POWER PRODUCTION WITH NATURAL GAS UNDER THE CONCEPT OF THE LOCAL IRP APPLICATION

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ABSTRACT

This document aims to state the references and the theoretical foundations of IRP – Integrated Energy Resources Planning, based on the Environmental Impact Study EIS and Environmental Impact Report - EIR of a Brazilian gas fired Thermoelectric Power Plant – TPP “Carioba II”. This paper’s approaches are within a global view, including the social, environmental, economical and political points of view that are aspects of the sustainable development – SD. The IRP bases are the integration of the supply and the demand energy resources, the participation of all players in the process and the consideration of the social, environmental and economical dimensions in the same importance level, considering the Full Cost Account Evaluation.

This work evaluates the sustainability of the Carioba II TPP (1200 MW) implementation, located in the municipal district of Americana, São Paulo State – Brazil, based on the EIS/EIR prepared by the entrepreneur, the IRP foundations and the SD. In such context, the following aspects are focused: Contribution of the plant for the electrical system; the enterprise regional insertion and its impacts; Integration of the plant as an energy resource within the IRP philosophy focused in the considered area (SD goal); society integration and all stakeholders participation showing that the IRP process is feasible in order to promote SD. This document approaches the bases of an Integrated Energy Resources Planning - IRP, as being the best alternative to reconcile the several involved interests as an optimized solution for the area.

The resources integration subject is studied, trying to state the IRP bases and its adherence to DS, in order to conclude that an IRP process could be developed successfully in the region. A general analysis of mitigating and compensatory measures is accomplished. The results show that the Carioba II enterprise, when approached systematically and based on the IRP philosophy, is sustainable, satisfying the EIS/EIR requirements. In that sense, the possibility to start an IRP process to the area is verified, as part of the physical TPP implementation.
1. INTRODUCTION

Integrated energy Resources Planning –IRP has as foundations the integration of supply and demand resources, the participation of the process players and the social, environmental, economical and political aspects consideration in the same importance level, considering for that the Full Cost Account evaluation - FCA. In that sense, IRP states the sustainable development as a diffuse goal to be reached that implicates in an increasing complexity in the planning process development.

Therefore, this document approaches those elements, trying to place the reference notions and some theoretical foundations of IRP, focused on Caríoba II EIS-EIR (Environmental Impact Study –EIS and Environmental Impact Report –EIR) and its relation to the sustainable development. This analysis based on IRP is not trivial and it is an innovation, mainly in the Brazilian context.

The present work evaluates the implementation sustainability of Caríoba II Thermoelectric Power Plant –TPP, located in the municipal district of Americana, São Paulo State, based on its EIS-EIR [1]. Is good to mention that Caríoba II TPP design is for 1,200 MW with a high efficient CCGT technology. So, the following aspects are focused: Plant contribution to the Brazilian electrical system; Insertion of the enterprise in the region and its complete impacts, as presented in the EIS-EIR; Plant integration as an energy resource within the IRP philosophy for the area; Integration of the society and of the involved and interested participation –In-In (the stakeholders);

This document introduces one of the main implementation problems (or solution) of the enterprise, which is the local society participation and acceptance of the TPP implementation.

Also, the IRP is presented as the best alternative to reconcile the several involved interests, being an optimized solution for the area. Such solution would contain the Social, Environmental, Economical and Political aspects contemplation, in the sense of introducing a long period plan consideration in the search of Sustainable Development –SD.

It is also discussed the Full Cost Account methodology, as form of "counting" all the involved costs (direct, indirect, less tangible, social), in a wide vision that minimizes the mistakes possibilities in the process of energy resources choice.

Finally, the resources integration subject is discussed, trying to state the IRP adherence to the sustainable development, showing elements that, when looked at the IRP insight, show how easy could be started an IRP process in the region. Then, comes a general analysis related to the mitigating and compensatory actions, considering reuse, emissions and hydro resources in the sustainability analysis.

2. THE PROBLEM BASIS TWARD ITS ACCEPTANCE

2.1 The Sustainability in the Power Provision

When thinking about IRP, we also think about the search of the sustainable development, which is based on the balance of social, economical and environmental aspects in the process of energy resources planning. The IRP considers the demand and offer resources equally, taking in account the environment and the Involved-Interested –In-In (the stakeholders) parties' participation. The presented aspects are complementary and the conditions for the sustainability occur as a result of a balanced relationship among them. Unilateral visions, polarized and radical in favor of one of them commit the others and, in that way, there won't be a good ambient for the sustainability. It is necessary the mutual trust among In-In, so, extreme or simplistic opinions should be abandoned in favor of a rational analysis of the conflicts, analyzing the benefits and the negative impacts as unavoidable impacts of an absolutely necessary energy provision policy.

In certain circumstances, such as social nuclei harnessed by industrial centers, the lack of infrastructure is a serious social degradation component, because it impacts the development of the socioeconomic activity. The infrastructure postponement is not configured as an alternative for the sustainable development, remembering that the social degradation, as rule, impacts the environment [6].

The infrastructure implicates in environmental, social and economical impacts, worse if badly implanted, but its absence camouflages such inconveniences. In that way the search of SD should consider the lack of infrastructure and its consequences.

In the global context of the infrastructure, the electrical power represents a preponderant role. Its presence is not an enough condition to achieve the development, but is a necessary condition, since the technology presence, information, production, social welfare and other infrastructure components are conditioned to its presence.

Today in Brazil exist at least 20 million people without access to electricity; many of them living close to energy resources facilities constructed for distant populations provisioning.

In the wide country context, a negative to the electrical system upgrade implicates in the maintenance of such social exclusion. Besides the people socially excluded of the electricity benefits, there is the vegetative population's growth and the consumer's uses growth, implicating in an increasing need of electricity offer. The
current restriction to the electrical power consumption in Brazil shows a tendency of GDP decreasing, job offer reduction etc., impacting the socioeconomic activity as a whole.

3. THE INTEGRATED ENERGY RESOURCES PLANNING

The methodology of the Integrated energy Resources Planning- IRP has as its main support the concern with the environment and the efficient energy in the final uses. In general terms, IRP [5] can be understood as the process that analyzes all the possible and feasible resources options in the time and geography, to supply the energy needs selecting the best alternative with the purpose of guaranteeing the socioeconomic sustainability. So, the IRP is one more instrument in the Sustainable Development –SD establishment. In this sense, there are different perspectives according to which the IRP process can be focused in its execution: in the State and Public point of view, its potential to the jobs creation; the environment preservation, conservation and protection; the international recognition (in terms of the energy and environment rational use); new techniques and technologies and; the possibility of SD. In this context, IRP includes efforts to create conscience in the energy industry as a whole, because it collaborates to satisfy the consumers’ needs and to support the regulation, the economy and the external market; For the public or private dealings, IRP means low cost options choice, lower tariffs, the capital expenses postponement and, the most important, the consumer's satisfaction. Also, the contributor/consumer has its earnings as a result of less expensive constructions or of smaller cost, saves in the monthly wage safety and comfort improvement resultants from lower tariffs. Finally, among other, the entrepreneurs/constructors can obtain benefits from improvement of market portions. So, the IRP can be seen from a win-win approach in the sense of reaching the involvement of all the affected ones (In-In) in their relation to geography and time.

In this enlarged context, IRP is characterized as a tool analysis that puts jointly, in the same conditions and expectations levels, the offer and demand options. Then the best resources options portfolio is established, including the energy use reduction; load cut; fuel change; the consumer's education etc. The IRP is a holistic approach that allows the minimum cost option with the environment protection improvement; the conservation in its wider meaning and; improvements in the transport and in the locality. The IRP also allows, step by step, earnings for all In-In.

4. STATEMENT OF ENERGY SUPPLY SOURCES

The transmission lines expansion, the machines upgrade in existent hydro plants, among other, are sometimes confused with alternatives to the electrical power generation. These, usually, only enlarge the system capacity (given in MW), but they don't aggregate new energy. Then, it is necessary to increase energy with new generating units.

Several alternatives of electrical power generation exist, since the cleanest ones, as the solar photovoltaic, to the most pollutant ones, as coal. The solar photovoltaic generation, in Brazil, has a cost around 10 times the hydroelectric (at least 5000 US$/kWp). Its application, at the moment, would implicate in prohibitive costs that just an economical elite would have access to this electricity. In such conditions, the option for this kind of generation would be socially unjust, once there is repressed demand in the country. Although, thinking environmentally photovoltaic is one of the best electrical power generation forms, but the amount of requested money, ten times bigger, would be better used to assist to ten times more consumers. As illustration, for the amount of 1000 MW, 20h/day, would be necessary something around 10 million m² in panels with a cost of more then US$ 5 billion. To maintain the energy level during the night period would be necessary batteries that, besides their high cost, are highly pollutants when discarded. Due to this fact and also to reduce the high cost with batteries, the solar systems of larger load are connected directly to the electrical grid, generating energy just during the day. In the current technological paradigm, the photovoltaic energy doesn't represent an alternative to the conventional generation sources, in order to assist the necessary energy amount that Brazil needs to maintain its social-economical growth.

The hydroelectric power stations are among the cleanest power generating forms, but its construction implicates in some severe environmental damages: artificial lakes construction, water quality changes, vegetables, animals and archeological sites flooding, proliferation of water transmitted diseases etc. Mainly when in great volumes, the impacts are still more pronounced.

Brazil possesses an immense hydraulic potential (around 260 GW), but great part of this is in the Amazon area, therefore far away from the biggest consumption centers. Part of this potential will be explored with costs (economical and environmental) much higher than the current costs for hydroelectric generation, specially because the electrical power generation in the Amazon implicates in big losses in the transmission system.

The SHPs (Small Hydro Power < 30 MW) are not an alternative to enterprises like Carioba II, 1200 MW (at least 40 SHPs). The SHPs are only complement that should be implemented, for environmental reasons, but
they don't have potential nor technician-economical conditions to assist to the total country needs, not even of the local demand in the studied area.

The wind power plants need batteries according to the inconstant wind characteristics (en stand alone systems). However, the wind energy is competitive when interconnected to the electrical system, being also characterized as a good complement that it is already used in Brazil (arriving around 30 MW recently). To the Carioba II plant substitution would be necessary 1000 wind power units of 1 MW, conditioned to the readiness of wind, which is not available in the area. So it is not a realistic option for this specific case.

The gas-fired thermoelectric plants started to be an option to Brazil since the moment that the Gasbol (Bolivia - Brazil natural gas pipeline) was built. This pipeline is only justified economically in the attendance of these TPPs. These plants have smaller implementation periods than the other options and lower implementation costs, facilitating the private sector participation in the electrical power provision. The Thermoelectric Prioritary Program of the Federal Government foresees the construction of more than 15,000 MW in thermoelectric plants, besides all the enlargement of the hydroelectricity. These generation values are necessary for the country growth.

Parallel to these, there is the distributed generation with natural gas and sugar cane bagasse. Both these options have smaller relative efficiencies than the bigger base loads gas combined cycle units. In other words, there is more pollutant emission by unit of generated energy (however the bagasse has the advantage of the closed carbon cycle). Its largest attraction is exactly the proximity of the load and the benefits that it provide in terms of losses, but these are also characterized as complementary generation.

There will be always damages and inconveniences in the electrical power generation and the society doesn't want and doesn't have means (technological and social) to stop using some energy sources.

The TPPs are necessary, even with the other existent sources. Its postponement implicates in lack of energy in the short period, which is the most onerous energy for the society. This cost should be considered in any analysis, because it is global and it affects the regional dynamic. Its short implementation time is not just an economical advantage for the investor, but also social, as the delay in the energy disposibilization, according to the repressed country demand, implicates in social damages.

Another emphasized aspect is the greenhouse gases emission of the thermoelectric generation. Concerning those gases, Brazil is one of the World's smallest originators by unit of produced energy. The construction of the foreseen thermoelectric doesn't alter this scenario substantially. Besides, the countries that should reduce their emissions are enclosed in the annex 1 - “developed countries” of the Kyoto Protocol. Brazil is not part of it and the enlargement of energy resources use is a recognized social necessity. When giving up the allowed emissions, Brazil takes the risk of giving up the progress already reached for the developed countries. Brazil needs to increase the historical growth of electrical power offer in order to meet the repressed energy demand. However it doesn't mean neglect the Environment care and, with that, in quest of he Sustainable Development.

Besides these factors, the thermoelectricity insertion in the Brazilian scenario amplifies the country energy matrix diversification, whose importance is verified in the long run strategic planning.

Despite of it, it is stood out that, especially the solar and wind power, are fundamental part of the renewable technologies development and they should be part of a plan towards the country energy sustainability. However, the social and economical needs are urgent at this moment and these sources are not sufficient alternatives in substitution of the thermoelectricity.

Also there is the Demand Side Management – DSM. In the IRP approach the DSM is appraised in the same level of importance that the offer resources. DSM looks for the best use of the electrical power through techniques and equipment of energy conservation, habits changing etc. With DSM it is possible: to make available energy without increasing the generation, saving energy resources; to postpone investments, saving financial resources; to avoid the current environmental impacts of the generation.

Several DSM programs have been done as energy resources, among them: The user's education, Load Control, Normatization and Classification of Equipment, Fuel Change, Energy Pricing, Regulation, etc.

These programs are fundamental part of IRP, but they are not enough resources in the current energy needs supply.

Finally, could be said that all the disponibilization forms of energy (offer and demand) are important in the composition of an energy resources portfolio for the region, mainly in a longer planning period. This wider glance on the resources allows establishing a wide mix of energy alternatives for the area in order to satisfy the In-In needs (in the sense of preserving the most important resources for the human development, the air and the water).

5. THE FULL COST ACCOUNT

The Full Cost Account (FCA) or complete energy costs consideration, intends to consider, in the evaluation of an energy enterprise, all the costs incurred in its accomplishment, considering the internal and external costs (externalities) [7].
It is a tool, which incorporates environmental and internal costs, with data about external impacts and costs/benefits of activities that affect the environment and the human health. In the cases where the impacts cannot be valued, it uses qualitative evaluations.

However, the great difficulty in this kind of evaluation is in the external costs, in other words, the externalities valuation.

Assuming that the externalities have been identified and monetarized, the damages caused by them can be corrected by costs internalization and compensatory taxation.

The Full Cost Account, when applied to the energy planning, is based on five premises. Those premises are consideration of energy resources and efficient uses; environmental impacts; social impacts; renewable energy resources; financial integrity.

In agreement with those criteria, the evaluation should consider: Impacts in the complete life cycle in the project, construction, operation, maintenance, decommissioning and disposition; Expected damages to the ecosystems, communities and human health; Positive and negative potential impacts; Quantification and monetarization of the potential impacts, when possible, or at least a qualitative description; Changes and compensations among selected alternatives.

The social and environmental impacts should be identified already in EIS. Those impacts quantification, in terms of costs, will be object of FCA. Such costs can incur before the impact (control cost) or after the impact (degradation cost). The control and degradation costs are defined ahead.

6. **IRP AND THE TPP CARIoba II INSERTION IN THE AMERICANA REGION**

It is necessary to highlight that the current demand of the municipal district of Americana (in São Paulo State – Brazil) is about 1600 MW, with a 53 MW hydroelectric generation and 32 MW in Carioba I TPP. In other words, this region imports energy from other places. It is easily verified that the area possesses a high demand that has not been supplied with the local resources. In the IRP assessment would be built a portfolio with all of the possible resources (power production or not) for supplying the local needs, according to the criteria of the sustainable development.

In the case, considering Carioba II, the previous supply resources analysis, shows that the area doesn't possesses explicit alternative to the thermoelectric generation in order to meet the local demand.

The economical viability analysis already is satisfied, once the investor already decided for the plant construction.

In the environmental aspect, the Carioba II implementation will represent a good step in the sense of supplying the load with close generation, giving global environmental benefits, related to the losses decrease in the transmission system. It remembers that generate energy always implies in environmental damages. This is why the waste of primary resources is considered a factor of negative environmental impacts.

It should be stood out that, in this case, avoid to produce electricity locally doesn't accomplish global environmental goals, once the local society won't give up the energy use and the electricity should be generated at distant places, resulting in transmission losses. In addition, the transmission lines construction implicates in environmental impacts along millions of m² that are deforested and disabled for other uses.

In order to balance the socioeconomic needs with environmental aspects Americana will have, more and more, to afford the costs (social, environmental and economical) of the power generation. In the limit, the ideal condition would be that each big consumer center reached its energy self-sufficiency.

The fact is that the electrical power is needed and must be generated and it is necessary that the ones whose use it takes the responsibility for the resultant inconvenience.

In the social aspect, the option for not generating the energy would be the worst option, as already stood out previously. Obviously, it doesn't mean that the energy should be made available at any cost, but its insertion should contemplate the society participation in the search of the minimum cost (of the energy, environmental, social and economical impacts), according to the IRP philosophy.

As an energy resource option, the thermoelectricity is, in function of the NG availability and of the great load, a good option, since there are no technical and economically alternatives to it. The NG (natural gas) option satisfies the adopted criteria in the portfolio elaboration: It optimizes the resources uses; It maintains the generation in competitive market costs; It is very appropriate to the existent load and demand supply; It introduces the environment in its concretion as enterprise.

It is worth to stand out that the thermoelectricity costs are higher than the one of the current hydroelectric energy.

In the current moment of power supply shortage (that is in the year 2001) in Brazil, the TPP will be part of a highly desirable supply resources mix.

The Carioba II insertion plan doesn't contemplated actions in the demand management, what would be also desirable.

The general enterprise analysis should be proceeded according to how much is spent and what are the benefits. The society will define which are their earnings and losses and which are the smaller impact alternatives. The investor; based on economical-financial balance analysis, will verify the proposal feasibility.
These several goals compose the preferential resources portfolio of In-In. The final plan should contemplate it in order to satisfy the balance among the social, economical and environmental aspects. The final objective is the best conciliation of the each In-In stakeholder party in the process. Maybe it is important to consider that, for the socioeconomic development there is always an environmental price. In this case, the "positive" balance would be the smaller global impact.

7. MITIGATING/COMPENSATORY MEASURES AND THE IN-IN

In the following items the relationship among the resources and involved-interested –stakeholders parties (In-In) are analyzed in the resources portfolio composition, focused in the gas fired generation. The mitigating and compensatory measures for each resource are commented.

7.1 Water and the Power Relatinships

The population and other local society sectors are concerned about the possible lack of water resources in a close future, because of the current water shortage in the Piracicaba river basin. In order to avoid a lack of water, as consequence of the plant operation, the TPP can: a) operate without the water treatment (discarded for the investor); b) increase the river availability, so such use won't reduce the available water amount.

The solution presented by the investor follows the second option that contemplates the problem solution at economical costs.

The proposed solutions and its efficiency or deficiency in relation to the expected results are commented ahead.

The Sewer Treatment for water uses in the plant. - The solution of Americana sewer treating for water use in the plant is a quite interesting solution [2], whose technical application has been approved by several specialists. However, such solution presented in the plant's EIS doesn't present an enlargement plan during the plant life period. It would be highly desirable, once, in 24 years, period initially foreseen of plant operation, the city population tends to grow substantially and, at this moment, the Piracicaba river water retreat will be more critical. It would be also important the establishment of a plan for increase the sewer treatment. It is worth to remind that, in the future, in the case of real lack of water, the priority will be given to the human and animals' consumption, according to the current legislation. The creation of a plan that states an enlargement of the sewer treated use would minimize the population concerns about future water shortage.

Another factor not considered in EIS is the financial compensation for the water use that has been discussed in the São Paulo State. In this aspect, it is waited that, in a close future, the water uses as resource should be taxed. The value initially cogitated is of US$ 0.08/m³, which would result in a monthly value around US$ 9600.00. This tax ratifies the initiative of using an increasing amount of sewer treated, which could be seen as compensation to the direct river water use. Also the water that returns treated for the river, 228 m³/h, could be abated of the total payment.

Combats the inefficient water use in the Piracicaba River. - Other quite important aspect stood out in EIS refers to the program for the water waste combat. This is important in the sustainable development, because allows a larger users number for the same amount of water.

Using Salto Grande Reservoir for the Piracicaba River Regularization. - In the energy resources and water integration, there is the proposal of using the Salto Grande reservoir for the Piracicaba river regularization only, stopping the hydroelectricity generation. This regularization is fundamental for the water consumptive use made by Carioba II plant [4]. The problem of the electricity "loss" must be faced as handling of the resources that are available for composition of a bigger and better resources portfolio.

In this portfolio, the dam and the reservoir acquire larger importance for the water management than energy. It propitiates a larger amount of energy generation, around 1200 MW, by stopping 32 MW generation in order to increase water to the river in its more critical period.

This solution comes in an analysis of alternative cities for Carioba II against to the Americana solution one (in function of the gas pipeline) but that don't possess the same potential in hydro resources handling, allowed by this reservoir.

It should be stand out that the river average flow increase has benefits to other In-In.

7.2 Air Quality and the Power Relatinships

One of the points stood out by the local population and environment defense groups refers to the decrease in the air quality as a result of the significant increase in the NO₃ emissions in relation to the current levels.

The Carioba II TPP operation allows the Carioba I TPP closing. Note that Carioba I is a fuel oil TPP but with steam turbines only for power generation. This fact, of switch off Carioba I, presents a series of benefits in terms of emissions, with substantial reduction in SO₂ emissions, as well as CO₂, CO and Particulate. In the
case of Carioba II abandoning, Carioba I will keep operating, maintaining the current emission levels. It
remembers the resources portfolio management (Carioba I and Carioba II) that maximizes the offer and
minimizes the impacts.

The highlight is in NOX emissions, which will increase significantly in function of the Carioba II operation.
The technical Report emitted by EFEI [3] shows that the NOX emission is equivalent to 2,342 cars, in one-hour
use, what is a low value compared to the existent fleet in the city. It is stood out that, unlike the urban fleet, the
plant will work 24h/day. Nevertheless, this comparison allows seeing that, in the energy use, the thermoelectric
emissions can be smaller than uses that are less discussed in the day by day of the local community. The
comparison is still more accentuated in the case of the others pollutants such as SOX, CO and Particulate.

In the analysis solution of such problem it is necessary an integrated approach for all the resources
available for the wanted portfolio formation. This way, should be identified all the local aerial emissions. The air
quality defines how much pollutant can be emitted without damages to the health, and this value defines how
much a resource can be explored economically. So, it is better for the local socioeconomic activity development
the possibility of increasing the city emissions without impact the environment and the economy. In this sense,
the inclusion of Carioba II could optimize the air resource.

Such action would allow accommodating all the needs (from industries, transport and electrical power)
with the minimum environmental cost and without restriction to the economical activity. Then, the evaluation of
all the energy uses in the area and the identification of energy demand management possibilities could be
analyzed with the objective of emissions reduction.

Among the possibilities could be exemplified: Creation of a pollutant emissions control program for the
automobiles; Incentives to the electric buses; Fuels substitution programs in the local industries (fuel oil to
natural gas) etc.

The subject that should be faced is always the optimization of all the energy resources that are
available, with benefits to In-In.

In IRP all the In-In should be considered in the process and the benefits must be transparent and well
distributed among all of them.

7.3 Socio-Economy and the Power Relationships

In the interaction electrical energy versus socioeconomy the TPP will create only 50 direct permanent
jobs, but there will be great attraction of industries for the area, which will be the effective permanent jobs
source. This effect requests an appropriated planning for its correct management, in infrastructure terms. This
attraction is highly desirable, because there is jobs deficit in the area. The own local infrastructure enlargement
turns into a factor of job creation and improves the area competitiveness. This enlargement is linked to political
and government actions, as well as of the private investor's participation. The aspect of the interaction among
In-In stakeholders extrapolates the enterprise, because of the tax amount that it generates, that, if well used,
can leverage the local economy.

The jobs creation is expected not only for the industries attraction to the area in function of the electrical
power availability, but also as a result of the multiplier effect that the resources injection has in the local
economy, enlarging the services and trade sectors.

7.4 Life Quality and the Power Relationships

Besides all those aspects stood out, there is the audible noise emission that can be characterized as a
factor of public health degradation.

In this aspect, EIS doesn't explain which measures will be adopted in the case in that the plant
operation reaches superior levels to the simulated ones in the same Report, nor which effects on the population
it could causes.

Corrective measures should be presented and also which levels the plant commits to reach as soon it
begins to operate. This compromising is essential part of a compensation rule establishment for the affected
ones, in order to establish trust among the parties to make possible a win-win relationship.

Another important subject is the aerial emissions, where would be important the participation of the
society in the process of emissions monitoring (noise and pollutants). The monitoring should be extended to the
population through meters that present the results in a comprehensible way to the lay people. This step is
important for construct a trustful relationship during the plant operation period. It would also serve as a tool to
clearly visualize the plant participation in the local emissions confronted to the other sources, mainly in the
critical moments.

7.5 Other Resources

Another factor to be explored refers to the possibility of this plant, 5th World's largest gas fired plant, to
be opened to the visitation, creating technical tourism potential in the city. The plant conception should
contemplate such objective also providing the necessary infrastructure to the daily plant opening to the visitation.

Considerations concern the Resources Integration. - It is stood out that, although some solutions present in the EIS comes with integrated characteristics, in the IRP process the integration is present in all the levels of the energy resources portfolio composition. Each resource will be analyzed according to an integrated insertion, considering the In-In participation since the initial stages of the process.

The DSM resources are inserted in this context and its total use allows the establishment of advantages that are not usually visualized in a usual planning process, like enlargement of scarce resources and the decrease in time spend with public audiences' process.

8. SUSTAINABILITY AND ENERGY RESOURCES USE

According to Brundtland [8], economical development and environmental protection should be goals that are reinforced mutually. Like this, it is possible to mention some strategic Sustainable Development –SD guidelines, with respect to energy subject: to promote the efficient energy resources use; to integrate environmental and economical subjects in the decision process; to diversify the future energy supply options; to educate and to encourage other agents in the society; to communicate and to publish opportunities related to the energy sustainable use.

In the introduction of the participatory decision is necessary to increase the affected ones involvement in the definition process of the projects.

8.2 TPP Sustainability

The subjects approached in the context of IRP for SD put the TPP enterprise in a sustainable level, since it represents an energy resources option for the area and maintain the balance among the economical, social and environmental aspects.

As appraised along the text, the Carioba II plant construction allows establishing energy, social and environmental benefits in relation to the current situation, even more in the regional level. Obviously, inconveniences are associated to its construction and operation, but, in general, these were appraised and with the presented solutions and the improvement in some of them, there is a positive result in terms of benefits and impacts.

Benefits can only be visualized under the optics of a wide analysis, like in IRP, where the sustainability aspects have the same evaluation weights. Punctual observations of the emphasized aspects drive to extreme positions that darken the global enterprise results.

Significant gains can be seen for all, since implemented the compensatory and mitigating measures, as presented. It is a result of interest's conciliation among the In-In stakeholders (including the Investors) that has more benefits than losses.

As example, could be mentioned that: There will be relative NOx increase (staying below the standards), but SOx, Particulate and CO decrease (the balance for the environment is positive); there will be the river regularization and, in the most critical period, there will be more water amount in the river; It will remove urban sewer of the river; It will bring environmental benefits with energy losses reduction with the transmission reduction; There will be few direct jobs, but many indirect can be created; There will be a overload in the local infrastructure, but the taxes collection will bring social gains.

As exposed above, the Carioba II enterprise sustainability can be verified through the following verifications: The technology used for electrical power generation optimizes the energy resource; The approach given to the subjects related to the water use guarantees the efficient water resource use; The materialization of this enterprise means an important step for the regional energy self-sufficiency, reducing losses in the energy use; The electrical power generation through the natural gas also means the diversification of the energy matrix, reducing the hydro resources dependence of the electrical system; The tax income generated by the plant can be applied in the area to improve the local infrastructure and the population life quality.

9. CONCLUSIONS

Carioba II, analyzed upon the IRP philosophy, is sustainable according to its EIS-EIR (Environmental Impact Study - Environmental Impact Report).

The EIS-EIR documents are impeccable (at least in the report matter). It is noticed that the complete study approaches the environmental problem in an organic way, including models, simulations and additional measurements. Can be affirmed too, that the environmental and socioeconomic evaluation levels are good enough to guarantee a sustainable implementation and operation.

Some details confirm the conclusions above: There was public consultation; introduction of the reuse and water regulation possibility; The final location of Carioba II includes the noises emissions analysis; It
presents the environment as a resource and assimiator of actions. It used credible mathematical models; It justifies the relevance of the gas fired thermoelectric generation since Carioba II costs are lower than the marginal expansion costs (US$ 35/MWh in the governmental 2008 decennial power plan); It shows that NG is a relatively cleaner fuel; It indicates reliability increase, less pluvial dependence and electricity imports decrease for São Paulo State and; It analyzes different resources, justifying the natural gas as the most prominent, for having smaller implementation periods, smaller initial investment and minimum transmission requests.

Carioba II acquires, in some moments, an IRP approach, when: introduces a system of environmental administration in accordance with ISO 14001; mentions the complexity of the regional road system upgrade; considers the negotiation with the Hydro Basin Committees with the inclusion of 3 related Hydro Basins Committees in the evaluation.

In the EIS-EIR of Carioba II there is an outstanding situation where the environmentalists don't offer solutions and, at the same time, the evolution of EIS is propitiated jointly with the civil society.

The FCA –Full Costs Account shows that not just the economical cost of the enterprise is what determines the investor's earnings, but the inclusion of the social, environmental and still policy requirements. Because of it, what is not evaluated correctly today can be the largest difficulty in capital recovering tomorrow.

With these, it is so important the insertion of the local organized civil society participating in the monitoring of the environmental impact of Carioba II during the operation.

Instead of eliminating Carioba I completely it would be interesting to define a project of zero pollution in the reactivation of this unit, transforming it in a laboratory that could be operated by a multidisciplinary team (several universities).

In the specific issue of the noise emissions, would be good to introduce a natural barrier like big leafy trees, what would complement the possibility of converting Carioba II in the postcard of Americana City, reinforcing, with that, the indirect jobs induction for the area.

Finally it is important to mention that many of the problems encountered in the EIS-EIR documents would have had a better approach if the Carioba II studies has had a previous IRP process, that, as explained, could have stated the In-In participation since the beginning of the process. It would have allowed a wide view of the TPP enterprise, facilitating the identification and pervious solution of many problems.

10. BIBLIOGRAPHY