Group Activity 2

Assessing Uranium Demand under Varying Nuclear Power Scenarios

5th Joint ICTP-IAEA Workshop on Physics and Technology of Innovative Nuclear Energy Systems, Trieste, Italy, 13-17 July 2026

When will innovative reactors with nuclear fuel (multi-)recycling be in demand?

Simplified reply: PWR technologies can work as long as there is enough uranium!

Task: to assess when the available uranium resources will run out with an increase in nuclear energy by only PWR technology deployment without nuclear fuel recycling.

Initial data: (1) Nuclear power growth projections and political requests,

(2) Identified recoverable uranium resources

Tool: NES Simulator (developed by IAEA INPRO)

It is suggested to assess three scenarios:

1) IAEA low (pessimistic) projection on growth of Nuclear Power Capacity

2) IAEA high (optimistic) projection on growth of Nuclear Power Capacity

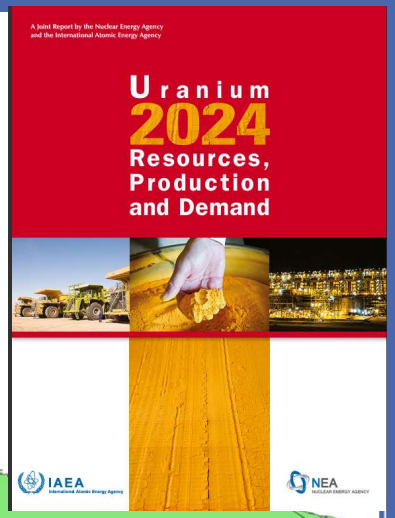
IAEA Projections (2024, RDS-1)	2025	2030		2040		2050	
Nuclear Electric Capacit,GW(e)		low	high	low	high	low	high
	377	**425**	**445**	**519**	**710**	**561**	**992**

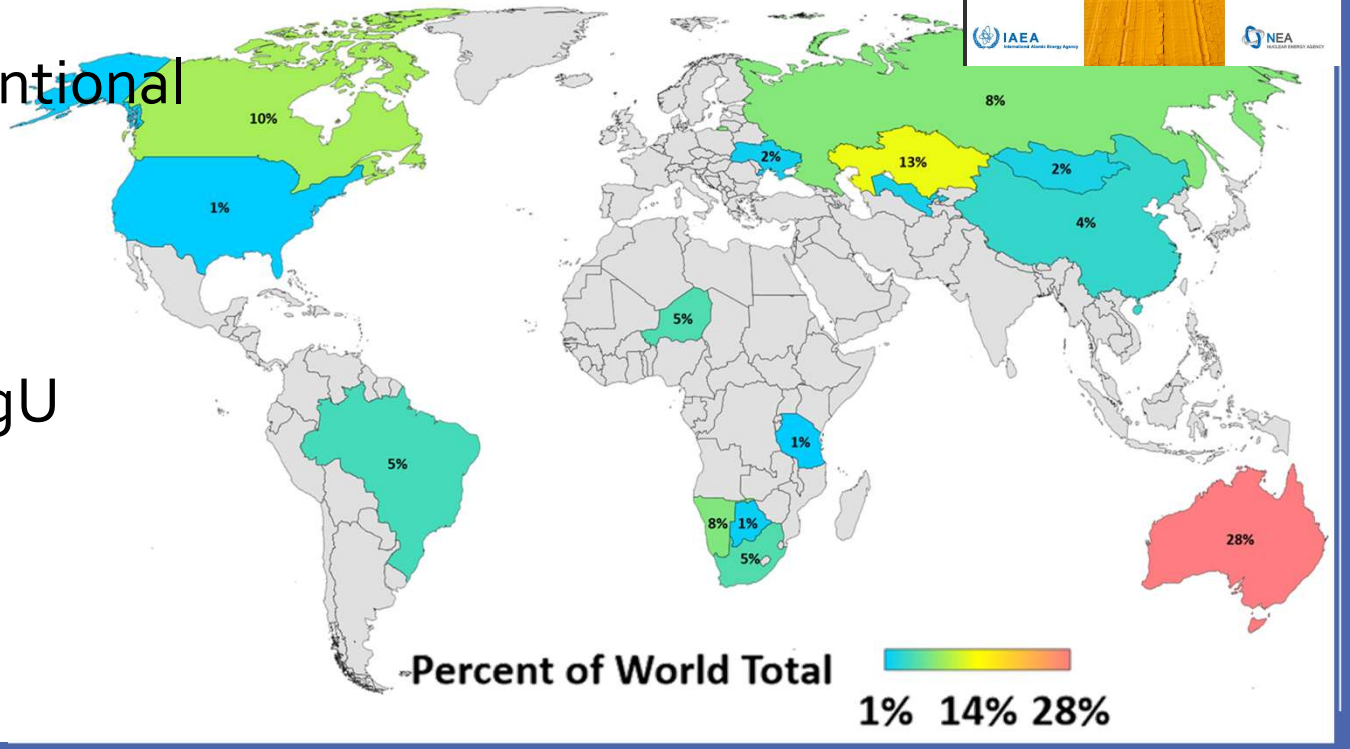
3) Call to triple nuclear power capacity by 2050 (COP 28)(reference capacity was 372 GW(e).

Global distribution of identified recoverable conventional uranium resources (<USD 130/kgU as of 1 January 2023)

5 925 700 tons of uranium – identified recoverable conventional resources <USD 130/kgU

7 934 500 tons of uranium – resources with <USD 260/kgU

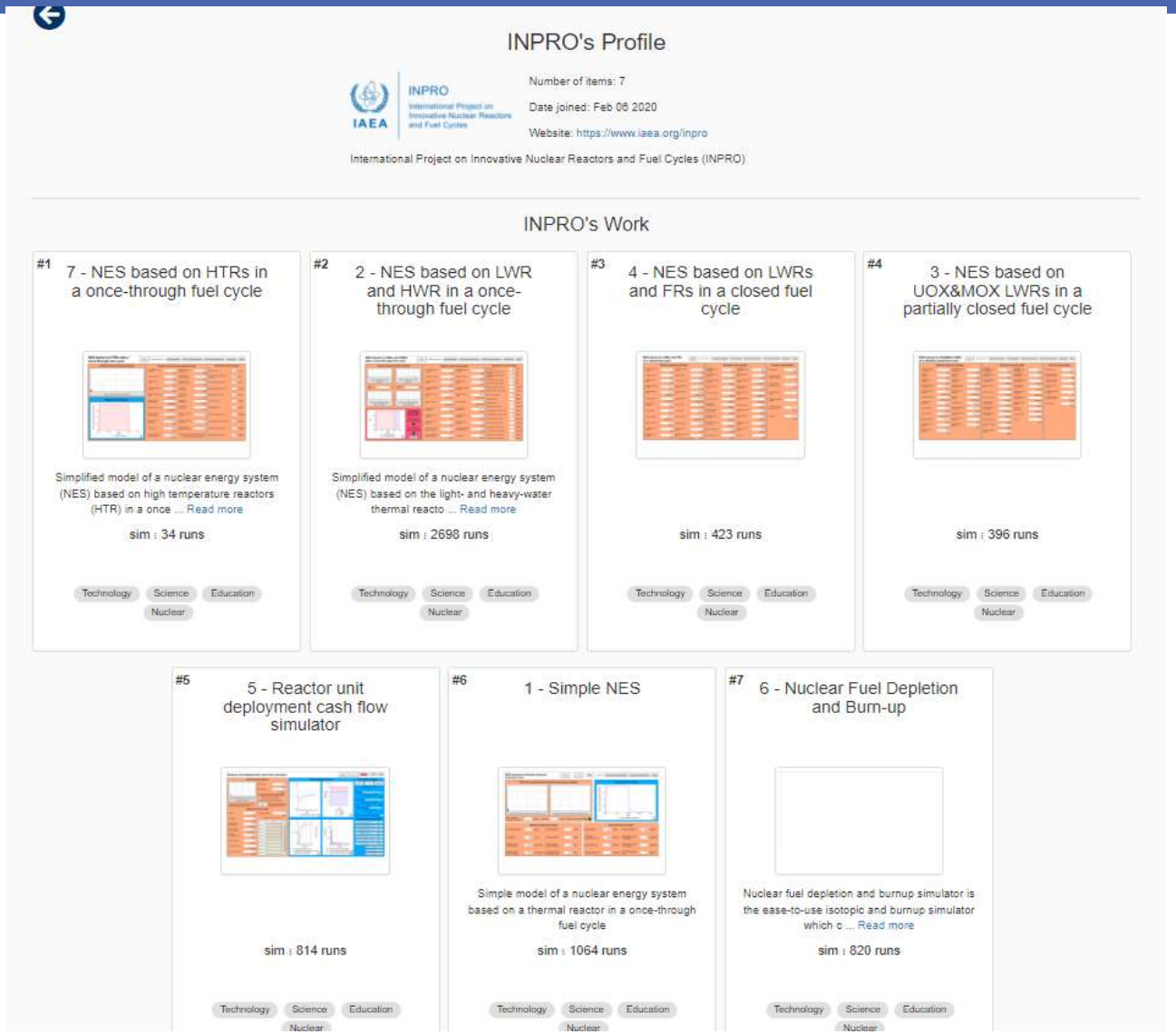




Tool:

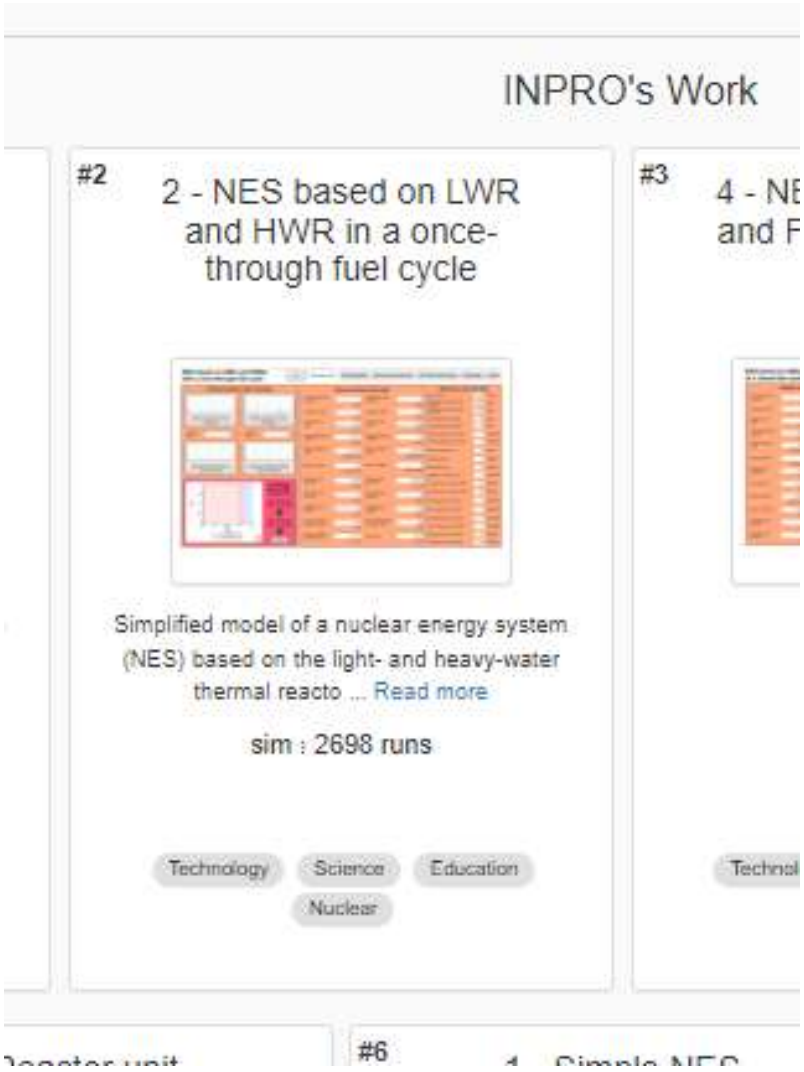
INPRO NES Simulators

https://exchange.iseesystems.com/profile/12288

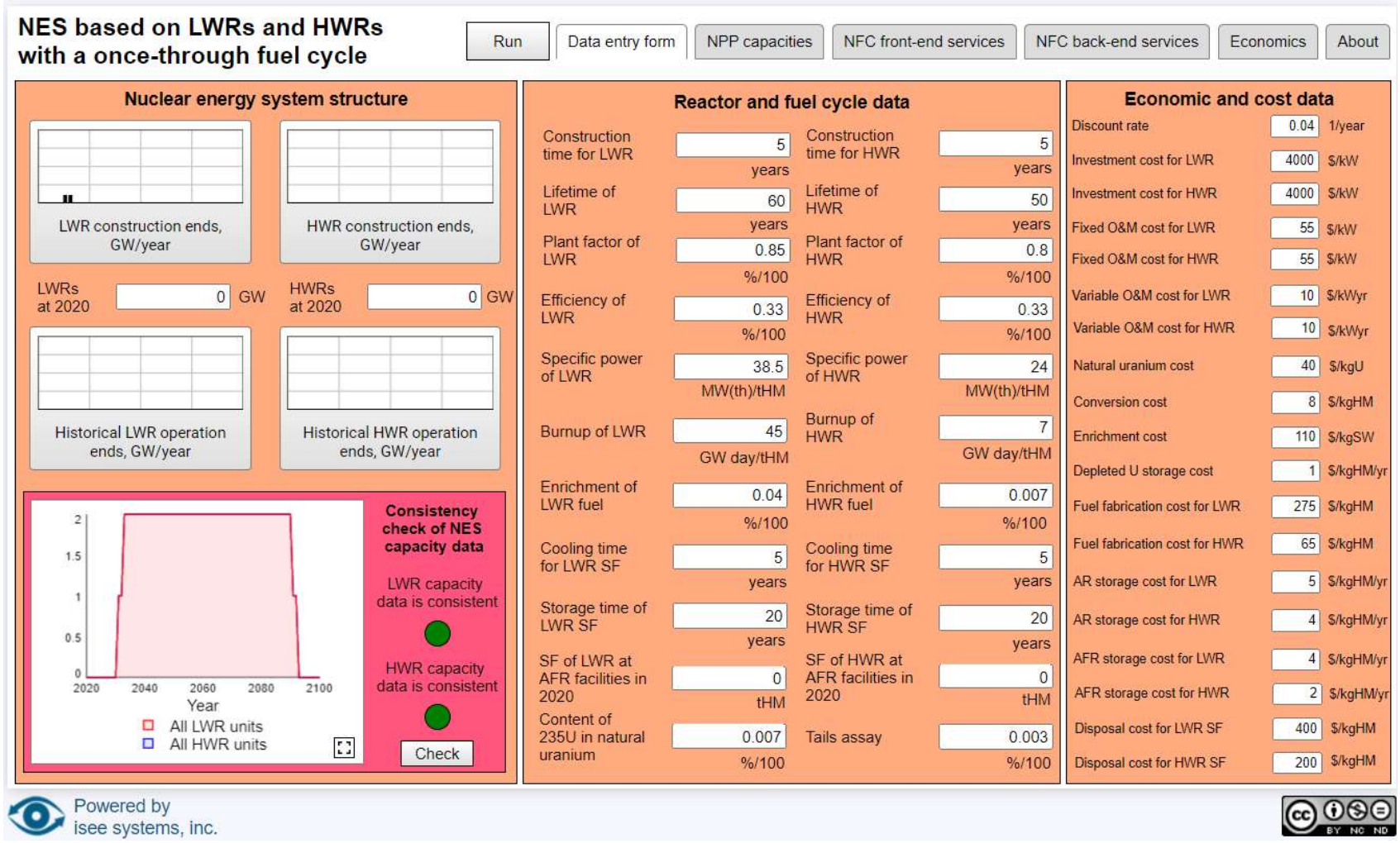


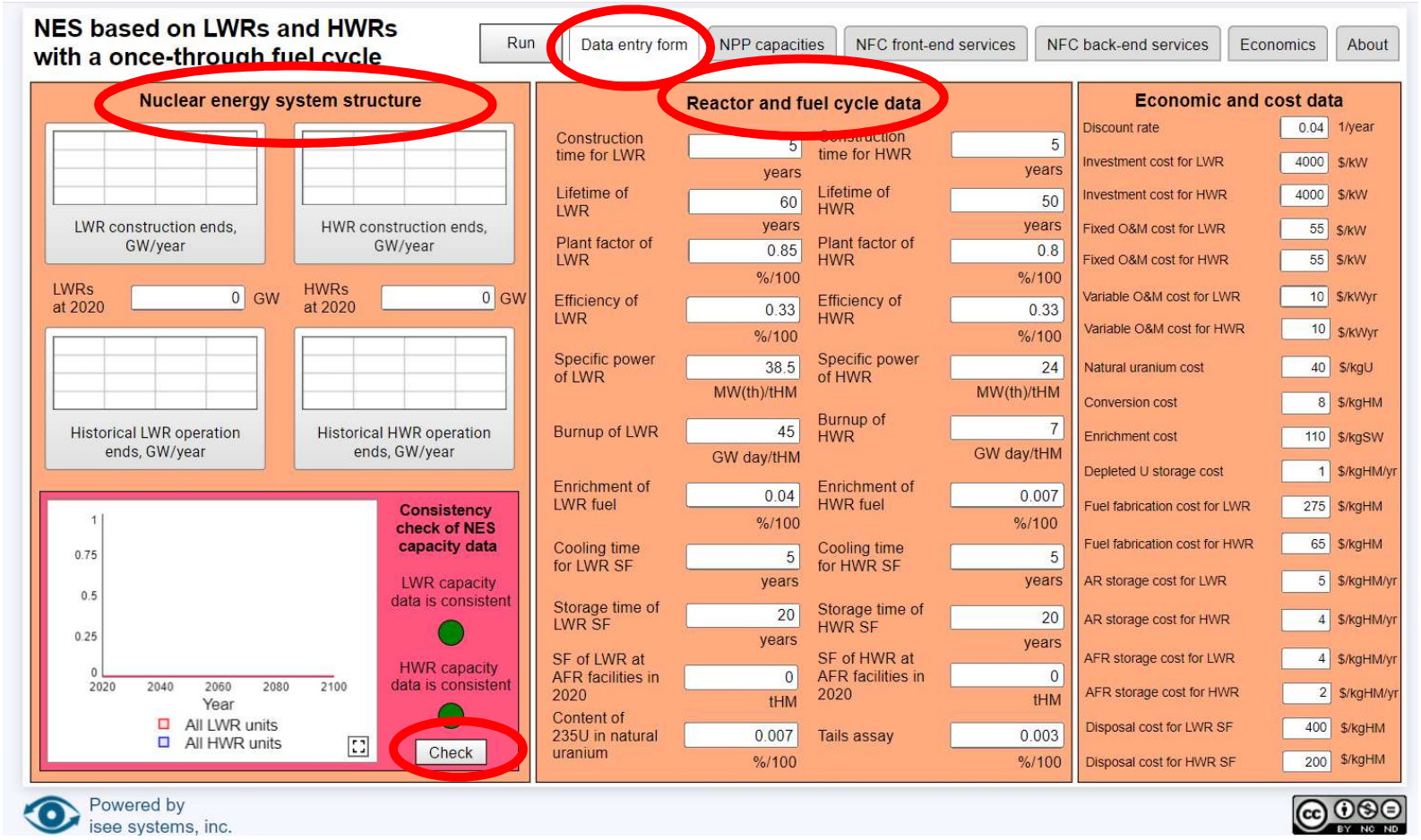
NES Simulator #2

Nuclear Energy System based on LWR and HWR in a once-through fuel cycle



NES Simulator 1 - Inputs




NES based on LWRs and HWRs with a once-through fuel cycle
Run
Data entry form
NPP capacities
NFC front-end services
NFC back-end services
Economics
About
Nuclear energy system structure
LWR construction ends, GW/year
HWR construction ends, GW/year
LWRs at 2020
0
GW
HWRs at 2020
0
GW
Historical LWR operation ends, GW/year
Historical HWR operation ends, GW/year
1
0.75
0.5
0.25
0
2020
2040
2060
2080
2100
Year
All LWR units
All HWR units
Consistency check of NES capacity data
LWR capacity data is consistent
HWR capacity data is consistent
Check
Reactor and fuel cycle data
Construction time for LWR
5
years
Construction time for HWR
5
years
Lifetime of LWR
60
years
Lifetime of HWR
50
years
Plant factor of LWR
0.85
%/100
Plant factor of HWR
0.8
%/100
Efficiency of LWR
0.33
%/100
Efficiency of HWR
0.33
%/100
Specific power of LWR
38.5
MW(th)/tHM
Specific power of HWR
24
MW(th)/tHM
Burnup of LWR
45
GW day/tHM
Burnup of HWR
7
GW day/tHM
Enrichment of LWR fuel
0.04
%/100
Enrichment of HWR fuel
0.007
%/100
Cooling time for LWR SF
5
years
Cooling time for HWR SF
5
years
Storage time of LWR SF
20
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Storage time of HWR SF
20
years
SF of LWR at AFR facilities in 2020
0
tHM
SF of HWR at AFR facilities in 2020
0
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Content of 235U in natural uranium
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Fuel fabrication cost for LWR
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Fuel fabrication cost for HWR
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AR storage cost for LWR
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4
$/kgHM/yr
AFR storage cost for HWR
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Disposal cost for HWR SF
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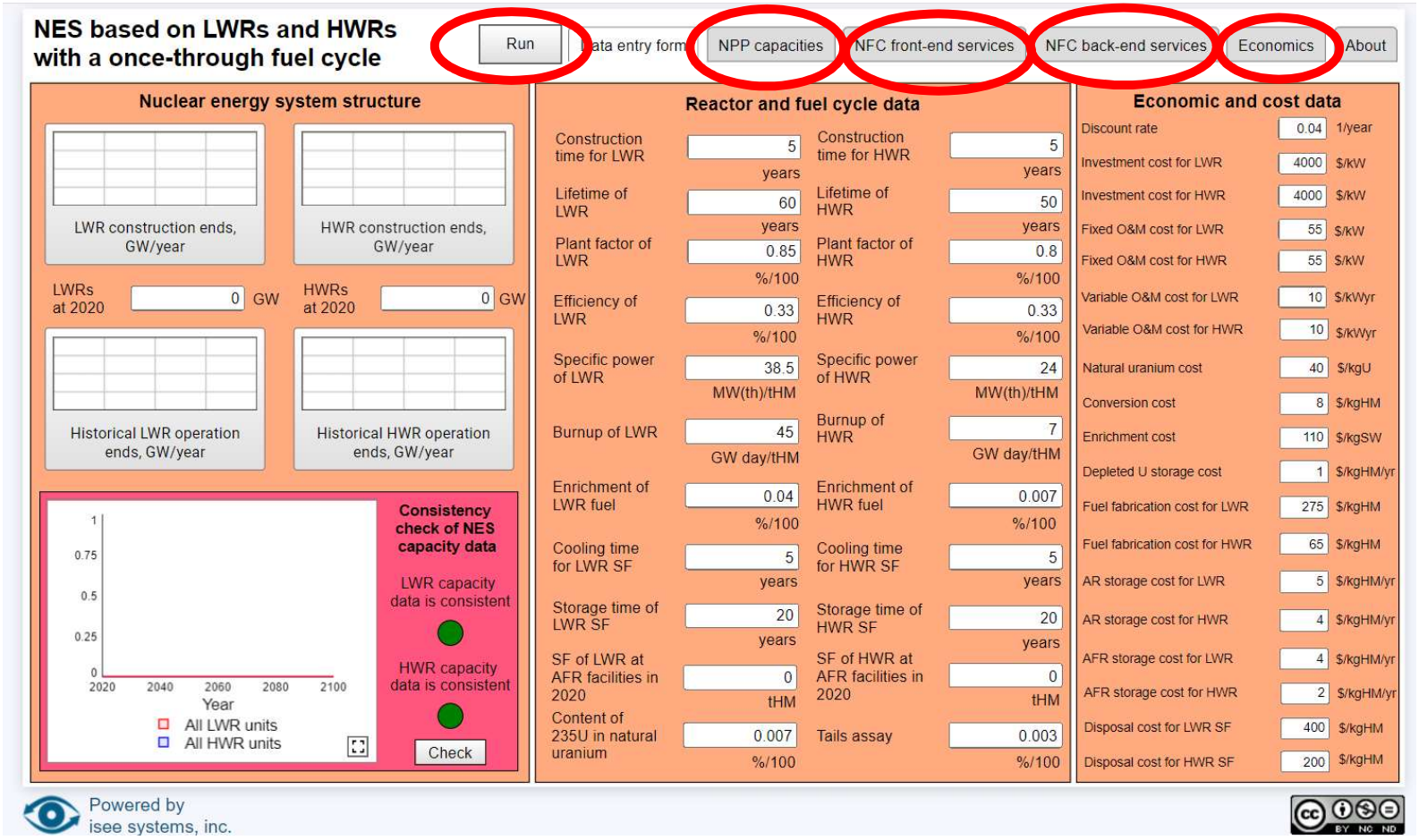
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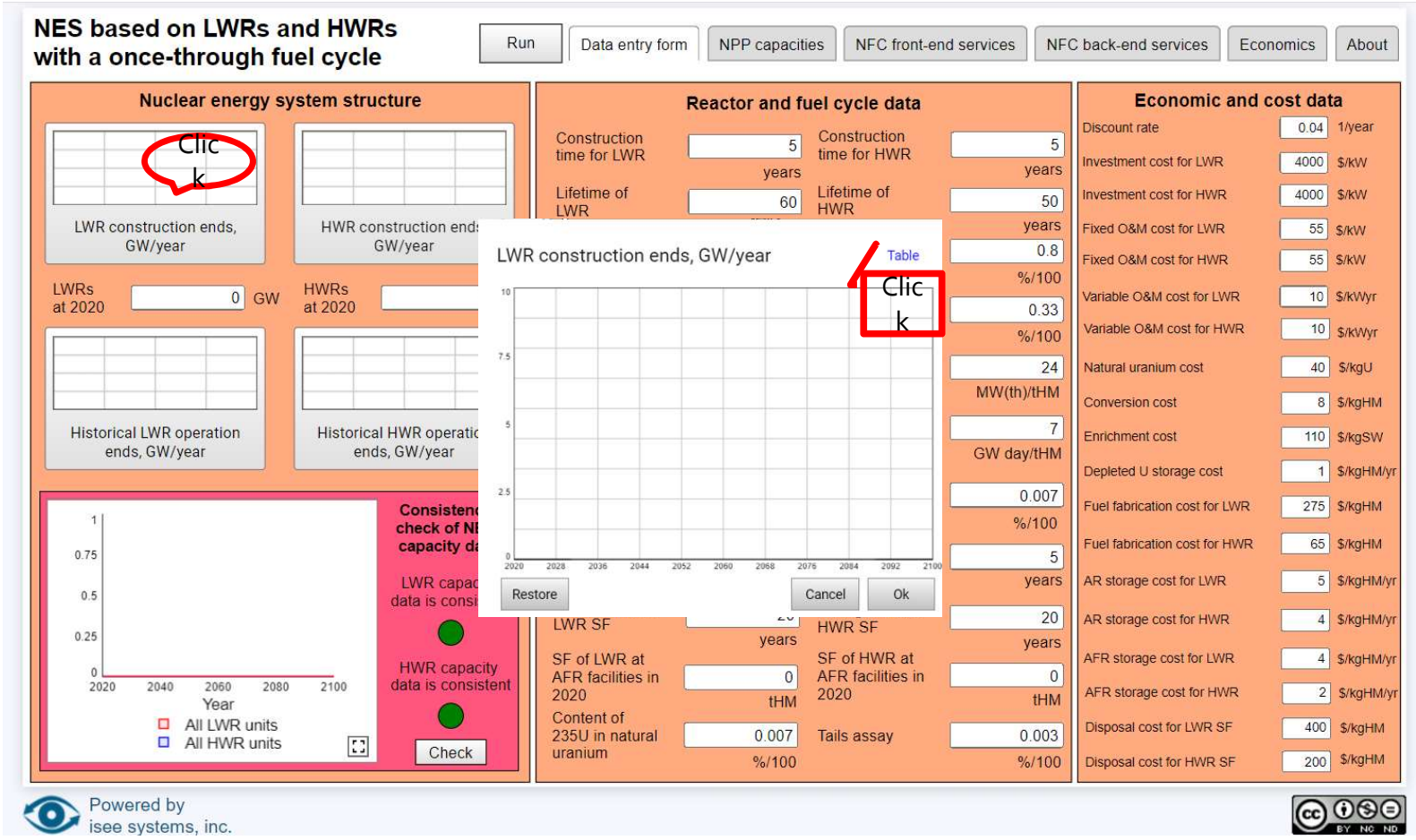
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Table
Click
Restore
Cancel
Ok
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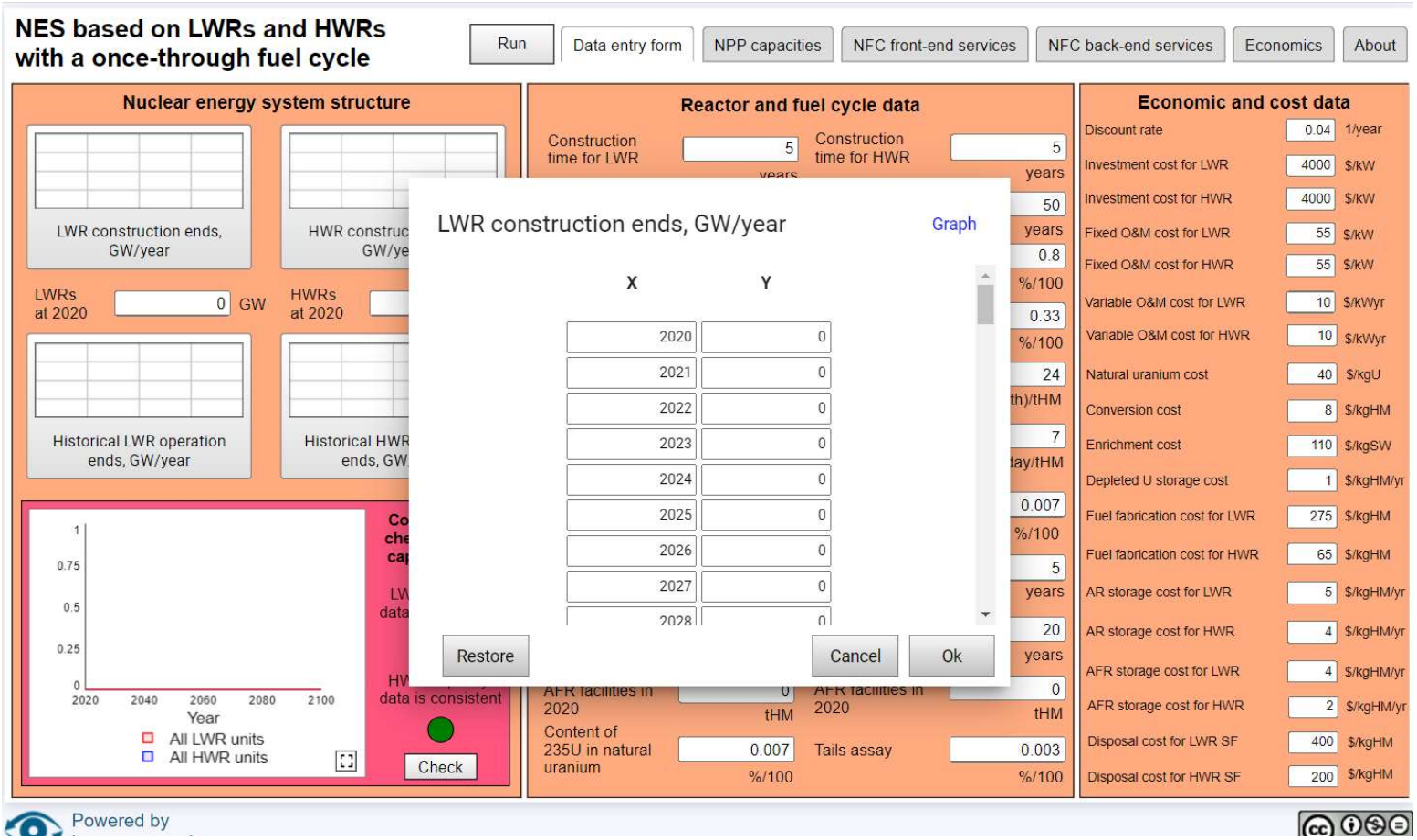
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X
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2021 0
2022 0
2023 0
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2028 0
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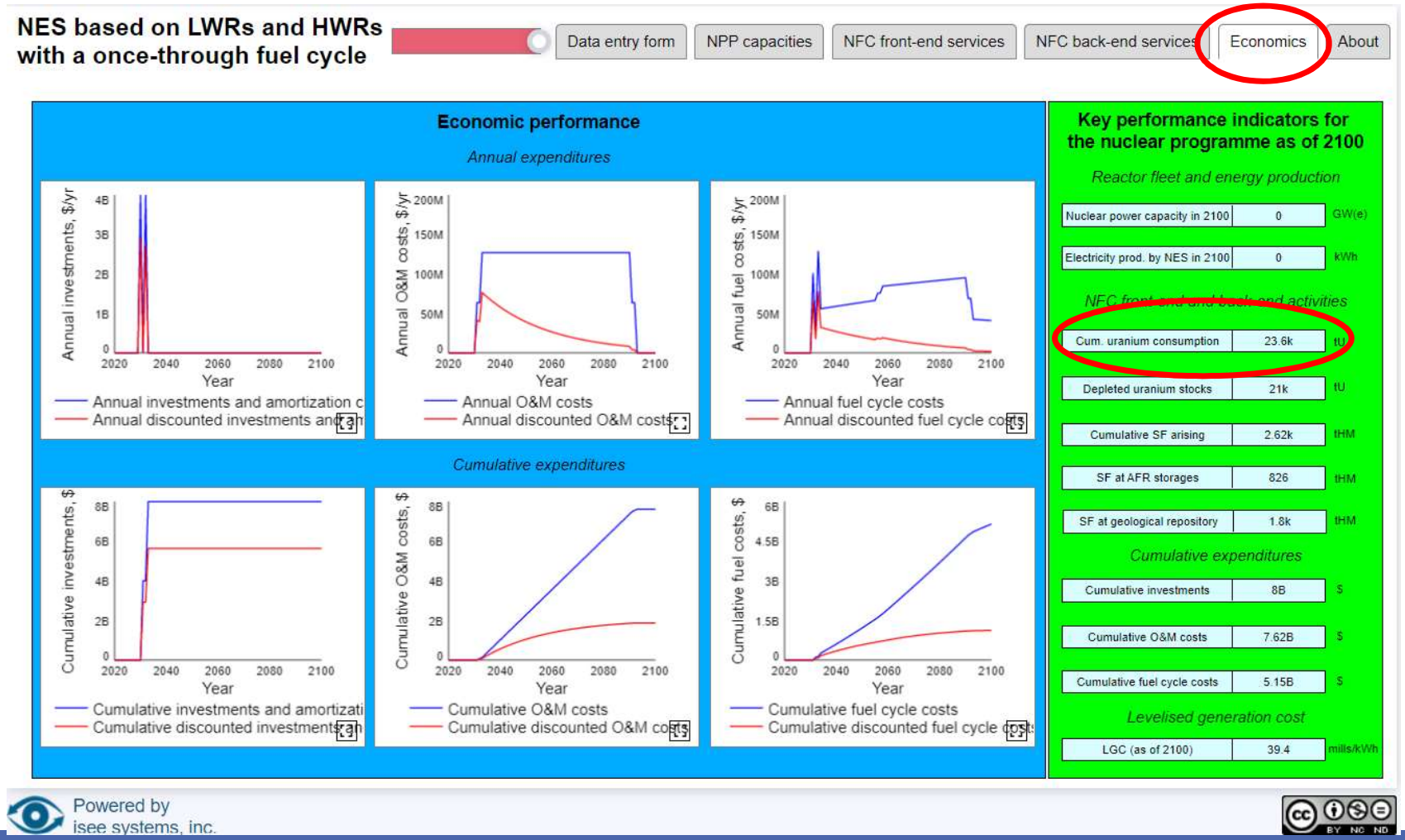
NES Simulator 1 – Results
Front end Material Flows

NES Simulator 1 – Results
Economic Performance



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