Application of functional-cost approach for cost assessment of NPP life cycle during the design process

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IYNC-2020, Sydney, Australia
2020, March 08-14
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OBJECTIVES

I. Comprehensive assessment of NPP life cycle cost:
- it is necessary to consider the design solution not as a separate part, but taking into account its impact on the entire object (both from an engineering and cost point of view)

II. Ability to manage the cost of NPP life cycle:
- the greatest opportunity to influence the cost - in the early stages of the object's life cycle (design);
- the assessment of cost should be predictable as the technical part of the project is developed;

III. Solving of the inverse task
- based on the required cost indicators - determine the most optimal design solutions
BASIC ASPECTS OF THE FUNCTIONAL-COST APPROACH

- During the cost assessment of a design solution, the key is to take into account the contribution of the NPP technological system to the cost of kWh

  ![Diagram](image)

  - CAPEX
  - OPEX
  - Production release

  Cost of kWh

- It is necessary to take into account the contribution from changes in each affected system

  ![Diagram](image)

  - \( \Sigma \Delta \text{CAPEX} \)
  - \( \Sigma \Delta \text{OPEX} \)
  - \( \Sigma \Delta \) Production release

\( \Delta \) Cost of kWh

Cost estimation of related design decisions in the design process

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EFFECTS OF USING THE PROPOSED APPROACH

1. Forecasting the cost of the design decision depending on the values of technical parameters.

A change in the technical part of systems leads to the question of changing interconnected support systems.

Impacts through interconnections = initial data for system design.

Design based on incoming provision requests.

Using machine learning methods applied to a historical database.

Technical specification
- Power;
- Work temperature;
- Material;
- Earthquake resistance;
- etc

Forecasting the capital cost of a technical solution.
EFFECTS OF USING THE PROPOSED APPROACH

2 ✓ Assessment of the economics not of a single change, but of the entire object as a result of this change.

The change in the engineering part is estimated by:
- **expendable components** (how much will it take to implement it);
- **revenue components** (how much will be received as a result of its implementation);

According to the previously described interconnections, the change in the engineering part of the local area can be determined.

Expenditure part includes:
- capital costs (costs at the design and construction stage)
- operating costs

**Complexity of assessment**

ΣΔ CAPEX
ΣΔ OPEX
ΣΔ Production release

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EFFECTS OF USING THE PROPOSED APPROACH

Assessment of solutions combinations and selection of the most cost-effective option.

\[ \Sigma \Delta I > \Sigma \Delta II \]

Choosing the most optimal between various options

It becomes easy to prove the need to increase the cost of one system, which leads to cheaper technology as a whole!

The task is currently under development and will be solved using methods of combinatorics and machine learning.
CONCLUSION

4. Taking into account the implementation of the mentioned cases, this will make it possible to come to an assessment of the cost during the design.

External constraints
- Project cost;
- External technical constraints (for example, climatic);
- Cost limit for a specific area of designing;

Internal tools:
- Predicted cost of the solution according to technical parameters;
- Suggestion of the optimal combination of design solutions;

Design solution for specified cost parameters
CONCLUSION

Based on the functional cost approach it is possible to obtain business-relevant effects

- Designer’s decision support based on an automated decision proposal and costing;
- Decision support at the management level based on data, not the expert opinion;
- Reasonableness of the construction project cost at various levels of consideration of NPP;
THANK YOU FOR YOUR ATTENTION