

## Thermodynamics of the Biological Energy System

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in cooperation with Dr. Walter Radebold

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## Agenda:

1. **How does the biological energy system works in view of thermodynamics?**
2. **Why did we start to understand the biological energy system?**
3. **What are the conclusions for establishing a bionic energy system?**

# Thermodynamics of the Biological Energy System

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**BES (1)** → **TES** → **NES** → **?** → **BES (2)** → **TBES**

**BES (1)** : Biological Energy System - role for our life, now and in it`s past

**TES** : Technical Energy System - role for our life, thermodynamics

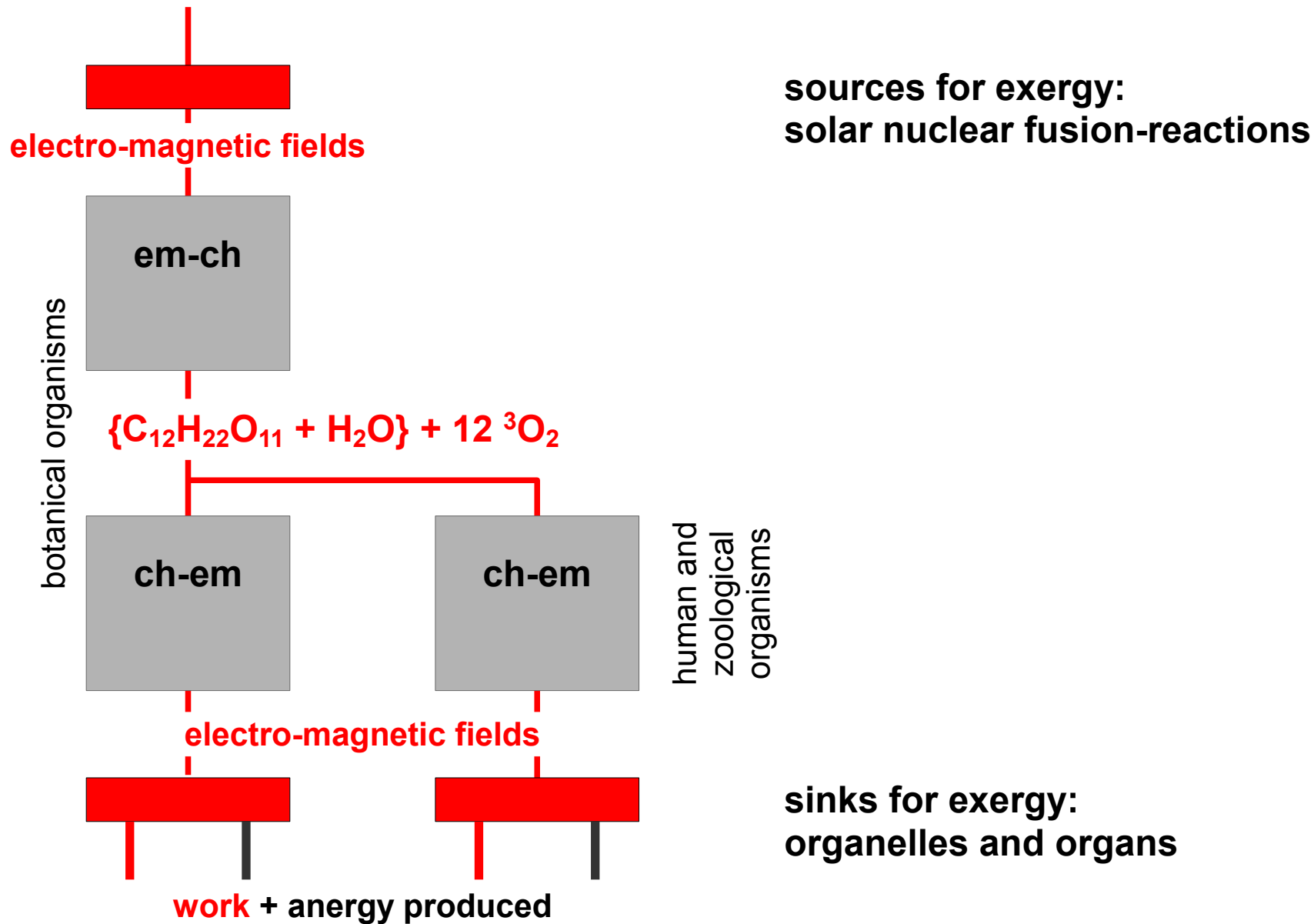
**NES** : Nuclear Energy System - terrestrial atoms for peace

**?** : Point of No Return

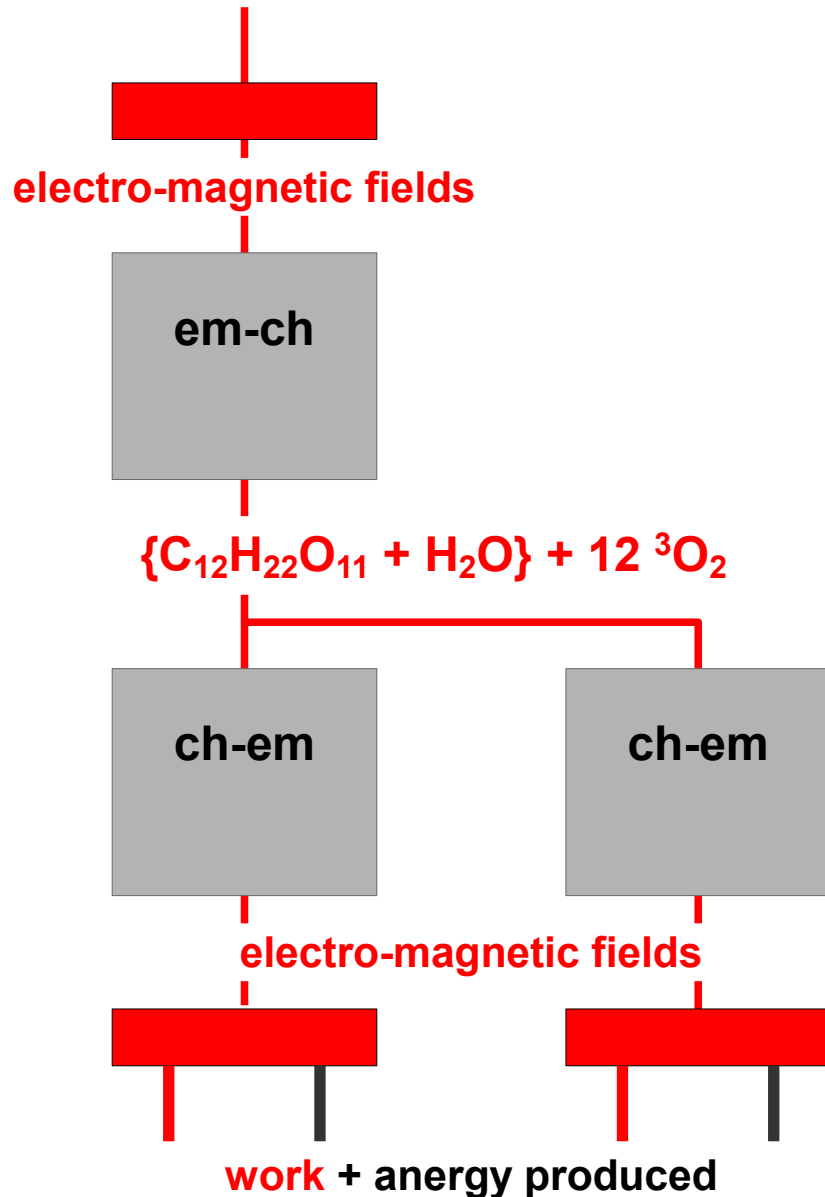
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# Thermodynamics of the Biological Energy System



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**sources for exergy:**  
**solar nuclear fusion-reactions**

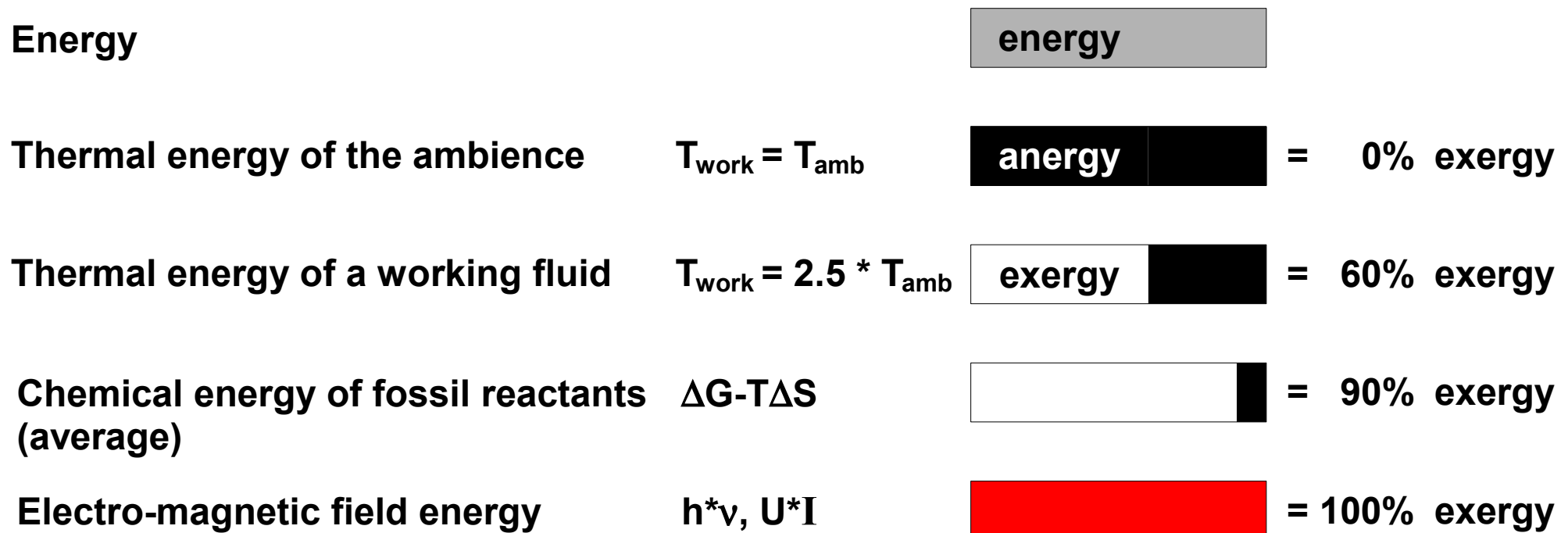
photosynthesis:  
= storage of electro-magnetic field exergy  
in electro-magnetic-to-chemical converters

surcrose = final product of field exergy storage

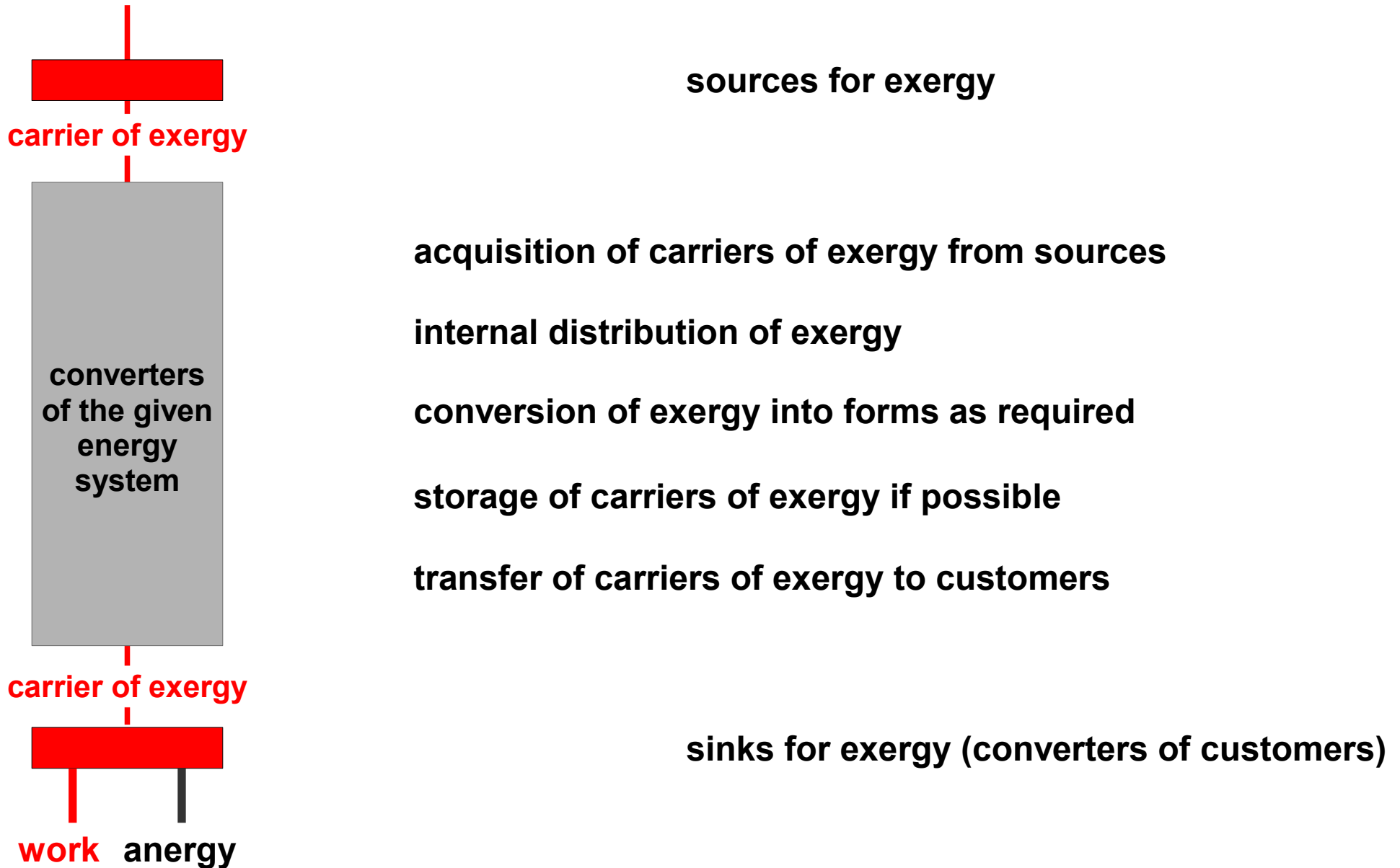
respiration:  
= release of electromagnetic field exergy in  
chemo-to-electro-magnetical converters

**sinks for exergy:**  
**organelles and organs**

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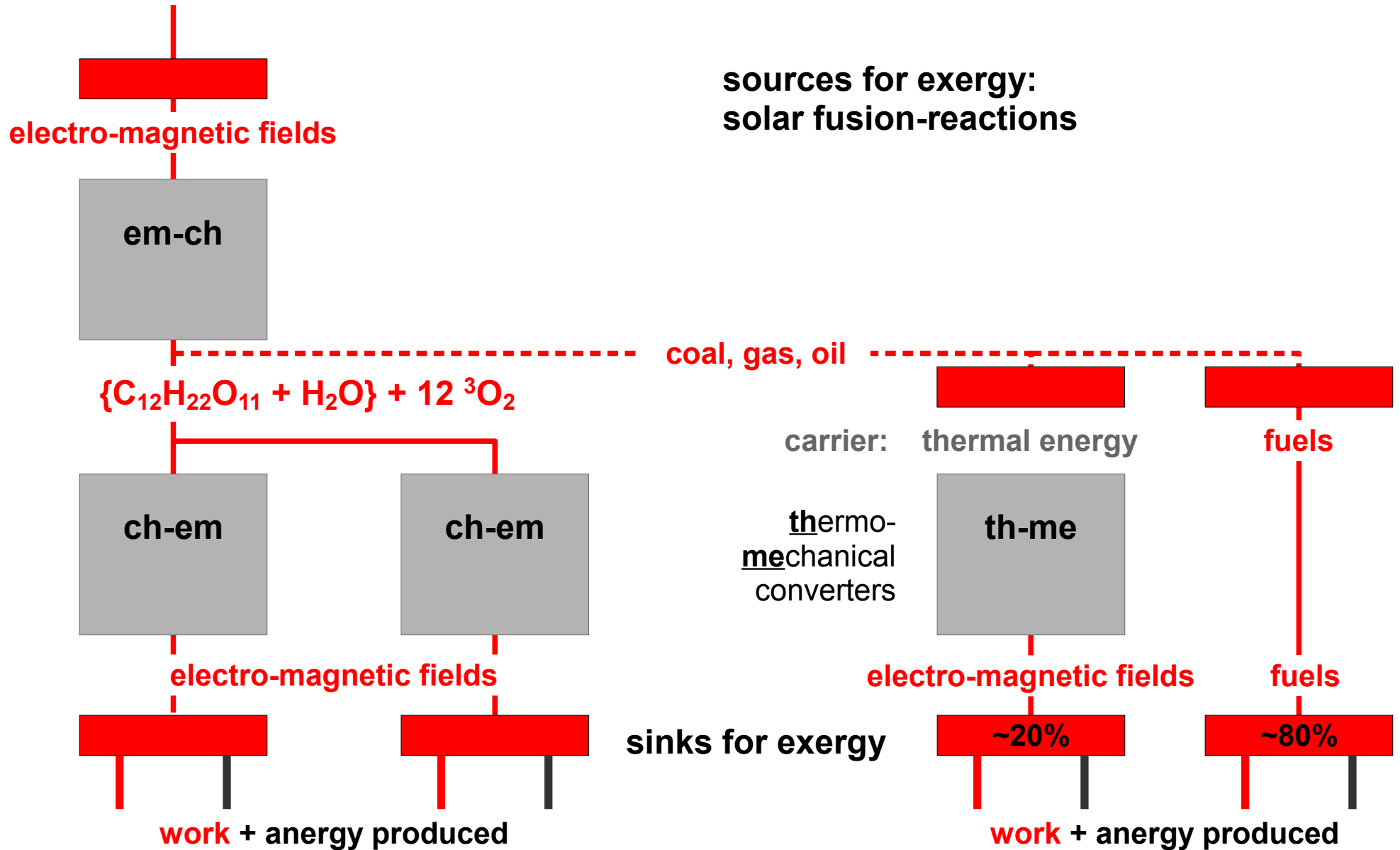
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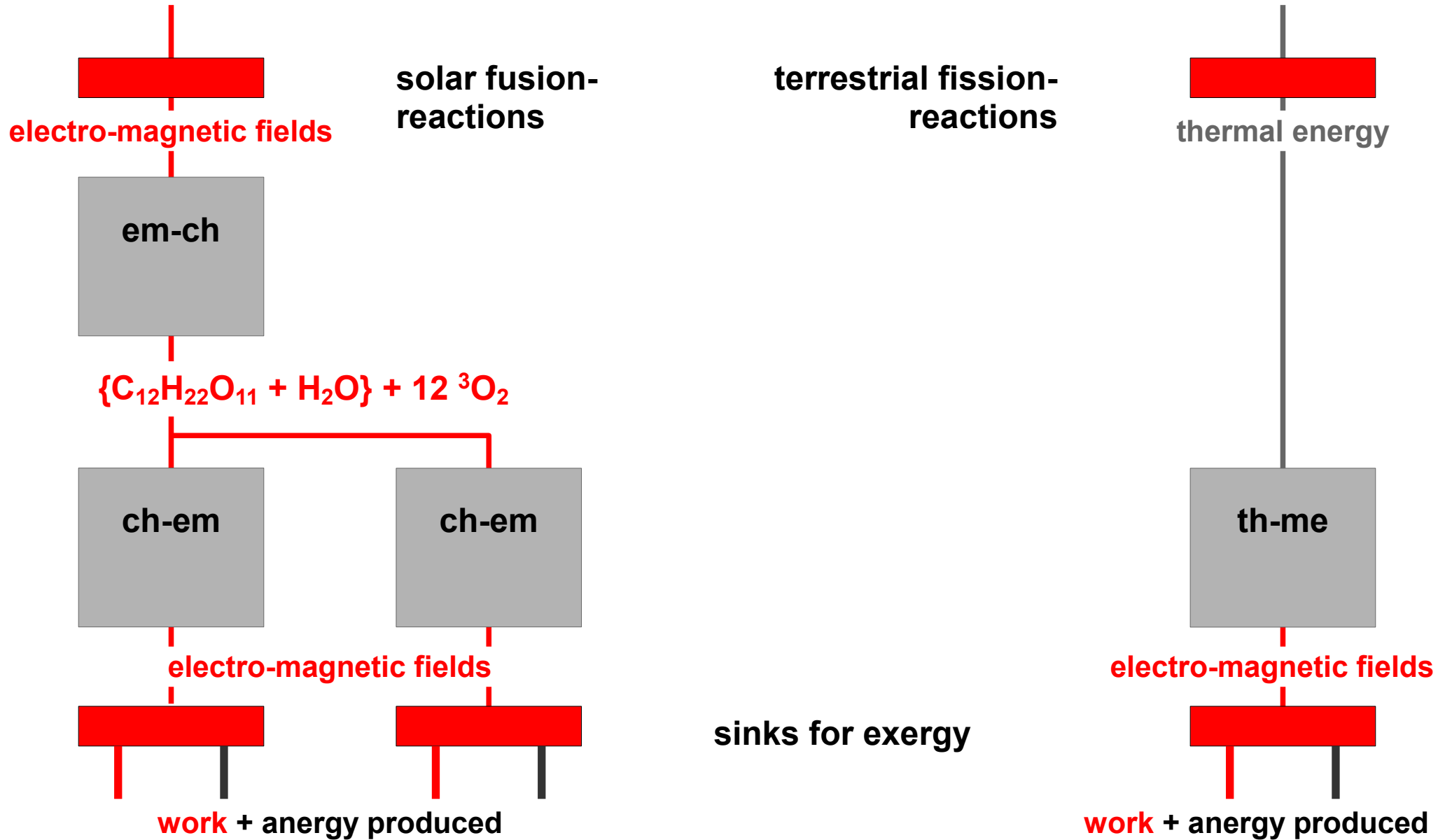
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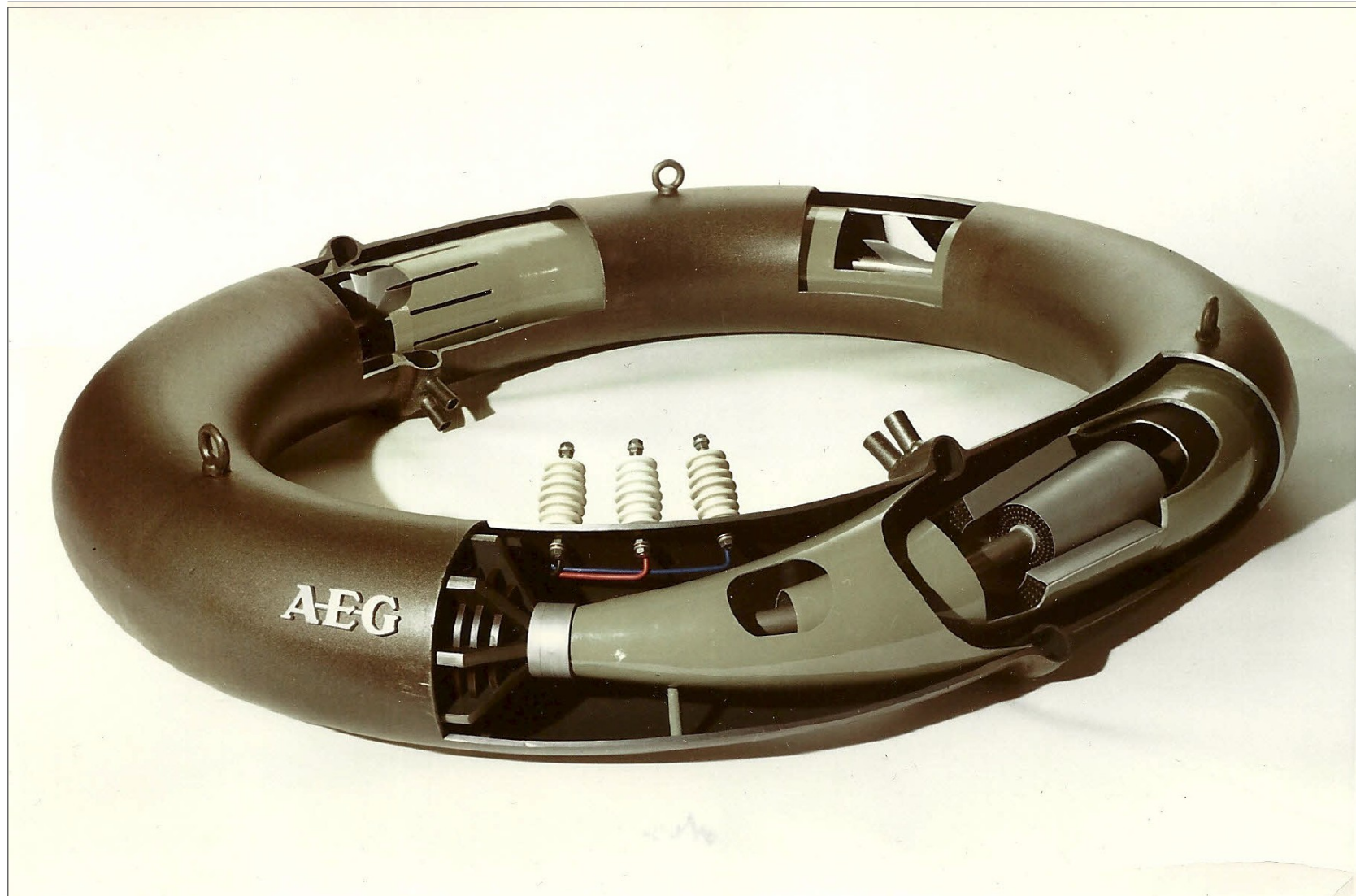
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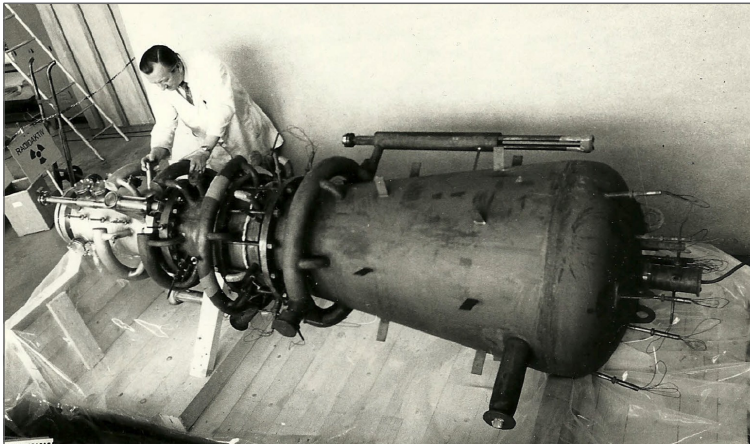
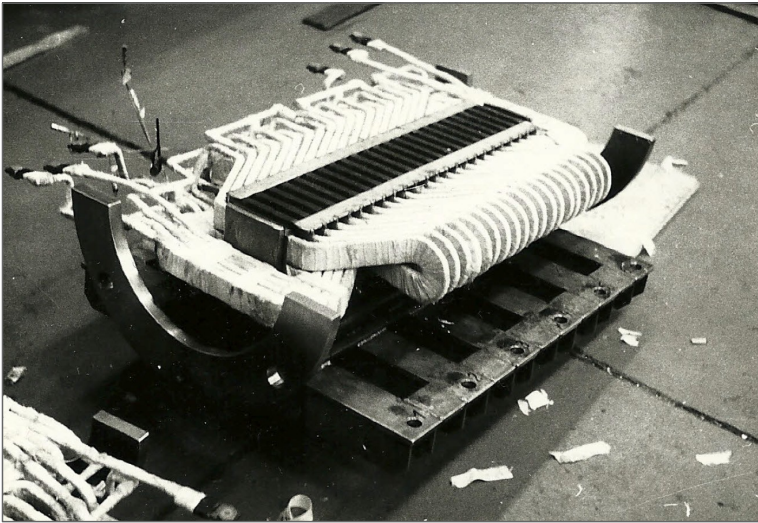
# Thermodynamics of the Biological Energy System





**Nuclear „MHD-Staustrahlrohr“ (MHD ram jet) for space applications (AEG)**

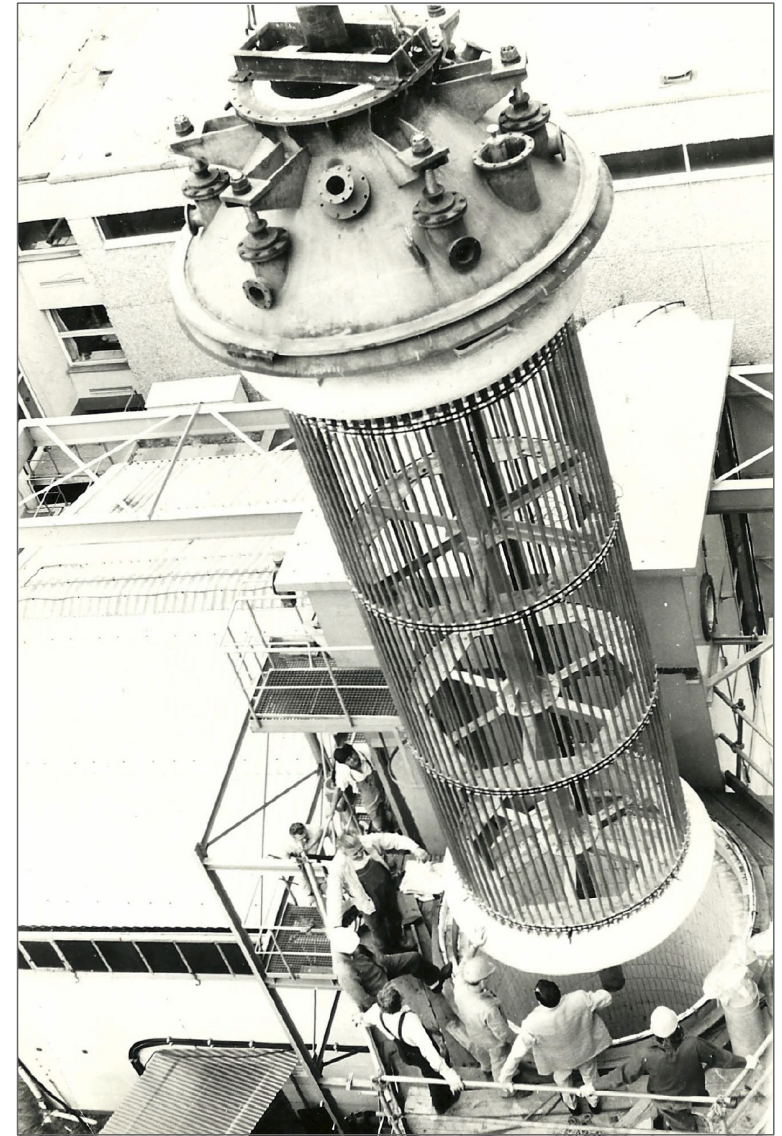
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## Liquid-metal MHD-System (AEG):

above: stator of inductive MHD-generator

below: thermodynamic drive for MHD-generator



Heater to replace nuclear fission reactor

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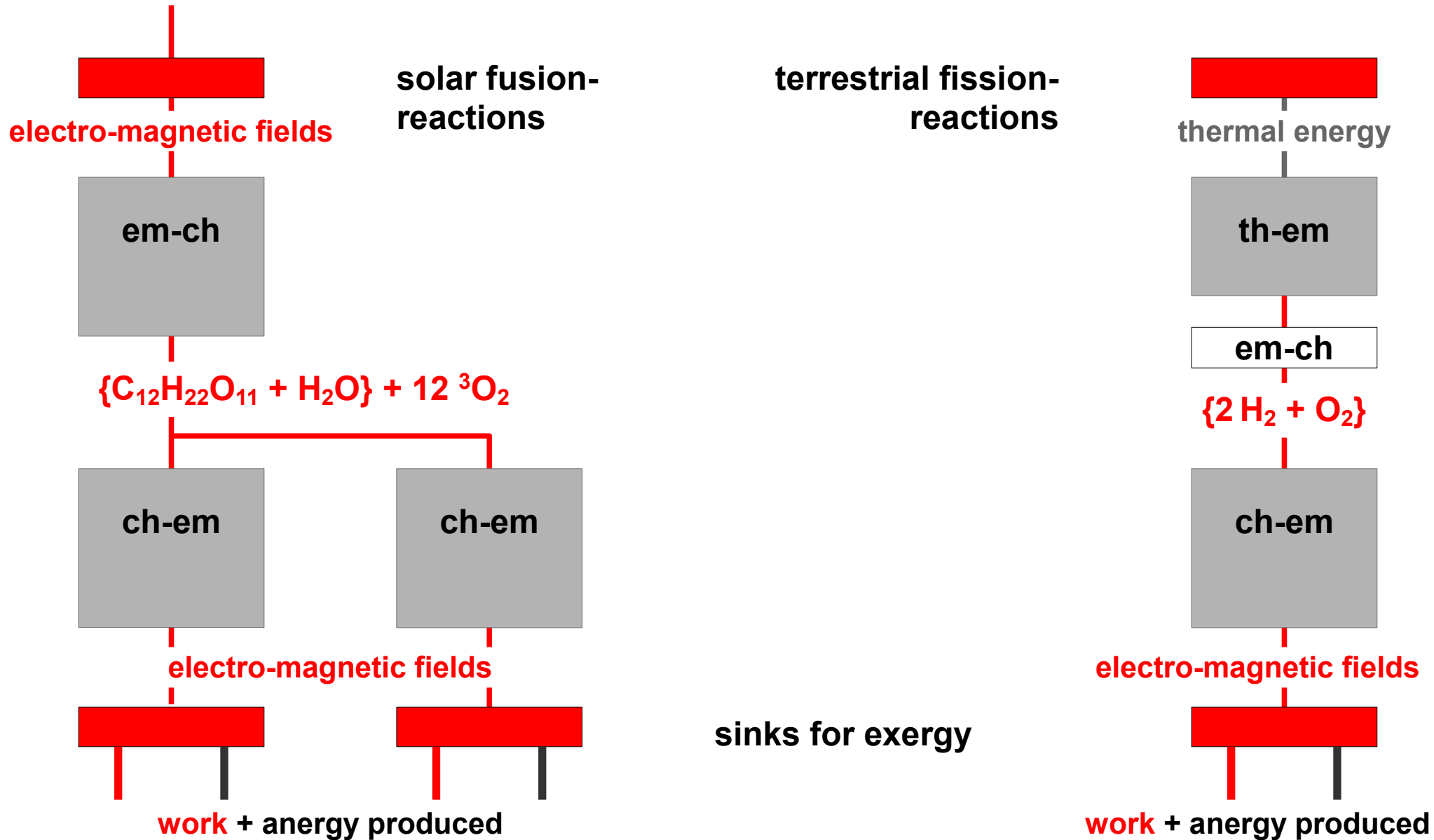
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## Assumptions :

Efficiency of nuclear power plant = 0,35

Efficiency of electrolysis = 0,65

Efficiency of 2 H<sub>2</sub>/O<sub>2</sub> fuel cells = 0,65

Overall efficiency of a full nuclear thermal-electric system (without radio-active waste management and H<sub>2</sub>-logistics)

= 0,15



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**“Power and water from sun and sea“, Sinai (Red Sea) (own Company)**

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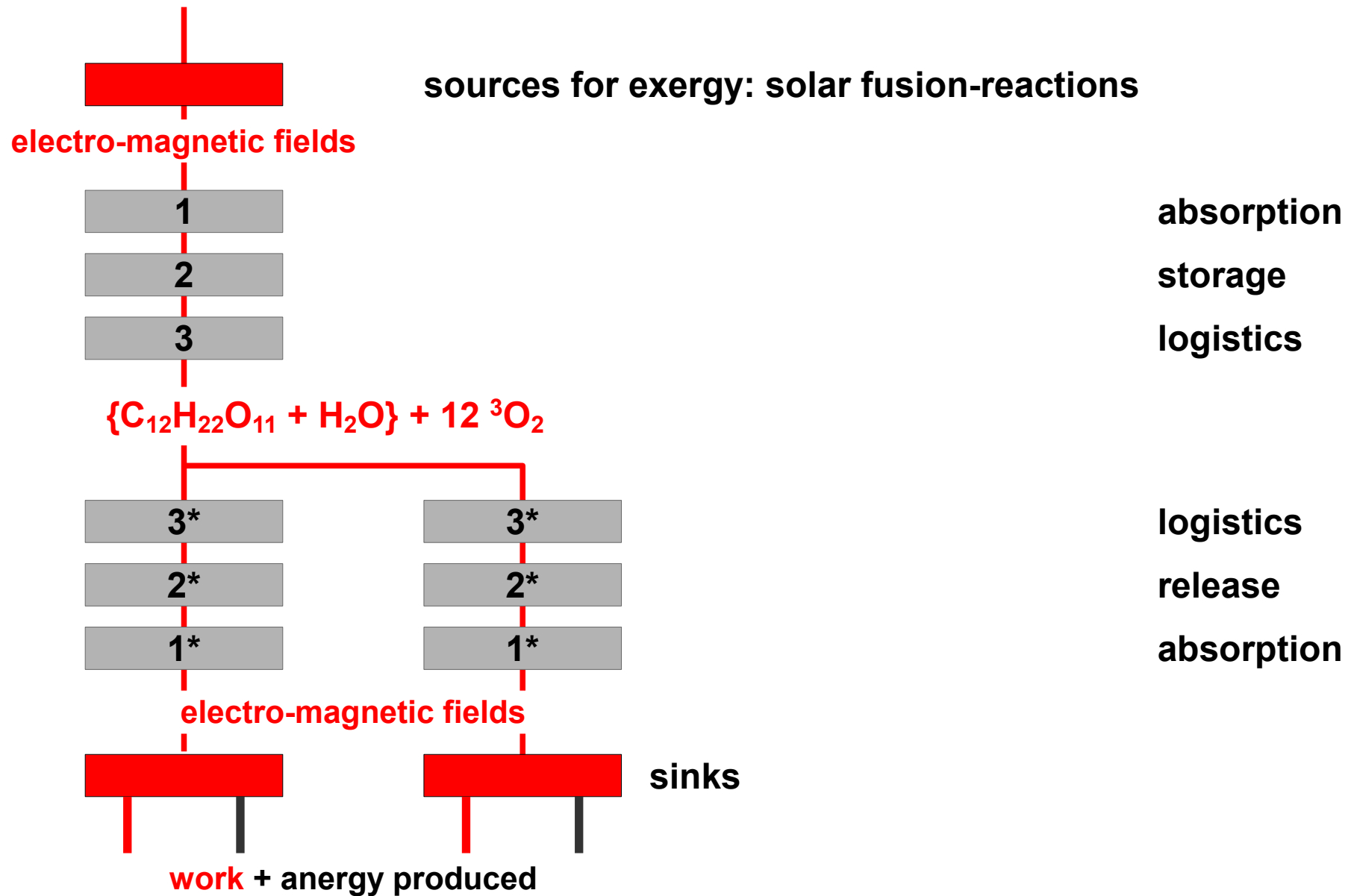
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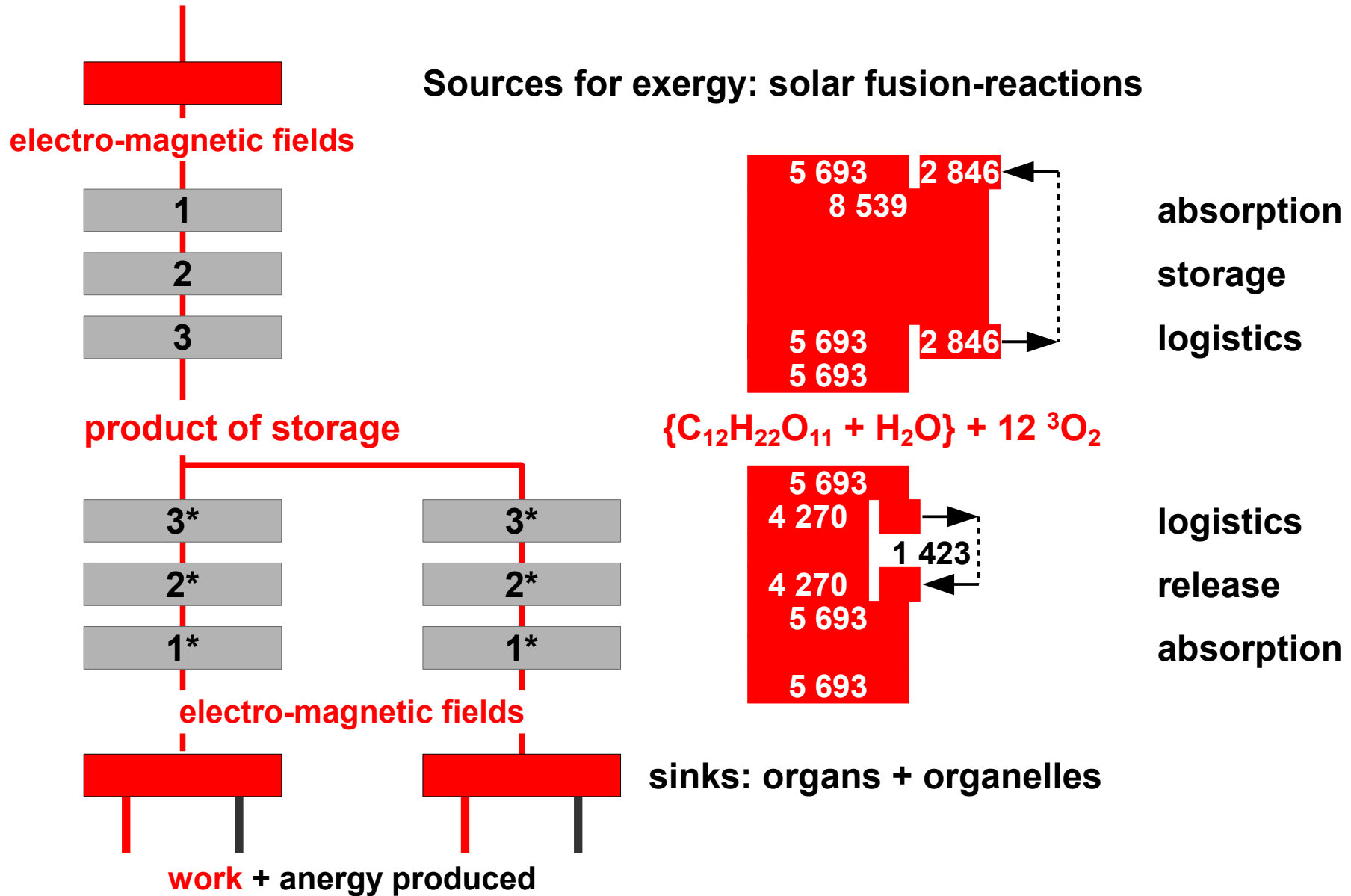
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Sources for exergy: solar fusion-reactions



fluxes of exergy in kJ/mol formula conversion

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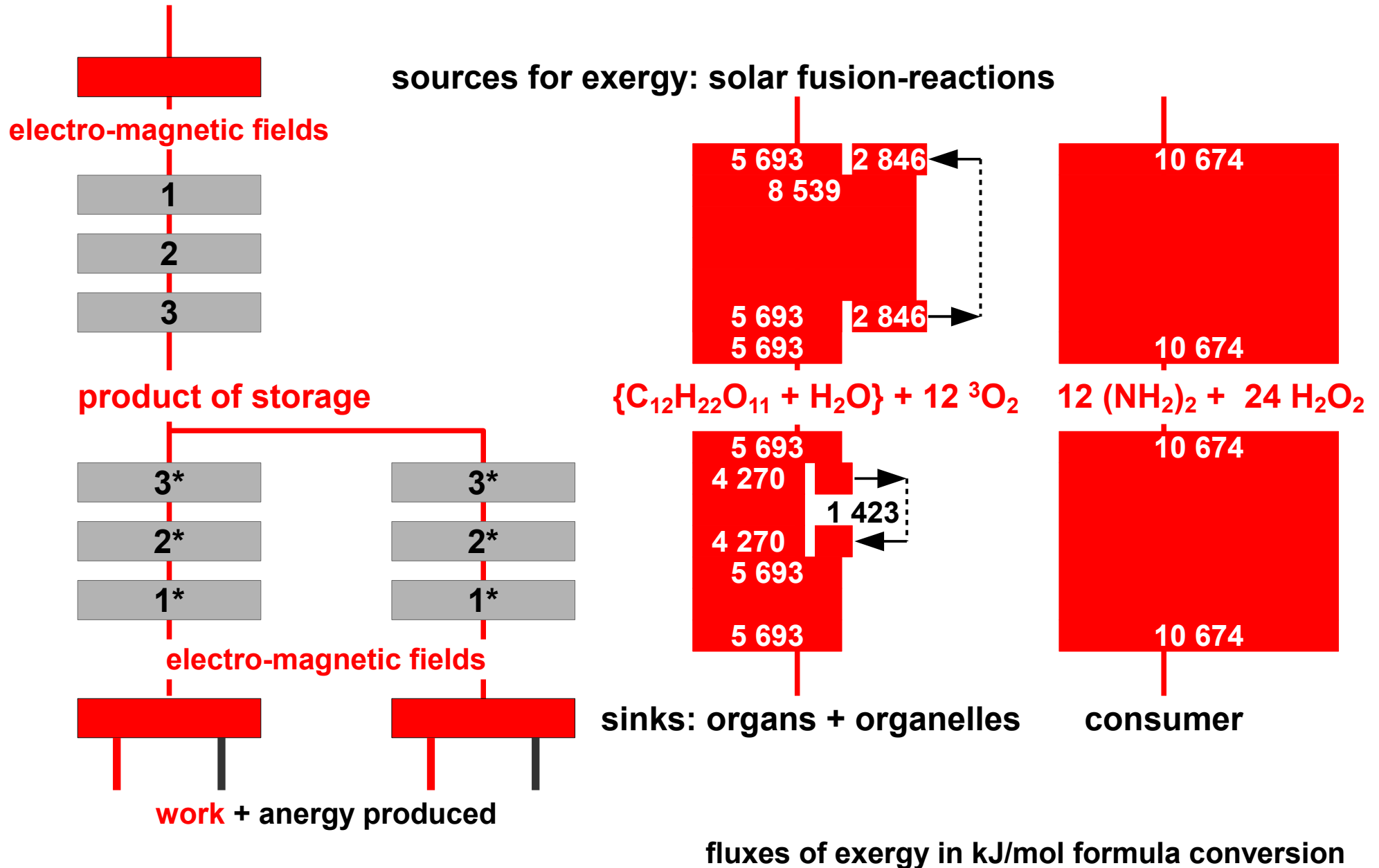
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## Summary:

- 1. A bionic energy system does not need to transfer and distribute oxygen O in the gaseous state of O<sub>2</sub> via the atmosphere like the biological energy system : In the contrary H<sub>2</sub>O<sub>2</sub> as a primary liquid product of redox-reactions transfers electro-magnetic field exergy in combination with 2H.**
- 2. Calculation of reaction data for the bionic system confirm the much higher flux of exergy, combined with an exergetic efficiency  $\varphi = 1,0$  .**
- 3. The bionic systems technical construction including (NH<sub>2</sub>)<sub>2</sub> / 2 H<sub>2</sub>O<sub>2</sub>-chemo-electric converters (fuel cells) will lower the exergetic efficiency to about 0,7 (much higher than any the terrestrial nuclear system because of its limitations by the Carnot-factor).**
- 4. The bionic energy system will be a modular, decentralized system, solving the CO<sub>2</sub>-problem as well as that of radio-active waste management.**

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**Thank You for Your Attention!**