the supply of the Rio de Janeiro clusters, and the stadiums of the five additional soccer

games host cities. From the strategic installations list, a criterion for prioritizing the Main Grid and distribution network installations was prepared.

A diagnosis on the 500 kV transmission trunk equipment and transmission lines of Rio de Janeiro Area was introduced to minimize the risk of incorrect and accidental actuations, or refusals, which may lead to major impact disturbances. An assessment of the Special Protection Systems (SEP) that was deployed in this trunk transmission started.

In addition, ONS started studies to review the fluent restoration procedures of Marimbondo corridors, Lajes Complex plants - Light and Luiz Carlos Barreto, as well as the procedures for the restoration of Belo Horizonte, Brasilia, Salvador and São Paulo. The studies aimed to ensure the quick and secure return of the priority loads such as: Olympic clusters, mass transportation (trains and subway), hospitals, among others, during the period of the Rio 2016 Olympic and Paralympic Games.

Additionally, t is noteworthy the attendance of the Brazilian Operator in meetings at the Ministry of Mines and Energy, with the Olympic Public Authority Energy Group (APO), to analyze the aspects regarding the energy supply for the Games.

2.6 Improvement of Electric Power Security

ONS continually works to add more security to the BIPS performance through various initiatives. Due to the network topology characteristics, the system's operational security is subject to different degrees of risk of accidental transmission shutdown or generation.

Although the BIPS is designed to face single contingencies (n-1 criterion), it is subject to more severe disturbances, triggered by sequences of events, which can occasionally lead to the simultaneous shutdown of more than one of the network components violating the referred criterion . Depending on the affected facility, consequences can be more severe, involving the shutdown of large amounts of consumers.

In order to minimize the chance of occurrence of a major disturbance, restricting the spread of a disorder and speed the loads restoration up, it is necessary to keep permanent observation, analysis, diagnosis and prevention of these events.

Considering the combinatorial nature of the problem, as well as the particularity of the events and system settings before and after disturbances, the post-operation analysis in major disturbances provides important input for the creation of preventive measures and for the reinforcement of the system security.

In 2015, a Special Protection System (SEP) was implemented. The system is able to identify the loss of large energy blocks, such as the loss of an Itaipu or Madeira Complex Bipole, dropping generation at Tucuruí hydro plant so that system stability is controlled, avoiding a disturbance spread with more severe consequences. This

SEP has its operations related to the exports scenario of the Northern Region to the Southeastern Region.

2.6.1 Strategic Installations

The concept of strategic installations covers power plants, substations and transmission trunks which, if turned off by electric problems or destroyed / damaged due to other reasons, the interruption of its services may lead to the occurrence of loss of large energy blocks and / or load, causing a major impact on society.

From the awareness of the strategic installations, ONS, since 2012, with the participation of the Agents involved, has undertaken the following actions:

- Identification / update of the set of assisted substations.
- Improving of information involving: environmental weather conditions (rain and direction of windstorms, lightning, air temperature, atmospheric pressure) and bushfires, available at Operation Centers, to prepare the BIPS for any multiple contingencies.
- Interaction with the expansion planning area for defining reinforcements that minimize the consequences of certain multiple losses.

  Implementation of new Special Protection Systems (SEP)
- Improvement of new SEPs design to minimize accidental or incorrect actuations.
- Adoption of more conservative criteria when maintenance services are carried out in those installations.
- Adoption of special criteria for testing of black-start generating units devices.

In order to make the BIPs more resilient, a working group composed by representatives of MME, ANEEL, EPE, ONS and Cepel was created, under technical coordination of ONS. The studies had the participation of agents owning installations. The goal was to identify the substations that needed arrangement complementarities or other measures to improve their intrinsic security.

The prevention from sequences of events can cause major disturbances involving substations engineering, aiming to:

- Minimize the risk of human error in the facilities' operation and maintenance;
- Provide protection, automation, control, monitoring and supervision in accordance with the Grid Procedures, which may be exceeded whenever the peculiarities of the installations require.

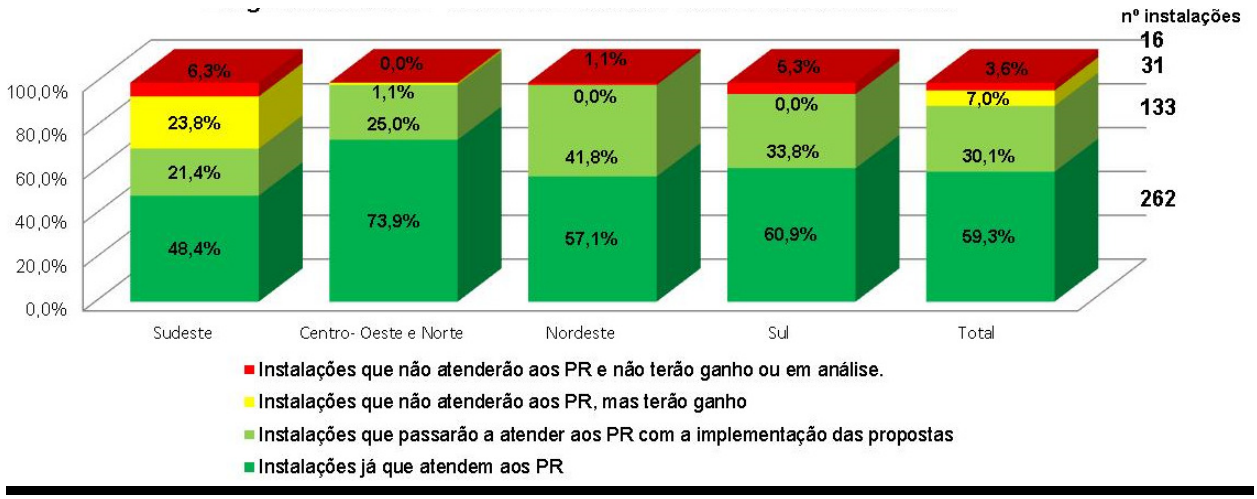
The preparation of the work consisted of verifying full compliance with the requirements set in Sub-module 2.3 of the Procedures regarding busbar arrangement:

- In substations with double bus arrangement with single circuit breaker, the deployment of an adaptive bus protection was proposed, together with the circuit breaker failure protection;
- Assessment of the possibility of reducing contingencies consequences, which may lead to major disturbances, such as of failure in the circuit breaker opening;
- Measures to minimize risks through improvements regarding busbar arrangements;
- Possible use of hybrid technology, with compact modules for equipment bays and construction of new sectors using GIS technology (Gas Insulated Switchgear).

As a result of the analysis, it was possible to identify the substations that needed arrangement complementarities or other measures considered necessary to improve substations' intrinsic security, and along with that the Brazilian Interconnected Power System's performance as a whole. 439 Main Grid installations 13 substations, which are part of ONS Operation Network were analyzed.

Figure 1 shows the general diagnosis in compliance with the Grid Procedures after the implementation of all the recommended improvements.

Figure 1 – Compliance with Grid Procedures– General Diagnosis



Performance Evaluation of Special Protection Systems

The criteria and procedures for the implementation of functional tests on the Special Protection Systems (SEPs) installed on the BIPS were set in 2012 in order to ensure proper performance. Between 2012 and 2014, tests were performed on 81 SEPs installed in several areas of the system. In 2015, continuing the process, 11 additional

tests were carried out. For each test, a report was elaborated, containing a brief description of the system, its purpose, the tests carried out, that abnormalities that could be encountered and the measures taken. Besides, in order to consolidating all tests performed in the previous year, a Technical Note was published by ONS in April / 2015.

2.6.2 Implementation of the Synchrophasor Measurement System (PMU)

ONS acted strongly with the Agents in order to receive the data from phasor measurements of the PMUs deployed in their installations. This integration between ONS and the Agents made possible to receive phasor measurements online, which served as an input for the analysis of occurrences in the BIPS and further solidified the use of PMUs at ONS. Still in 2015, it was given continuity to the bidding process for the acquisition of data concentrators and applications that will integrate the BIPS' Synchrophasor Measurement System (SMSF), highlighting the following related milestones:

- Until 08/2015 - preparation of the Public Notice to the bid;
- 08/31/2015 - ONS received the Bank's no-objection to the beginning of the bidding process;
- 09/15/2015 - approval for the start of the bidding process and presentation of the Project schedule and Telecom System (Infrastructure) to ONS's Board;
- 09/18/2015 – publication of the public notice of the bidding process for the Brazilian Interconnected Power System's SMSF project on ONS's website, DOU, *Valor Econômico* and the UN website. Twenty-two applicants requested link for access to the public notice.
- 10/15/2015 - Workshop – Pre-Bid, meeting with suppliers;
- 10/22/2015 - Meeting with ANEEL; presentation of the final project's format to ANEEL;
- 11/23/2015 - technical proposals were received, phase 1 - opening and start of the analysis on the proposals received. At this stage, the ONS received proposals from three applicants;
- 12/08/2015 - ONS held a meeting with the Agents, for updating and clarification of the SMSF Project development;

The completion of the bidding is scheduled for 2016, with the choice of supplier to be hired by the end of the first semester.

2.7 Operation Planning and Scheduling

The annual cycle of the BIPS Operation Planning consists of mid-term studies regarding the energy operation, published on the Energy Operation Plan (PEN), whose horizon of analysis is the month / year in which is designed until December of the fifth year ahead, and of mid-term electric operation studies, published in the Electric Operation Plan (PEL), whose analysis horizon is sixteen months, from January of the year following its preparation until April of the second year. Following these studies the weekly and daily scheduling are carried out with the participation of the associated Agents in which the energy and electric aspects intertwine increasingly, as much as the analysis horizon is shortened.

2.7.1 Energy Operation

Mid-term Horizon

In 2015, the Energy Operation Plan 2015/2019 (PEN 2015) was unusually issued in September, considering the information of the 2nd Own Load Review in August. The results subsidies the Electric Sector Monitoring Committee (CMSE) and the Energy Research Company (EPE) on the possible need for generation expansion planning studies and regional interconnections, to adjust the power supply to guarantee criteria supply established by the National Energy Policy Council (CNPE).

The new energy aggregate by the auctions and the addition of new transmission lines increased energy offer in the period. Hydroelectricity will remain as the main source of electric power generation, in spite of its share being reduced from 73.7% in 2014 to 68.0% at the end of the horizon. There will be a significant increase in wind power plants installed capacity, which will rise from 3.7% of the electric matrix to 9.4% at the end of 2019.

The paradigm shift in how to operate the BIPS is to be highlighted, as pointed out in several studies issued in recent years, due to the lack of new multi-year regulation reservoirs; the more intensive use of thermal generation even with average hydrology and to complement the supply to peak load; the importance of transmission expansion to the reduce operating costs; the significant growth of wind generation and new run of river hydroelectric projects in the Amazonian Region and with seasonal offer.

The 2nd Quarterly Load Review's power load and demands values, brought forward to August 2015, were used in this study. This review considers: the economic and market environment during the first half of 2015; the observed deviations between the observed load and projections made in April for the 1st Quarterly Load Review of the year; the current dynamics of the economy; the release of the increase in electricity tariffs due to variable tariffs, the extraordinary and common tariff revision already occurred; and an annual average GDP increase rate in the period of 2015/2019 to 2,5% p.a.

The supply conditions evaluations were divided into two horizons in the 2015 PEN. In the first one, 2015/2016, environmental, deterministic and stochastic analyzes were carried out, highlighting each BIPS's subsystem storage evolution. In general, during this period, power plants and transmission lines configurations are defined, and there is hardly any possibility of incorporating or forwarding new projects. The second horizon comprehends the three remaining years, 2017-2019, and shows a more structural feature, where indicators such as deficit risks and operation marginal cost were observed. During this period, the expansion of generation and transmission is key to increase the security of supply to the market in a structural form.

Due to the loss of the system's regulating capacity face to load growth, it can be noted that there is an increase in the influence in the initial storage conditions concerning the results in the first two years of the evaluation horizon, impacting the metric typically used such as deficit risks, expected value of non-supplied energy and operation marginal costs.

Regarding the analysis of load supply conditions, the 2017/2019 horizon probabilistic assessments, based on the energy deficit risks, point to suitability to the supply criteria set by the National Energy Policy Council (CNPE), to the extent deficit risks are lower than 5% in all subsystems;

The maximum demand supply analysis indicates that, despite the existence of available surpluses to meet the BIPS's maximum demand, special dispatch actions may be required to keep the frequency control in situations of demand's unanticipated increases in the maximum demand due to temperature rise in the summer months, once the maximum demand tends to increase to around 4,000 MW every 10 °C, from temperatures near 35 °C;

In addition, it could be identified a high frequency of congestion in the North / South interconnection, reducing at the end of the horizon, with the entry into operation of the reinforcement associated with the energy flow from Belo Monte power plant, confirming the energy assessments diagnosis on the need for cost / benefit assessments of reinforcements / anticipations.

Short-Term Horizon

Under the climatic point of view, 2015, since the very beginning, was marked by occurrence of a positive anomaly of atmospheric pressure in the South - Central region of the country, which caused a blockage of the entrance of cold fronts and low pressure systems. This phenomenon also led to a reduction of the humidity transport from the Amazonian Region to the Southeastern Region of Brazil and led to the non-occurrence of episodes of South Atlantic Convergence Zone (SACZ). Therefore, there was significantly below average precipitation in the hydro basins located in the Southeastern, Midwestern, Northeastern and Northern Regions, creating an unfavorable situation in the wet period in major basins of the BIPS, such as the Paranaíba, Grande, São Francisco and Tocantins.

The occurrence of the El Niño phenomenon, associated with the rise in sea surface temperature in the Equatorial Pacific Region, began to have a strong influence on the rain regime in Brazil. In the Southern Region, especially, episodes of high precipitation occurred, and in areas located further north in the Northeastern and Northern Regions, a negative precipitation anomalies occurred. The El Niño event that began during the 2015 summer / fall, was classified as very strong and is among the three most intense in history, reaching its peak in November 2015.

In this context, the Southeastern / Mid-Western subsystem presented unfavorable inflows in the 2015 wet season, following what had been observed in 2014, with only 74% of the LTA (long-term average), representing the eighth worst wet season in history. The dry period had inflows around average, with 109% of LTA, which totaled an annual amount of 89% of the LTA. In the South subsystem, the inflows were very favorable, 140% of LTA in the year. In the North subsystem, the inflow behavior was unfavorable, 73% of the LTA, especially during the rainy season (71% of the LTA). In the Northeast, the year was very critical, with 38% of the LTA, being classified as one of the driest in the history - 85 years, even worse than 2014, which had been described as the worst at that moment.

In 2015, once more, the hydrologic diversity of the BIPS's component subsystems was highlighted. A hydrological transition condition was shifted from critical to average in the Southeast / Mid-West subsystem; very humid in the South, reflecting the start the El Niño actuation; drought in the North; and the most critical in the Northeast, establishing in this subsystem, a new critical multi-year period, as shown in Table 1.

Table 1 – Energy Inflow by Subsystem

Subsistemas	Energia Natural Alfuente (ENA) - % da média histórica				
	Jan./Abr. período chuvoso 2014/2015	Maio/Nov. período seco 2015	Dez. período chuvoso 2015/2016	2015	Classificação no histórico 1931 – 2015 (ordem crescente)
SE / CO	72	110	99	89	21º
Sul	145	161	294	165	82º
Nordeste	36	44	27	38	1º
Norte	68	89	29	73	8º
SIN	72	113	103	92	28º

Table 2 summarizes the 2015 river basins inflow conditions, also showing the hydrologic diversity observed within the main ones in the Southeast / Midwest subsystem. While critical conditions were observed in the basins of the Rio Grande, Paranaíba, Tietê, Paraiba do Sul, Paraná and Doce (worse one in history), there were very favorable inflows in on the Paranapanema and Madeira rivers. In this table, the Jacuí, Iguaçu and Uruguay river basins, components of the South subsystem, showed a very uniform and favorable behavior in 2015.

Table 2 – Storage and Energy Inflow by Basin

Principais Bacias	Part. % no Armazenamento da Região	Armazenamento em 30/11/15 (% EAmax)	Energia Afluente 2015	
			%MLT	Classificação no Histórico 1931 – 2015 (ordem crescente)
Parnaíba	38% SE/CO	10,6	65%	1º
Grande	26% SE/CO	26,7	53%	2º
Tietê	4% SE/CO	77,9	97%	41º
Doce	-	-	34%	1º
Paraíba do Sul	4% SE/CO	12,7	62%	2º
Madeira	-	-	119%	72º
Paranapanema	6% SE/CO	92,0	154%	79º
Iguaçu	51% S	97,9	157%	79º
São Francisco	97% NE	4,5	38%	1º
Tocantins	96% N	16,1	65%	4º

As a result of these reduced inflows in most basins of the Southeast / Mid-West subsystems, especially during the wet season, and in the basins of the North and Northeast subsystems, reservoir storage levels in these three subsystems remained low, reaching the end of year, as is the case of the Northeast and North, lower values than the ones recorded in the previous year, according to Table 3.

Table 3 – Energy Stored by Subsystem

Subsistemas	Part. % no Armazenamento do SIN	Energia Armazenada (EAR) - % da EAR máxima	
		31/12/2014	31/12/2015
SE /CO	70,0	19,3	29,8
Sul	6,9	57,4	98,4
Nordeste	17,9	17,3	4,9
Norte	5,2	33,3	15,4

The operative measures and the management of water resources adopted in 2014, due to the water shortage observed in the main basins of the Southeast / Midwest and Northeast subsystems in that year, were kept face to the permanence of hydrological conditions and the unfavorable storage in these subsystems in 2015, requiring ONS to prepare the Monthly Operation Program (PMO) and its weekly review, the careful management of the available hydro resources. Among the operational measures implemented to this purpose, it can be highlighted the preservation of the headwater reservoirs storage of the main hydro basins, the full dispatch of power plants availability for energy security, and the use of power transmission capacity to carry out transfers from regions with higher energy

availability, North and South, to those in worse conditions, Northeast and Southeast / Midwest.

Besides, the following had great importance to ensure the electric energy supply in 2015: keeping the operating flexibility policy of some of the main hydraulic constraints of the BIPS, resulting from the articulations and joint work between ONS, the regulatory agencies ANA and ANEEL; IBAMA, MME, MMA, Basin Committees and sector Agents, in order to match the energy requirements with those associated with the multiple use of water, especially:

- Minimum navigation levels from the Tietê / Paraná Waterway to the downstream area of the Nova Avanhandava plant;
- Minimum Outflow of Três Marias, Sobradinho, Xingó, Jupiá, Porto Primavera, Caconde plants and of Santa Cecilia dam;
- Minimum Generation of hydro plants generating units during light load periods;
- Itaipu plant operation as a regulating reservoir, between the maximum level of 220.40 m and a minimum of 216.00 m;
- Minimum storage at Mascarenhas de Moraes hydro plant (75% of its storage volume) to capture water and crossing the reservoir by ferry; and
- Special rule for lowering the Jirau and Santo Antônio plants reservoirs, which ensured conditions not to aggravate the flooding upstream and downstream of the plants, minimizing the risk of plants inoperability.

The implementation of these operational measures associated with the of the BIPS's hydroelectric conditions over the year, as well as the expectation of achieving storage levels of around 30% in the Southeastern / Midwestern Regions, at the end of November 2015, enabled CMSE to deliberate for the shutdown of thermal power plants with Variable cost per Unit (CVU) above R$ 600 / MWh, dispatched for Energy Security, from August 08, 2015, with a reduction of about 2,000 average MW and consequently a monthly operation cost savings of thermal plants.

2.7.2 Electric Operation

Mid-Term Horizon

The electric operation planning process originates two products: the Mid-Term Electric Operation Plan (PEL) and the Guidelines for the Electric Operation with Quarterly Horizon (Quarterly).

The 2015 PEL presented the BIPS's electric power performance assessments for the period between January 2016 and April 2017. Studies show the evolution of the regional interconnections capacity, with the entry into operation of 22 new 500

kV circuits, totaling 6,300 km lines associated with Belo Monte plant, to the North / Northeast and Northeast / Southeast interconnections, and the 500 and 440 kV network of the Madeira River plants flow. The best anticipation reinforcement alternatives were evaluated to manage a possible delay of the entry into operation of Araraquara 2 - Taubaté transmission line. Besides, the connection of six additional generation units at Santo Antônio plant, the integration through temporary connection and the planned configuration of the plants of Teles Pires River, and the progress of supply systems to Manaus and Macapá were evaluated.

Other points are worth mentioning such as the integration of wind sources and the need for thermal generation due to transmission constraints and the supply to the BIPS electric areas, which resulted in a proposal with operational solutions in addition to the identification of a set of extremely important works that eliminate constraints regarding generation or load supply. Among these, it can be highlighted the recommendation to advance the Belo Monte's first DC Bipole to the end of 2017 second semester, currently scheduled to February 2018, in order to increase the generated energy flow capacity the Northern and Northeastern Regions.

The increasing share of wind generation in the Brazilian electric energy matrix, reflected by the deployment of about 800 MW parks in the Southern Region and 7,000 MW in the Northeastern Region, totaling about 15,000 MW to be installed in April 2017, requires robust structural solutions in the Main Grid to enable the flow of all this generation. Furthermore, wind generation forecasting associated with the scheduling process and dispatching should be improved. The variability and intrinsic unpredictability of wind power generation from winds bring major challenges for system operation.

The Electric Power Operation Guidelines Report detailed, for each four-month period, the operational measures required to meet the standards and criteria established in the Grid Procedures, in order to match the electric restrictions and the load supply with the energy policies, aiming at a lower operation cost and maximum operational security.

In the 2015 studies, the implementation of a cyclical alternative for the production flow of Teles Pires' first units supplying Manaus Area stood out, as well as the usage of operational measures to increase the North-South interconnection limits, face to the loss of large generation amounts in the Southern, Southeastern and Midwestern Regions.

Short-Term Horizon

Throughout 2015, ONS developed studies and implemented cyclical measures that allowed operating the electric power grid in accordance with the continuity reliability and supply quality criteria established in the Grid Procedures. Several guidelines were established, to enable receiving high amounts by the Southeastern Region from both Itaipu, Southern Region and Northern and Northeastern Regions, and also to explore the full installed capacity of Santo Antônio and Jirau plants, through

the usage of the DC Bipole that flows these Madeira river plants' power, associated with the operation of several Southeastern / Midwestern subsystem' hydro plants with small number of machines, keeping this subsystem's energy condition from getting any worse.

This year, the analysis of interventions process involved about 44,000 disconnections requests regarding the BIPS's operation network equipment. This activity aims at meeting the agents' maintenance needs, defining the necessary operational measures, meeting the standards and criteria established in the Grid Procedures, matching the electric constraints and meeting the load supply with energy policies, thus aiming at the lowest operation cost and maximum operational security.

In the monthly planning various assessments regarding the BIPS's electric performance were prepared, which suggested measures in the following areas:

- Southeastern Region voltage control - Operation with reduced number of generating units at São Simão plant.
- Tucuruí-Presidente Dutra trunk voltage control - Operation with reduced number of generating units at Tucuruí plant.

2.8 The BIPS's Operation

Operation's preparation activities

In 2015, aiming at improving the real time operation support resources, improvements were made to the structure and layout of the regulatory documents, which allowed to minimize the risk of failures and speed up consultations with over a thousand documents available for viewing on monitors in Control Rooms. Around 2,500 revisions regarding guidelines, procedures and operating instructions were carried out. The integration of new works to BIPS motivated the increase in regulatory documents, in particular the addition of 78 wind farms in the Northeastern Region and 26 in the Southern Region, which added 2,626 MW to the BIPS's installed capacity.

ONS's Operation Centers also issued 116 technical report as part of the access reports for the integration of new works to the BIPS.

Throughout the year, the Operation Centers handled more than 54,000 interventions in Operation Network, motivated by the operational measures associated with the ongoing water crisis, by conducting the tests for the full integration of the Madeira complex DC link and by the capacity confirmation tests of blackstart plants, being all these operations properly performed.

Two new computer systems were implemented at ONS's Operation Centers, with positive effects in the interventions and energy analysis approval processes:

- Operation Centers Intervention Management System (SICOP), which supports the consolidation of planning and preparation of the Daily Operation Program (PDO);
- Consolidation System: of the Energy Programming, Commercial Operation, Reservoirs Operation and Flood Control (SIPOCH).

Real Time Operation Qualification Activities

The success of real-time operation activities is highly dependent on the expertise and responsiveness of their technical teams. In 2015, ONS developed and deployed the Real Time Teams Structured Training Program, designed specifically for the continued development of Operation Centers' real-time teams.

Three courses were carried out within this program, totaling 512 hours of training for about 200 employees at five ONS's Operation Centers: Brasilia, Florianópolis, Recife and Rio de Janeiro, without the need for the displacement of the teams, according to the methodology adopted.

For training and qualification of ONS's and of the several involved Agents' teams, 26 exercises with simulated operation (drills), with regional range (RJ / ES Area, Eastern Area of the Northeastern Region, Manaus / Macapá Area, Campos Novos

Area) and systemic (Southern / Eastern and Northern / Northeastern restoration), were carried out with the participation of 343 employees.

Post-Operation Activities

Post-operation activities can be gathered into three large groups: analysis of the performed operation, settlement and statistical processing of data, and dissemination of technical results, as detailed in Table 4.

Table 4 – Activities inserted in Post-Operation

Analysis of the performed operation	Voltage Control, Frequency, loading e limits
	Control of interventions
	Control of reservoirs
	Oral communication in operation
	Compliance with the Production Daily Program
Settlement and statistical processing of data	Data on availability and operational restrictions of transmission assets
	Generation data and availability
	Data on the transmission system usage amounts
	Hydrology Data
	Consumption Data
	Control Points Interruption Data
Dissemination of technical results	Dissemination of the performed operation's daily, weekly and monthly results
	Dissemination of monthly reports on wind power generation, international exchanges, energy demand and load by state, generation by state
	System and Operation Performance Indicators
	Data availability for CCEE aimed at the short-term market accounting
	Data provision for accounting regarding the usage of the transmission system (MUST) and variable value mechanism provided in the Transmission System Services Contracts (CPST)
	Data availability for ANEEL e MME

In the activities of performed operation analysis, 500 reports were issued during the year in compliance with the Grid Procedures, as detailed in Table 5.

Table 5 – Reports issued in 2015

Report	Amount
Occurrences Report	359
Operation Analysis Report	10
Disturbance Analysis Report	35
Failure Analysis Report	2
Blackstart Tests Report	79
TOTAL	**485**

As for the settlement and statistical processing of data and events, the figures recorded in 2015 increased sharply regarding system expansion and new regulatory determinations.

As for the dissemination of results, new products are now available on ONS's website, increasing the information released to the society.

It is also worth mentioning the reports issued following ANEEL's specific demands, such as Occurrences Releases in Generation Installations (COIG) with 513 documents issued in the year, Transmission Installation technical requirements, with 1,240 documents issued for testing , temporary operation and permanent operation (REN No. 454/2011), Statements of Grid Procedures Compliance for generating units entry into operation, with 564 documents issued for testing, temporary and permanent operation (REN No. 583/2013), and monitoring and preparation of blackstart tests reports in plants, with 79 documents issued in 2015 (REN No. 697/2015).

Another highlight of 2015 was the implementation, planned and coordinated by ONS's Centers, with the involvement of the Operation Agents, of three new Normative Resolutions from ANEEL published this year: REN No. 666/2015, which updated guidelines for hiring, settlements and accounting of the amounts of the Transmission System's Usage; REN 669/2015, which disciplined the programming and performance of transmission agents' minimum maintenance plan; and REN 697/2015, which updated guidelines for hiring, monitoring and dissemination of information on ancillary services. These new regulations led to reviewing the Grid procedures for ONS and Agents, reviewing of the Grid Procedures, reviewing of computer systems and holding workshops with the agents.

Operation and Maintenance Activities of Supervision and Control Systems

In 2015, new features were implemented in the development of the Energy Management Network's (REGER) Phase 2, already consolidated as ONS's Operation Centers' Supervision and Control System since the previous year.

Several applications developed to support real time Operation and also the Post-operation activities, and other activities intended to REGER's own performance follow-up and their connections with the agents were added, such as:

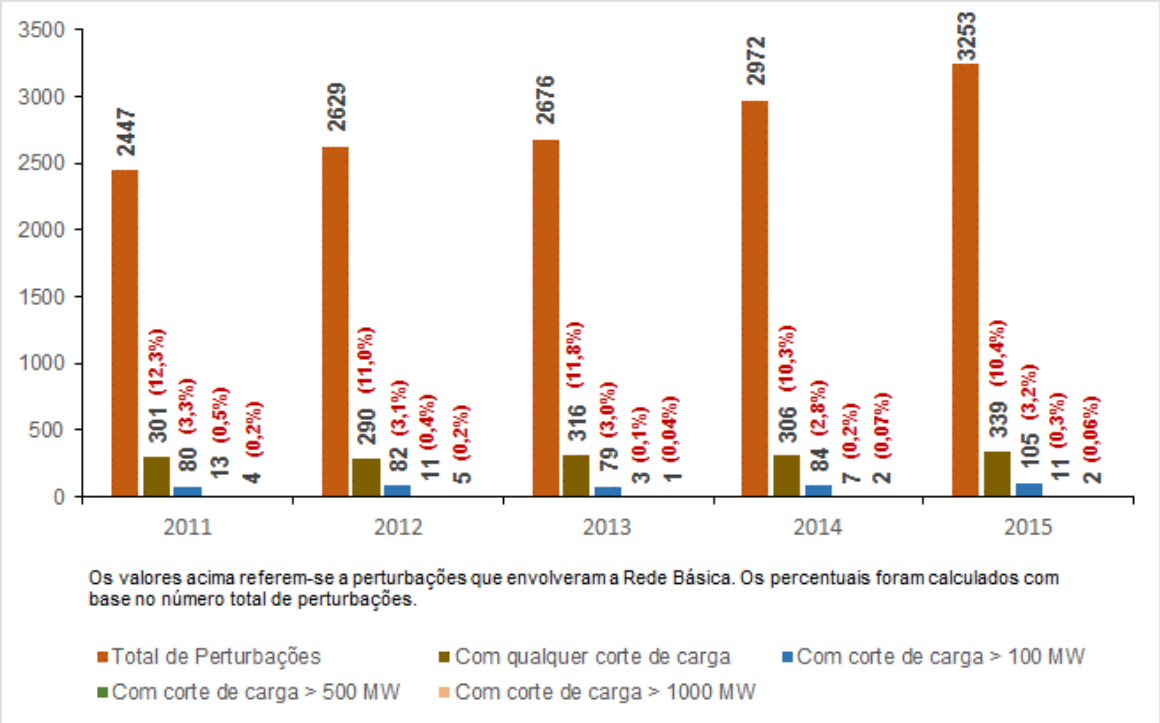
- Screens of Electrical Areas, which allow displaying disturbances occurred illustratively with dynamic data, as they are collected, making the understanding by the agents and the entities involved in the determination of occurrences easier;
- Analysis of Violations, which allows daily monitoring of all network equipment;
- Security Area Monitoring, which allows graphically viewing the security area defined for the electric power system, considering the topology at the time of operation, reducing the risk of disconnections.

Throughout 2015, ONS reported in its Regional Operation Centers, the increase on the number of data and voice connections with the agents' systems, reaching a total of 367 connections, through which around 84,000 analog measurements points and 155,000 digital measurements points are currently being monitored, corresponding to approximately 2,400 BIPS installations supervised by ONS.

2.9 BIPS's Performance Indicators in 2015

Of a total of 3,253 disturbances registered in 2015, only two (0.06%) showed load cuts of more than 1,000 MW. In Figure 4, it can be observed that there were eleven events (0.3%) with a 500 MW load cut, and a total of 105 (3.2%) with a 100 MW load cut.

Figure 4 – Evolution regarding the amount of disturbances and their impact on the BIPS



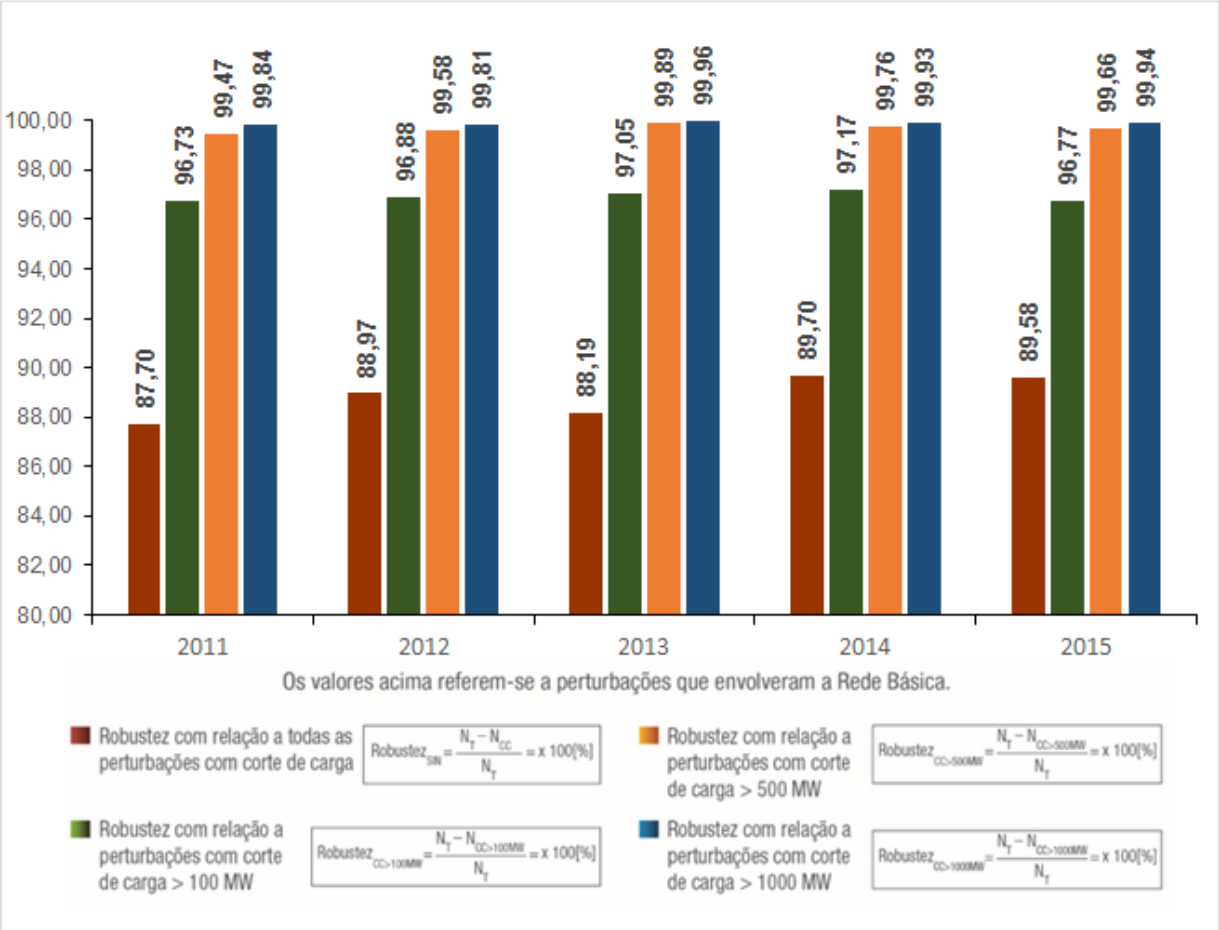
BIPS's Robustness Indicator

A fairly representative performance indicator of the electric supply security reached in 2015 in the BIPS, is the one regarding robustness, because it relates to the BIPS's disturbances with the loads supply. It is expressed by the ratio between the number of disturbances with a certain level of load shedding and the total number of disturbances.

The values calculated for the robustness index in 2015 are as follows, as shown in Figure 5:

- For any load shedding - the robustness was 89.58%.
- For load shedding above 100 MW - the robustness was 96.77%.
- For load shedding above 500 MW - the robustness was 99.66%.
- For load shedding above 1,000 MW - the robustness was 99.94%.

Figure 5 – BIPS's Robustness Index (2011 – 2015)



2.10 Definition of Improvements in the Areas of Fluent and Coordinated Restoration of the BIPS

The fluent restoration is a procedure that minimizes the system's time of interruption quickly, simultaneously and independently. It can be performed by substations' operators or by agents' Operation Centers, with minimal communication possible, in accordance with procedures previously defined in studies.

ONS, along with the agents, set and kept fluent and coordinated restoration corridors updated for the restoration of the country's main load centers. Throughout 2015, it was evaluated the fluent restoration process regarding several areas of the BIPS, especially where the entry into operation of new equipment caused relevant changes in the grid topology, which required a reassessment of the restoration process.

2.11 Evolution of Processes and Methodological Improvements

In the area of inflow forecast, another stage of the Inflow Forecast Management System (SGPV) project was completed, which automates the incorporation of precipitation information in this process, including the removal of rain forecasts bias. This improvement adds more robustness and agility to the preparation process of the Monthly Operation Program. Still regarding hydrological forecasting, it was completed the calibration project of the SMAP model for the basins of the rivers Uruguai, São Francisco and Tocantins, which will enable the expansion concerning the use of this rain volume X river flow model in prospective studies to assess the BIPS's hydroelectric conditions.

With the incorporation of the North and Northeast subsystems, the monitoring of severe weather conditions in the BIPS's strategic installations was expanded, which is conducted in partnership with the Paraná Meteorological System (SIMEPAR). It is now possible, with this incorporation, to identify risk situations regarding weather aspects and incidence of lightning in strategic installations of the four BIPS's subsystems, leading to improvements in electric security.

A new feature was implemented in the Hydroexpert hydraulic simulator, which enables simulations with storage below the minimum operating levels, which proved to be very useful, especially for plants which were more severely affected by the water crisis this year. It was also incorporated to this simulator a lowering routine and a recovery of the dynamic reservoirs, with direct application in the lowering of the Salto Santiago plant reservoir, to improve the flood control operation in an integrated manner on Iguaçu River basin.

Within the Permanent Committee for Electric Sector Computational Methodologies and Programs Analysis (CPAMP / MME), the analyzes were completed for the entry into operation, in January 2016, of the share of equivalent subsystems used in mid-term studies with the NEWAVE model in a total of nine equivalent energy reservoirs.

In order to address the differences found in energy studies that compared the results of computational models with the operation performed, the Working Group for Evaluation of the Registration Data Used for Capability (GTDP), was created under ONS's coordination, with the participation of CCEE, EPE and all 38 generation agents that own concessions of the 142 existing hydro plants and simulated in studies on Operation Planning. In 2015, the GTDP defined the methodologies to be adopted as standard by agents to calculate the water discharge, as well as for the calculation of representative hydraulic load results and losses.

The Action Plan project for the implementation of the Load Forecasting System for Energy Studies (SPCEE) was completed aiming at improving the daily load curve forecasts, one of the main inputs for the BIPS's daily schedule of operation.

The SPCEE enabled the creation of the Simulation Data Base (BDS) for use with load consisted and temperatures data from ONS's internal systems and external systems, as CEPETEC and RedeMet (Airspace Control Department Meteorological Network). This system is essential for the development of forecasting models and decision-making and for the validation of load forecasts received from agents. Its implementation is considered a "hallmark" as it provides the speeding up of the process of data collecting and consistency, besides improving the analysis of forecasts aiming at an increase in accuracy, which resulted in a significant load forecasts improvement for the Daily Scheduling.

As for the use of the DC systems simulator, actions to support corrective works and logics control improvement and protection of bipole 2, manufactured by GE / ALSTOM, were carried out, throughout the year, highlighting :

- Provision of infrastructure for the integration tests of the second bipole (GE / ALSTOM), from the Madeira river transmission system, to the Master Control (ABB).
- Provision of infrastructure for testing about thirty versions of the control and protection software, included in the adequacy of the initial project of ALSTOM's HVDC controllers to the joint operation with those manufactured by ABB.
- Provision of infrastructure for ONS's proposals evaluation tests including changes regarding ALSTOM's HVDC controllers logic, in order to meet the dynamic performance requirements set out in the Technical Annex of the Bidding Public Notice.

2.12 Transmission Administration

2.12.1 Expansions and Reinforcements

In 2015, the BIPS's Transmission Installation's 2016-2018 Expansions and Reinforcements Plan (PAR) was issued incorporating the works in the Main Grid, and in Transmission Substations where Distributors are connected as well as the works of Other Transmission Installations (DIT). The unification of documents aimed at facilitating the works of the consolidation process carried out by MME, as well as the authorization ones made by ANEEL.

As in previous years, the studies that originate the PAR are carried out by Special Groups, with the participation of all agents and of the Energy Research Company (EPE). Later, the PAR is sent to MME to be made compatible with the Transmission Expansion Program (PET) prepared by EPE. After it is made compatible, the proposed expansions and reinforcements in the Main Grid and in the DIT are consolidated in a specific document submitted to ANEEL so that the transmission installation's concession granting processes or permit are started.

For the implementation of 381 projects proposed in the PAR for the 2016-2018 period, an investment of R$ 27 billion is estimated, based on the costs of the works provided by ANEEL. The expansions and reinforcements, in this period, correspond to additions of transmission lines in the range of 18,453 km and 57,612 MVA of transformation capacity, shown in Table 6 below. These values, when compared to 2014, represent an increase of about 15.9% in transmission lines additions (148 new lines) and 19% in the rated power installed in transformers (231 new equipment) of the Main Grid and Transmission Substations where Distributors are connected, regarding the existing and already granted network.

Table 6 – Additions in the 2016-2018 PAR's Transmission Lines and Transformers

Transmission Lines		Transformers	
Voltage (kV)	Total (km)	Voltage kV (*)	Total (MVA)
800	0	800/765	0
500/525	13,844	500/525	31,696
440	144	440	4,683
345	495	345	5,716
230	3,970	230	15,367
Total	18,453	Total	57,612

(*) Referrers to the voltage on the transformer's high voltage side

Table 7 summarizes the proposed works this period of the PAR.

Table 7 – Summary of the proposed works in the 2016-2018 PAR

Item	SE/MW	South/MS	NNE
Construction of new transmission lines (km)	8,283	3,336	6,834
Addition of new transmission lines	53	53	42
Addition of new transformers (MVA)	26,338	11,832	19,292
Addition of DITs' lines (no.)	4	6	1

Addition of DITs' transformers (no.)	13	1	3

In this period, ONS introduced a major improvement in the methodology applied to the PAR, in order to increase the level of reliability of some installations that, due to their systemic behavior, play an important role in BIPS. This installations include the large transmission trunks, which interconnect the regions and enable the exchange of large blocks of energy, and a better use of the country's energy resources.

2.12.2 Expansions and Reinforcements Plan – Preliminary Statements

Aiming specifically at speeding up the entire bidding process and / or authorization of works from the publication of the PAR, ONS proposed the elaboration of a new product named Preliminary Indications of the Expansions and Reinforcements Plan (IPAR), which contains preliminary and basic information enabling the Grantor to initiate the concession granting processes.

The IPAR does not have a regular periodicity of issue and may be issued at any time with the necessary information so that the MME makes the consolidation of the works and starts the bidding and / or authorization process.

It can be noted that all IPAR issued in a given year will be included in the PAR regularly issued in September, with proposals for extensions and reinforcements considering a three-year horizon.

2.12.3 Energy Auctions by Transmission Margin

In 2015, ONS contributed significantly to the implementation of energy auctions based on transmission system margin. To this end, ONS conducted analyzes and system studies and proposed, together with EPE, methodology and criteria for defining the generation amounts by electric area and by busbar, which could be sold at auctions, with this energy's flow assurance at the time of delivery.

The adoption of this auction category coincided with the need to mitigate possible delays resulting from mismatch of generation and transmission works schedules, enabling generation entrepreneurs to more certainty in the implementation of their generating units.

2.12.4 Access to the Transmission System

It is up to ONS to prepare technical reports to access the BIP's Main Grid and Additional Transmission Installations (DIT). The process of access to the transmission system is defined in Module 3 of the Grid Procedures, in which all

steps, instructions, information and studies to be conducted to ensure viability are detailed.

The graph below is a summary of the access activities in 2015, among which, it can be highlighted, the issue of 87 assessments and 92 reviews.

Figure 6 – Access Activities in 2015

Still in 2015, 325 equivalent access documents were developed, aiming at technical qualification purposes regarding photovoltaic solar source projects to the 1st Reserve Energy Auction of 2015.

74 Access Information was also issued, designed to provide ANEEL with technical information regarding the impact on the transmission system due to generation units' connection, with the purpose of obtaining new granting or changes in existing ones.

2.12.5 Main Design Compliance Analysis

The characteristics and technical requirements that must be met by the winning bidders of transmission auctions lots are set in the Technical Annexes of the auction notices, which include the participation of ONS in the preparation. This important set of requirements is aimed at the homogeneity of different transmission installations, ensuring their proper integration to the Main Grid, as well as the desired level of the BIPS's performance.

When the transmission companies winning the lots of auctions elaborate the project's main design, it is ONS's attribution to check the compliance with the requirements set

in the Technical Annexes and the Grid Procedures. In 2015, the technical requirements for 49 lots auctioned were defined and 230 compliance reviews of new transmission installations' main designs were conducted. Compliance analysis of the DC transmission system (bipole 1) main design associated with Belo Monte plant were also carried out and the technical requirements for the auction of bipole 2 were defined.

After approval of the main design by ANEEL and the development of the project, the transmission company presents ONS with the features with which the new installations have been built. It is ONS's attribution to prepare the technical report, which ensures that these new installations have been built in accordance with the auction's Technical Annex, with the installation's main design of the and also with the Grid Procedures. This technical report is very important for the integration of these installations to the BIPS. Throughout 2015, 348 compliance assessments of the Main Grid's new transmission projects were issued as effectively deployed.

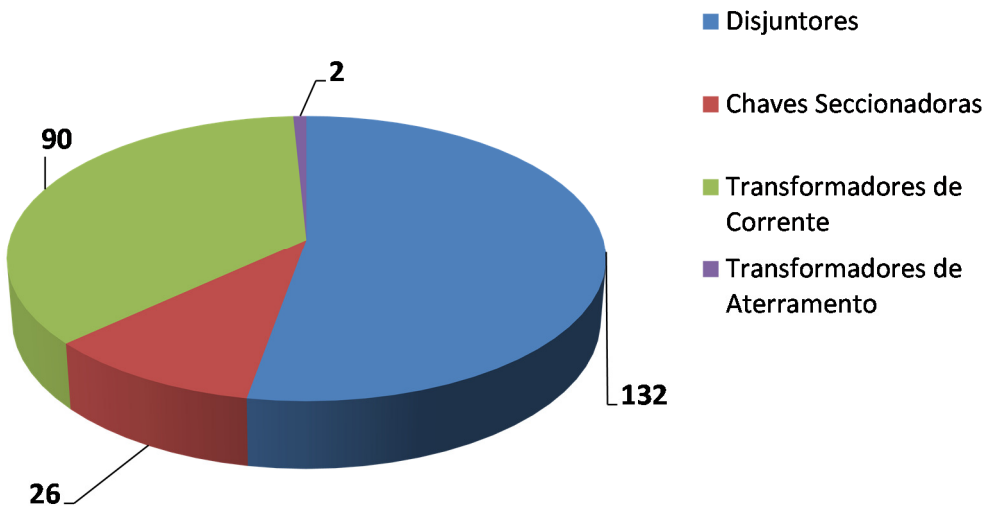
2.12.6 Main Grid Equipment Overstress Analysis

In accordance with the definitions in the Grid Procedures, it is ONS's attribution to perform annual equipment overstress analysis caused by short circuit, load current, time constant and other types of request. Such analysis are intended to ensure operation security, as they can identify in a three years advance scenario, possible cases of network overstress, which are sent to MME and ANEEL for analyses.

For the coordination and implementation of this process, ONS created the Working Group for High Voltage Equipment Overstress Analysis (GT-AS), composed by Transmission, Distribution and Generation Agents. The analysis conducted annually by the GT-AS are part of the PAR processes and cover the Main Grid equipment, DIT and relevant generation and distribution installations.

In this period, 250 equipment were identified as overstressed. Figure 7 shows a summary of the overstress by type of equipment. The highest indication of overstress was found in circuit breakers, followed by current transformers and disconnection switchers. There was also an evidence of two grounding transformers overstress.

Figure 7 – Overstress Evidence by Type of Equipment



2.12.7 Electric Power Quality

The management process of the Main Grid's performance indicators established in the Grid Procedures' Sub-module 2.8 is relevant for the BIPS's electric power quality management.

Among the main indicators monitored and related to Electric Power Quality (QEE), the unbalance, voltage fluctuation and voltage harmonic distortion can be highlight.

In 2015, a database was created to allow the management of information on measurement campaigns and also to monitor the installation of harmonic filters in wind and solar plants that are being integrated into the electric power system.

It was also revised the document "Instructions for Conducting Studies and Electric Power Quality Measurements (QEE) related to the New Accesses to the Main Grid" and it was also elaborated the guidelines for the implementation of harmonic performance studies and measurement campaigns directed to wind and solar parks and free consumers.

2.12.8 Transmission Contracts

In 2015, five new Transmission Service Contracts (CPST), 115 new Transmission System Usage Contracts (CUST), 182 new Transmission System Connection Contracts (CCT) and Installations' Sharing Contracts (CCI) were signed.

Still in 2015, ONS reached the significant milestone of 906 transmission contracts, being 223 CPST and 683 CUST. Among the 115 new contracts of use signed in 2015, 102 were signed by wind power plants, showing how the transmission management has absorbed the wind energy share increase in the Brazilian energy matrix.

Also in that year, the Transmission System Usage Contracts, as well as the processes associated with the settlement of the usage amounts contracted were adequate to the ANEEL's Resolution No. 666, published on June 23, 2015, which improved the regulation associated with contracting the use of the transmission system on a permanent, flexible, temporary and reserve capacity basis, and the forms for establishing the related charges.

2.12.9 Monthly Calculation of Services and Charges

The Monthly Calculation of Services and Transmission Charges (AMSE) involves the calculation of the revenue amounts to be paid to Transmission service providers (transmission utilities and ONS) and the Transmission System Usage and sectorial to be charged from each user of the Main Grid and Transmission Substations where Distributors are connected.

AMSE ended the year with 163 transmission utilities and 573 users. The total transmission sector revenue reached about 12.0 billion reais in the year.

2.12.10 Metering System for Invoicing

In 2015, technical opinions on nearly 1,550 Measurement System projects for Billing (SMF) and Commissioning Reports from the entire free energy market in the Brazilian electric power sector were analyzed and issued.

SMF technical analysis were also carried out to issue about 1,800 documents related to the integration of new installations and new generation projects to the BIPS.

3 MANAGEMENT RESULTS IN 2015

3.1 ONS's Institutional Relationship

Due to the continuation of unfavorable hydrological conditions that affected the electric power supply, ONS, in 2015, reinforced its institutional relationship with the society aiming at keeping it permanently informed on the most relevant issues related to the operation of the BIPS.

In the Electric Power Sector Monitoring Committee, the articulation with the Ministry of Mines and Energy and ANEEL facilitated solutions to ensure the security of electric power supply at the lowest cost. .

In 2015, ONS took part in several events, which reinforced the relationship with specific segments of the external public:

- Secure and Economic Operation of the Brazilian Interconnected Power System: ONS's Challenge. Presentation to the Minister of Mines and Energy, in Brasilia, on January 8th.
- Secure and Economic Operation of the Brazilian Interconnected Power System: ONS's Challenge. Presentation to the School of Public Policies and Government Management, in Rio de Janeiro on January 14th.
- Assessment on the BIPS's Electrical Energy Supply Conditions - 2015. Lecture at the 2015 Supply event, organized by Canal Energia, in Rio de Janeiro on March19th.
- Paraiba do Sul River Basin Storage and Hydrologic Conditions: 2014-2015. Presentation at Public Hearing with the Federal Public Ministry - RJ, in Rio de Janeiro on March11th.
- Water Scarcity: actions, lessons and perspectives. Lecture at the 91st meeting of the National Industry Confederation's COEMA, in Brasilia, on March 25th.
- Assessment on the BIPS's Electrical Energy Supply Conditions - 2015. Presentation at the Permanent Joint Committee on Climate Changes of the Federal Senate, in Brasilia, on March 26th.
- ONS's Short and Long Term Vision. Lecture at the seminar "The New Configuration of the Brazilian Electric Matrix", organized by FIRJAN, in Rio de Janeiro on March 27th.
- Supply Conditions and Challenges for the BIPS's operation. Lecture at the Event "Generation Strategic Reflection", organized by ENEL in Niteroi, on April 7th.

- ONS's Challenges for the BIPS's Operation. Presentation at the workshop "CEEE and the Electric Power Sector Strategic Perception", in Porto Alegre, on April 8th.
- Supply Conditions and Challenges for the BIPS's operation. Lecture in the third edition of the event "Energy in Focus", organized by AES Tietê in São Paulo, on April 16th.
- Adequacy of the BIPS's operation face to the Distributed Generation. Lecture at Forum COGEN / Channel Energy on Cogeneration and Distributed Generation.
- Brazilian Thermoelectric Sector Structured Planning – ONS's vision. Presentation at the 2nd Thermoelectric Generation Forum - Scenarios 2015, in Rio de Janeiro, on May 18th.
- Supply Conditions and Challenges for the BIPS's operation. Presentation to ABRADEE's Council, in Brasilia, on May 20th.
- Brazilian Electric Power System's Operation and Security. Lecture at the 4th Course on the Electric Power Sector for the Judiciary, organized by CCEE and MNE / AMB, in Brasilia, on May22th.
- Supply Conditions and Challenges for the BIPS's operation. Presentation at the 12th National Meeting of the Electric Power Sector's Agents, organized by Canal Energia, in Rio de Janeiro, on May28th.
- ONS and the BIPS's operation. Presentation at ANEEL's technical visit and the Federal Public Ministry, in Brasilia, on June 11th.
- Assessment on the BIPS's Electrical Energy Supply Conditions. Presentation to Banco Santander, in Rio de Janeiro, on July 23th.
- BIPS Supply Guarantee: Short (2015/16) and Medium (2017/19) Term Visions. Lecture at Getúlio Vargas Foundation, in Rio de Janeiro, on August 17th.
- Integration of Wind and Solar Generation in the Brazilian Power System. Lecture at the French-Brazilian Seminar on Energy, organized by the Embassy of France, in Rio de Janeiro, on August 31st.
- The National Generation and Transmission Scenario. Lecture at the 12th Brazil Energy and Power, in Rio de Janeiro, on September 21st.
- São Francisco River Basin Storage and Hydrologic Conditions. Presentation at the Permanent Joint Committee on Climate Change of the Federal Senate's Public Hearing, in Brasilia, on October 15th.
- Short and Mid Term Scenarios and Challenges for the operation of the BIPS. Lecture at the opening session of the XXIII National Seminar on

Electric Power Production and Transmission, in Foz do Iguaçu, on October 19th.

- Short and Mid Term Scenarios and Challenges for the operation of the BIPS. Lecture at the National Forum of State Secretaries of Mines and Energy, in Goiânia, on December 1st.
- Short and Mid Term Scenarios and Challenges for the operation of the BIPS. Lecture at a CTEEP internal event, in São Paulo, on December 18th.

Due to the continuing shortage of water resources in 2015, there was an intense relationship with the media, both through interviews with the General Director, as well as with the explanations provided by the communications team. ONS was quoted in a total of 1,549 articles published in print in the year, with a percentage of favorable exposure of 91%.

ONS's website remained as an important tool for the dissemination of technical activities and relationship with the Internet users.

The Institutional Visitation Program enabled students, technicians of the sector and other national and foreign visitors to better acquainted with ONS's activities regarding the centralized operation of the BIPS. At the System National Operation Center, in Brasilia, 13 visits were conducted, with 209 visitors. At the Southeastern Regional Operation Center, in Rio de Janeiro, there were 21 technical visits, totaling 206 visitors. In Florianopolis, there were 19 technical visits in the year, with about 163 visitors. In Recife, there were about 120 participants in eleven visits, highlighting the presence of the Mines and Energy Minister in the Control Room of COSR-NE, on July 3rd.

The development of joint activities with CCEE and EPE was continued, as what have been established in the respective Operating Agreements.

3.2 Relationship with Agents and Integration of New Installations

In 2015, the number of Agents Associated with ONS reached 363. This number shows the complexity of the Operator's processes and its increasing responsibilities as manager of the network of institutions and installations involved in the BIPS's operation.

1,508 Terms of Approval, were issued in 2015, for the entry into operation of transmission installations, and 574 Statements of Compliance with the Grid Procedures Requirements for generation installations.

Regarding the total Terms of Approval issued, there was an increase of about 55% on the figures recorded in 2014. This high percentage is justified for several reasons, including:

- The publication of ANEEL's REN 454/2011, which expanded ONS's scope of action;
- It was also noticed a significant increase in the number of transmission agents in the sector and therefore the amount of works' integration processes under monitoring;
- In recent years, the BIPS's expansion had as main feature the reinforcement of the transmission system, especially of inter-regional interconnections, the addition of new lines to regional systems and the entry into operation of large transmission trunks, including DC, for the exploitation of the country's northern region potential.

In 2015, the construction of the New Installations Integration System (SINI) was completed, supporting the monitoring of planned activities in the latest version of the Grid Procedures' Module 24. This new version deals, in addition to the generation and transmission installations, with other types of installations, such as reservoirs, importers / exporters, distributors and free consumers. During the year, working groups were formed, which defined, planned and configured processes regarding generation, transmission, distributors and free consumers in the new tool.

This year, the Data Register for External Relations (CDRE) became the gateway to many of ONS's systems. The aim is that access to all systems are performed via CDRE in the next year. Groups were also created to send press releases and invitations to technical processes meetings. Thus, in 2015 there was a considerable increase in requests regarding registration and updating of external users data. CDRE was reference was to elaborate lists to send announcements and convocations, having been used for the convening of the General Assembly and all other communications made by the ONS to the general public.

3.3 ONS's International Strategic Relationship

ONS continued, in 2015, its participation in GO 15 - Sustainable and Reliable Power Grids, for considering it an important forum and unique for the treatment of subjects relevant for the operation of the Brazilian electric power system. ONS participated in the studies developed considering its priority issues, and has coordinated directly, since 2014, some of these works:

- Evaluation of the impact and proposition of solutions to ensure electric power systems' secure operation due to the significant penetration of new renewable energy sources, wind and solar, centralized and decentralized;
- Application of Phasor Measurement Units (PMU), especially in real time;
- Security and reliability, focusing on dynamic system assessment, preventive measures in the operation planning phase;

- Electric power systems' ability to face natural disasters;

These works will have their final results presented in 2016, although some relevant intermediate results have already been incorporated into ONS's practices.

Considering the world's supply and demand evolution concerning electric power, ONS also monitors issues that will have important repercussions to the BIPS's operation, such as:

- Improvement of energy management systems used in real time;
- New IT solutions for electric power systems operation;
- Development and penetration of new renewable sources;
- New roles and relationship between Distribution and System Operators.

3.4 2016-2020 Strategic Planning

In the preparation of its strategic plan, ONS adopted in 2015 a methodology that, in its essence, was already being followed in previous years.

From internal and external subsidies, the external constraints and the internal issues that shape the vision and strategic objectives of the organization were identified.

Internal subsidies were obtained from interviews with ONS's directors, from an evaluation of the results from previous strategic planning cycles and from a of Technological Development and Knowledge Management Committee report, which identified strategic actions and challenges focused on innovation and technological development, also considering ONS's participation in international collegiate bodies.

External subsidies came from a personal interview with the Minister of Mines and Energy and from lectures held at ONS by ANEEL's directors, by EPE's General Director, by UFRJ's Electric Power Sector Study Group Coordinator, by the representative of the Electric Power Sector's Forum of Associations, and by the president of the Board of Curators of *Fundação Nacional da Qualidade* and the former president of ONS's Advisory Board.

From these inputs, a survey was held on the external environment main factors under various approaches - the BIPS; the sector model and the regulation; society and governance; innovation - and how they rebut the organization's internal issues: human resources, structure and processes, agent's network management and information technology.

This analysis allowed to ensure ONS's continuing mission and to adjust the statement of its vision for 2020: "Ensuring electric power supply in the BIPS at the lowest cost possible in an environment of uncertainty and increasing complexity."

The following also served as basis for the formulation of the strategic objectives for the 2016-2020 Strategic Plan:

1. To act preventively along with the expansion planning, the regulator and the Granting Authority, aiming at increasing security and reducing costs of operation.
2. Work along with the Governance in order to improve ONS's corporate performance.
3. Ensure the BIPS's Electric power security face to the changes in the electric matrix structure, the consumption profile and the significant introduction of innovations.
4. Improve the actuation as manager of the Agents' network and the respective installations: Regarding the relationship with the Agents and the Management of the Grid Procedures.
5. Improve the management ability to perform its attributions guided by the Organizational Values.
6. Improve institutional communication with stakeholders.

Then, for each of the objectives challenges and 43 multi-annual strategic actions were identified, in which ONS will concentrate its efforts in the following years.

3.5 2015-2018 Action Plan

ONS prepares, annually, its Action Plan in order to ensure the fulfillment of its attributions in the coordination and control of the BIPS's operation, generation and transmission of electric power, both from a technical and corporate point of view, under ANEEL's supervision and regulation.

The Action Plan is structured considering the following aspects:

- The strategic objectives and their respective challenges and priority actions;
- The expenses regarding programs and their projects to be developed in the period, continuing the improvement and constant updating of the Operator concerning technology, corporate processes and technical procedures;
- Guidelines for elaboration of the work programs of each of the Operator's areas.

To achieve the strategic objectives, the 2015-2018 Action Plan includes a 30 project portfolio. The following results achieved in the projects may be considered as highlights of 2015:

- Attainment of REGER Project, electric power management system for installation at ONS's System Operation Centers.
- Corporate Education Program's Evolution.

- Application of Short-term outflow forecasting models.
- Development of the Load Forecast System for energy studies.
- Plan for Improving the BIPS's Security.
- Restructuring of ONS's Corporate Telecommunication Infrastructure
- Evolution of Infrastructure and Backup Procedures, Restore and Disaster Recovery.

3.6 Management of Risks and of Grid Procedures

Activities related to the management of processes, risks and Grid Procedures have as main objectives the improvement of ONS's processes and their compliance with the current regulation. These activities are developed in partnership with other areas of the organization, seeking to meet, in a coordinated manner, different kinds of demands to the organization.

Em 2015, a área de gestão de riscos, em parceria com as áreas técnicas e jurídica, participou de seis processos de Fiscalizações da ANEEL, na elaboração de respostas a quatro Termos de Notificação (TN) e a seis Autos de Infração (AI). Nesse contexto, foi implantada internamente uma nova sistemática para acompanhamento dos compromissos assumidos junto à ANEEL, nas respostas aos TN e AI recebidos. Além disso, deu-se continuidade ao processo de auditoria externa dos dados de entrada do PMO e suas revisões e dos dados de geração apurados pelo CNOS, obrigatória para o ONS após a publicação da Resolução Normativa ANEEL nº455 de 2011.

In 2015, the risk management area, in partnership with the technical and legal areas, participated in six of ANEEL's Inspections processes, in the preparation of responses to four Terms of Notification (TN) and six Infraction Notices (AI). In this scenario, it a new system for monitoring the commitments made by ANEEL was internally implemented, in response to the TN and AI received. In addition, work continued on the external audit process of the PMO input data and revisions and generation of data collected by CNOS, mandatory for ONS after the publication of ANEEL's Normative Resolution no. 455/2011.

Regarding the management of the Grid Procedures, it was started, in 2015, the process of ANEEL's Public Hearing to obtain subsidies for the improvement of sub-modules. Due to the high amount of documents involved, the Agency opted for dividing the Audience into four phases. In each, ONS sent its contributions to alter the documents made available by ANEEL, demanding a strong participation of the organization's technical areas during preparation.

With regard to Process Management, modeling initiatives were carried out and the analysis of processes focusing on the development or acquisition of new information systems. In these initiatives, the area responsible for the process, the

IT area and the areas that interface with the processes addressed were involved, seeking to increase the synergy among the areas of the organization. Throughout the year, actions were made in the following cases:

- Elaboration of the Access Opinion Document;
- Wind Forecast for Daily Scheduling, Real Time, Electric Studies and Energy Studies;
- Maintenance Monitoring;
- Economic and Financial.

3.7 Personnel Management

ONS's continuous recognition over the past few years, due to its good management practices, encourages new corporate actions that contribute to the improvement of the organization, so that the teams are increasingly prepared for the challenges of fulfilling ONS's institutional mission.

The actions listed below represent the implementation, in 2015, of the strategies defined by the Board of Directors for funding, development and keep the Operator's personnel:

ONS's Corporate Education

ONS's Corporate Education project was implemented in 2015, symbolizing a milestone in the evolution of the organization, for the sustainable development of its permanent personnel and the valorization of knowledge as critical success factors for the organizational development.

ONS's new model of Corporate Education aims to effect the transition from the existing Training & Development model, to an education model primarily based on corporate solutions aligned with the company's strategies, skills, values and prioritized knowledge. Its logical structure is segmented into three learning approaches: Institutional, Technical Expertise and Leadership.

The implementation of this new model brings to the organization more consistency in education investments, from the alignment of the priority actions in the strategic planning and the integration of different corporate programs such as Performance Management and PDI, Knowledge Management Practices, Management Development.

The main products developed in 2015 were:

- The summary of the Leveling Course on Electric Energy, directed at professionals majored in Electrical Engineering with emphasis on Power Systems
- The formation of the new Leadership Track, which will guide the development of the current and the new generation of managers. The Leadership Development Program was implemented, a training action integrating this track, with emphasis on the training of managers at the beginning of their managerial career, so that they can deal with the Operator's current and future managing challenges.

KNOWLEDGE MANAGEMENT

In order to speed up the process of qualification of new experts and potential managers, the third edition of ONS's Mentorship Program was held in 2015. 13 pairs composed of Mentors and Mentees from different areas and experiences participated, which provided the dissemination of relevant knowledge related to technical careers and management.

"CONSTRUIR PROGRAM" – ONS's Internship and Trainee Program

Opportunities for trainees and interns are offered in all locations where ONS has offices and operation centers. In 2015, ONS selected 23 professionals among 1,410 candidates after a careful selection process involving the evaluation of general knowledge, languages, technical tests, group dynamics and individual interviews.

This process has achieved favorable results, since about 50% of trainees were hired, by ONS, between 2001 and 2015.

Candidates may apply for *Construir* Program through ONS's website or through lectures in public and private educational institutions recognized technically in the sector, especially those located in the cities where the Operator has offices, within *Programa Sinergia* (Synergy program).

In visits to these institutions the courses' briefing and pragmatic contents are discussed with coordinators and professors of Electrical Engineering.

QUALIFICATION PROGRAMS

The qualification activities are structured in specific programs, distributed in the following detailed corporate actions:

MAIS VALOR PROGRAM

Mais Valor is a development program aimed at promoting training courses for employees' qualification, administered by the employees themselves, on topics of interest for the organization, aligned to its Strategic Planning.

Among the various courses offered in 2015, the highlights of the modules I and II of the course on Power System's Security and Dynamics and the course on Substations and High Voltage Equipment.

ENGINEERING DEVELOPMENT PROGRAM

The program, aimed mainly at Engineers, with the following main objectives: expanding and consolidating knowledge on the Brazilian electric power sector; contributing to integrating and keeping these professionals.

OPERATORS' CERTIFICATION AND DEVELOPMENT PROGRAM - DEVELOPMENT OF OPERATION

The operators' certification process is held every three years and aims at meeting the requirements set in the Operation's Procedures Manual. Its main objective is to certify the skills of System Operators and the Operation Network Installations, enabling them to perform their attributions in the Control Room.

In 2015, six operators were certified in Rio de Janeiro, ten in Recife, nine in Florianópolis, totaling 25 System Operators.

HEALTH MANAGEMENT PROGRAM

Based on the successful results achieved, the Health Management Program promoted several actions during the year, in order to motivate and orient employees, such as:

- *Cuidar* Program – in 2015 "stress" was the focused theme, with lectures and workshops on wellness management. In Brasilia, Florianópolis and Recife, for following physicians' guidance, this edition of the Program had focused on fighting the sedentary lifestyle and on dietary re-education .
- In October 2015, ONS joined the worldwide movement Pink October and conducted lectures given by a specialist on breast cancer prevention.

3.8 Telecommunications and Information Technology

Among the main results of the actions undertaken by the IT Corporate department in 2015, regarding Telecommunications and Information Technology, it is highlighted:

Improvements in the use of Big Data Solutions and Analytics

During 2015, a Data Management program structuring was started to guide the use of information and to create solutions directed at analyzing large volumes of data. Some pilot initiatives were developed, with emphasis on:

- Relation between Load and Temperature - an analytical model to analyze, gather and relate load and historical temperature curves, generating a model in order to obtain a probable load curve, given a temperature curve
- Visualization / Data Exploitation - the Tableau tool was adopted and deployed in order to assist the company's directors in the follow-up of audit reports.

Applications Systems Projects Completed

Throughout 2015, significant development projects and actions of support systems to finalistic areas that contributed significantly to the management of data and information were completed, among which we highlight:

- BIPS's Geo-referenced Registration Information System (SINDAT), to facilitate the consultation of information on the BIPS's transmission and generation installations.
- Technical Data Base Registration Management System (GERCAD), which replaces older systems and provides more flexibility in use, allowing simultaneous consultation by multiple users to the Technical Database (BDT).
- BIPS's Asset Ownership Alteration System (ATASIN), which supports the alterations of the assets ownership, preserving the history and the validity of the ownership.
- Improvement of the Determination of Alterations on Operating Status System of Generating Units and International Interconnections (SAMUG WEB), in order to include all the necessary features for the determination and consistency of events.
- System for the Daily Operation Program Generation (SPDO) replacing the current Daily Operation Program (PDO) used in the Pre-Operation and Real-Time environment.
- Limits Management System (GERLIM) to systematize the workflow of the elaboration of Registration Documents (CDs), Operating Instructions (IOs) and

Operational Messages (MOPs) concerning the transmission and equipment limits.

- ONS's Weather Information System (SIMONS), to automate the receiving, processing and use of the meteorological measures necessary for the preparation of the Daily Schedule and Monthly Operation Program.
- Replacement of the old Domino.doc technology by Sharepoint technology, facilitating access to relevant documents.
- Improvement of publishing solution of Grid Procedures and Operation Procedures Manual (MPO), making it more accessible to all of ONS's external public.
- Development and implementation of the Main Design Project Monitoring System and Transmission Installations Management (SAGIT-PB), allowing to automate the process
- Improvement of the Transmission System's Usage Amount Determination (SAMUST) for compliance with REN 666.

Application Systems Projects under Development

Throughout 2015, specifying actions and development of support systems projects to finalistic areas were also conducted, highlighting:

- Development of the Interventions Management System for use in Real Time (SICOP)
- Development of the Load Forecast Consolidation System by Busbar (SCPCB), to manage the necessary information to the load forecasting consolidation process by busbar for electrical studies in a centralized manner
- Development of the Outflow Forecast Management System (SGPV), which will support the outflow forecasting process.
- Development of the BIPS's Electric Programming Management System (PDES), which aims at improving the technological solution that supports the current daily scheduling process.
- Development of the Electric Studies Management System (GPAR), whose objective is to be the main support tool to perform short, medium and long term Electric Studies.
- Design of the Content Management System of the Operation Procedures Manual , which will replace the current SIGOP / MPO
- Design of the Transmission's Administration and Determination System (SAAT) and of the Generation's Determination System (SAGER) and selection of integrated technology platform to support the development.

- Design of the SAM replacement project, in compliance with the demands of the Normative Resolution No. 669/2015 issued by ANEEL.
- Design of the Decomp Assembler, a system that aims to promote more agility, security and traceability of the Monthly Operation Program Process

Improvements in Information Security

ONS makes use of several protection, detection and response to cyber threats technologies, however it is necessary to ensure the continuous updating and evaluation of these solutions' effectiveness. Therefore, the Cybersecurity Roadmap was developed, in order to:

- Set a reference for ONS's maturity assessment regarding cyber security practices;
- Identify ONS's current cybersecurity positioning concerning the adopted technologies and processes;
- Recommend ONS's proper positioning for each of these practices, based on a short and mid-term assessment, in the light of available resources or considered viable for a 3 year horizon.

In addition, to increase cyber security ONS's main Datacenter firewalls structure was redefined, a solution was deployed to detect real time threats, which extends the ability to prevent malicious attacks and the solution deployment was started for the Identities Management, in order to ensure more control over the concession, maintenance activities and removal of users' access to applications and systems.

Improvements in Infrastructure

In 2015, the IT Asset Management Project was completed, obtaining the result of full compliance in two external audits made by Oracle and Microsoft.

Main Datacenter migration from Brasilia to Rio de Janeiro was performed without generating any impact on the continuity of ONS's processes.

New telecommunications assets were implemented with expansions of local and long distance networks' processing capacity and mitigation of weaknesses in infrastructure.

3.9 Purchasing and Building Administration Management

Em 2015, em consonância com as diretrizes estabelecidas pela Diretoria, foram desenvolvidas ações junto aos fornecedores visando reduções nos custos referente à aquisição de bens e contratação de serviços. Os ganhos de negociação / gestão totalizaram no ano cerca de R$ 1.900 mil.

In 2015, in line with the guidelines established by the Board of Directors, actions were developed with suppliers aiming at reductions in costs related to the acquisition of goods and to contracting services. The trading gains / management totaled about R$ 1.9 million in the year.

Continuing the improvement of the purchasing area's controls and results, the first stages of the implementation project of the Purchasing Portal tool were completed, which will enable, among other things, more transparency, agility and cost reduction in the procurement of goods and services, management of suppliers and ONS's procurement processes' automated controls.

The project originated from the need for controls to the ONS's purchasing area, whose processes were not fully automated, associated later, to a demand by ANEEL.

The tool is ready to work with the Quotation, Requisition and Supplier Management modules. The Auction and Contracts modules will be finalized by July / 2016.

The Purchasing Portal will be fully integrated into the current ERP System - Enterprise Resource Planning, allowing the continuity of today's existing financial and budgetary controls.

3.10 Economic and Financial Management

Regarding the economic and financial management, in 2015, it can be highlighted that ANEEL approved the ONS's request concerning the compatibility of the budget cycle with the calendar year (January to December). ONS's request was based on the following benefits:

- Compatibility of the figures presented in the financial statements with the ones of the budget approved by ANEEL;
- Compatibility of the tax calculation basis with the budgetary cycle horizon;
- Compatibility of the budgetary cycle with the Operator's Organizational
- Programs (e.g.: Performance Management and Development Programs).

For the budgetary cycle alteration from the July - June period, to the January - December period, a transitional cycle of six months was established, the period from July to December 2015. From 2016, ONS's budgetary cycle will coincide with the calendar year.

The financial statements for 2015 were prepared and are presented in accordance with the accounting practices adopted in Brazil, comprising the statements of the Accounting Pronouncements Committee (CPC) and in accordance with the instructions contained in ONS's Accounting Manual, established by ANEEL.

Year Budget

ONS's budget was approved by ANEEL through the Authorizing Resolution No. 4,731 of June 24th, 2014 for the period from July 2014 to June 2015 was R$ 527,748 million, of which R$ 244,298 million estimated for the semester ended on December 31st, 2014 and R$ 283,450 million semester ended on June 30th, 2015.

The budget for the period from July to December 2015 was approved by ANEEL's Authorizing Resolution No. 5,339 of July 7th, 2015, was R$ 275,706 million.

Thus, the budget for the period January-December 2015 amounted to R$ 559,156 million, of which were released R$ 533.406 million, corresponding to 95,4% of the proposed budget. From that deviation, it is highlighted the Personnel entries, with R$ 14,094 million, and Taxes, with R$ 9,353 million, a result of the composition of items of expenditure and investment that occurred during 2015.

ONS's Funding Sources

Under the Article 34 on the Bylaws' single paragraph, amended by ANEEL's Resolution No. 1,888, of April 22nd, 2009, the following are sources of ONS's resources:

I. Contributions from its associate members, proportional to the number of votes in the General Assembly, included in Part "A" for purposes of tariff transfer and collected by other associates and agents of the electric power sector not subject to tariff transfer.

II. Resources deriving from the budget established by ONS and approved by ANEEL:

a) Transferred by associate members and agents of the electric power sector connected to the Main Grid, whose values are included in the Transmission System Usage Tariff (TUST) and in the Part "A" of the Electric Energy Service Tariff;

b) Collected by other associate members and agents of the electric power sector that are not subject to tariff transfer;

c) Other revenues authorized by ANEEL.

For the viability of its budget, ONS used, in 2015, the resources of the transmission usage charges and contributions from associate members, R$ 501,164 million and R$ 16,525 million respectively, as well as previous year's budgetary cycle resources.

Results Statement

In the preparation of 2015's result, the deficit resulting from the lower level of investments made by ONS in 2015 can be highlighted. Despite the accounting deficit presented after the adjustments were made in line with current tax laws, fiscal profit was calculated thereby generating the current income tax (IRPJ) and social contribution (CSLL).