

# ***ESTIMATING ENERGY RATIONING COSTS IN BRAZIL WITH CONTINGENT VALUATION MODELS***

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## **Overview**

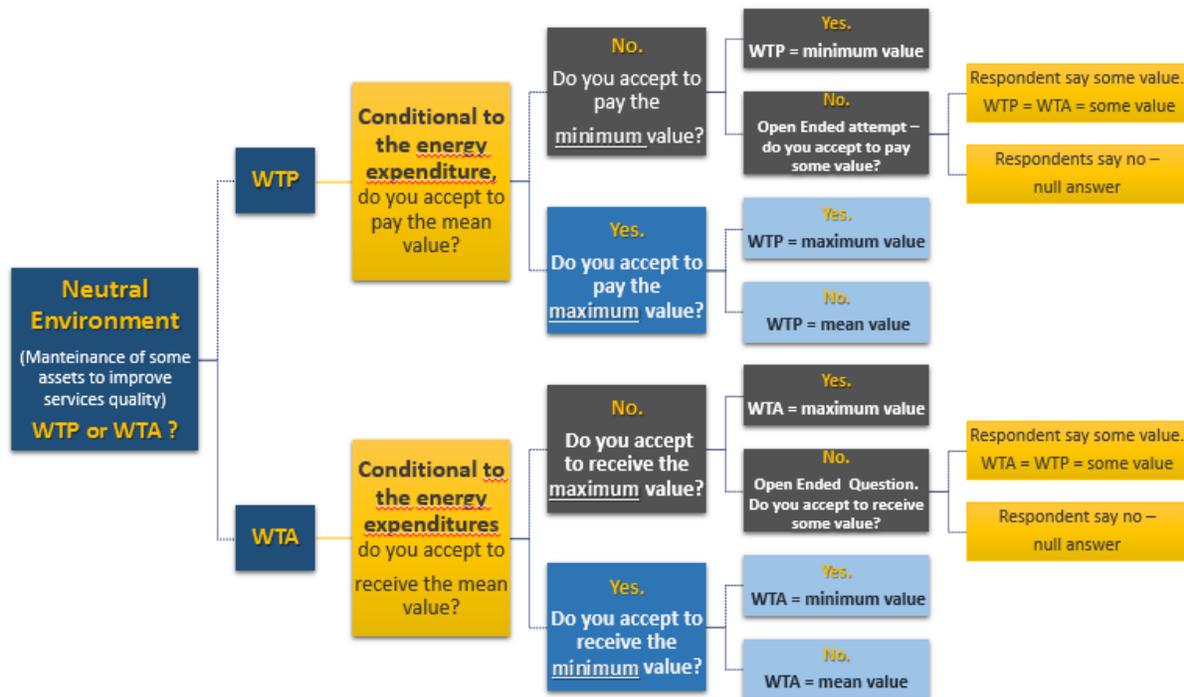
The Brazilian electricity sector is characterized by a hydrothermal composition and centralized operational procedures, including the dispatch of energy sources available. Among the fundamental information needed for planning of expansion and operation the cost of rationing or energy deficit cost plays a central role. In summary, it represents the maximum amount that could be attributed to a new venture able to avoid power outages or, more generally, the economic cost of shortage or lack of availability of electricity. This parameter is also used in other fundamental processes, being an essential reference to design public policies related to energy in Brazil. In this context, the main goal of this research is to develop and implement a new methodology for energy deficit cost estimation, capable to be used by policy makers involved. In contrast with current methodology, based on national accounts system and Leontief's input-output matrix, we propose a contingent valuation method, analogous to that used on similar studies more focused on short interruptions or Value of Lost Load estimation.

The paper is organised as follows: after the introduction, giving more details about the role of energy deficit cost in Brazilian energy system, the second section describes the application of contingent valuation methods to the problem considered. The third section describes the field research, using data from a sample of residential, industrial and commercial consumers, some qualitative results and descriptive statistics. In section four we present the quantitative results and econometric models for willingness to pay / willingness to accept to avoid an energy rationing in Brazil. The final section discusses policy implications and research extensions.

## **Methods**

The empirical strategy is based on Contingent Valuation Methods. To perform field research we will use both "willingness to pay" (WTP) and "willingness to accept" (WTA) methods – this strategy is related to sample available – data from 1600 residential consumers, comprising the four Brazilian energy subsystems (400 interviews for each subsystem), 500 industrial firms and 500 commercial firms; so, the survey is designed through a decision tree, where consumers may choose if they desire to pay for avoiding electricity shortages or receive some amount of money (or a discount in their bills) in order to compensate for the lack of energy.

This design allows for a confidence level of 95% (national level) and minimizes null answers. Concerning to the approach, open ended questions regarding how consumers value energy deficits will be used only if necessary – there is a huge evidence about potential bias in using these kind of questions (NOAA Panel). In this sense, questionnaires for residential consumers will contain values for WTP and WTA that are compatible with the income and energy expenditures of respondents – this matrix of values is obtained through some assumptions regarding what would occur if a rationing program really was implemented and about consumer's behaviour. Therefore, we have to simulate a power cut policy – one hour in the peak period for each day, during 3 months and on summer – considering a base value for price elasticity of demand. These assumptions allows the construction of a range for WTP/ WTA that will be used on interviews.



## Results

Contingent Valuation Methods are presented as a tool for policy makers in Brazilian energy sector. Similarly to countries like Peru and Colombia, we estimate the costs associated to energy rationing through surveys that elicit consumer's perception. As results, we are able to obtain the average willingness-to-pay/ willingness to accept to avoid lack of energy in Brazil from different kinds of customers and which attributes or parameters are more relevant to explain the deficit. These kind of analysis will be performed through econometric models for discrete choice, like Probit or Logit, in order to estimate the expected value of energy deficit costs. Results will permit also a better understanding about how to really implement a power cut policy in Brazil if necessary.

## Conclusions

Customers willingness to pay to avoid energy rationing will be used not only for usual applications in Brazil, related to planning and operational procedures, but also to improve contract design and quality of the services. We argue that field research must be performed on a regular basis so as to build knowledge, always providing new information about consumers' preferences, capable to be used by firms, policy makers and regulators of public utilities. The usefulness of such methodologies is not limited to the energy sector.

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