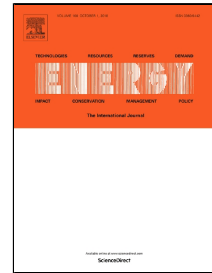


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Systems approach to energy and exergy analyses

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1 **Systems approach to energy and exergy analyses**

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9

10 **Abstract**

11 The complexity of contemporary energy arrangements created the necessity to apply not only
12 a process approach, but also a system approach in energy and exergy analyses. This distinction
13 was developed at Professor Jan Szargut's Silesian School of Thermal Engineering in the 1960s,
14 and Input-output (I-O) analysis as a method of mathematical modelling of energy systems was
15 applied. The I-O linear mathematical model of the energy economy of an industrial plant was
16 then developed, and the following problems were resolved:

- 17 – optimisation of the mathematical model in order to select the optimal structure of the
- 18 energy economy of industrial plants within the framework of preliminary design,
- 19 – nonlinear mathematical model of the energy management of ironworks for control and
- 20 scheduling,
- 21 – system analysis of the exergy losses considering the energy systems of ironworks,
- 22 – mathematical model of the energy production system of complex buildings, and
- 23 – application of the I-O model in energy and exergy analyses of oxy-fuel combustion
- 24 power plants with CO₂ capture, transport, and storage.

25 The I-O method was also applied in the modelling of calculations of the cumulative energy and
26 exergy consumption, cumulative emissions, and the indices of thermo-ecological costs.

27

28 **Keywords:**

29 system analysis; input-output analysis; energy analysis; exergy analysis; energy systems

30

31 **Nomenclature**

32 *Main symbols*33 **A** – matrix of the coefficients of the consumption of energy carriers and materials

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