

**The interactive model for quantitative assessment of  
nuclear energy system.**

**Code DESAE and modernisation for DESAE-2.2**

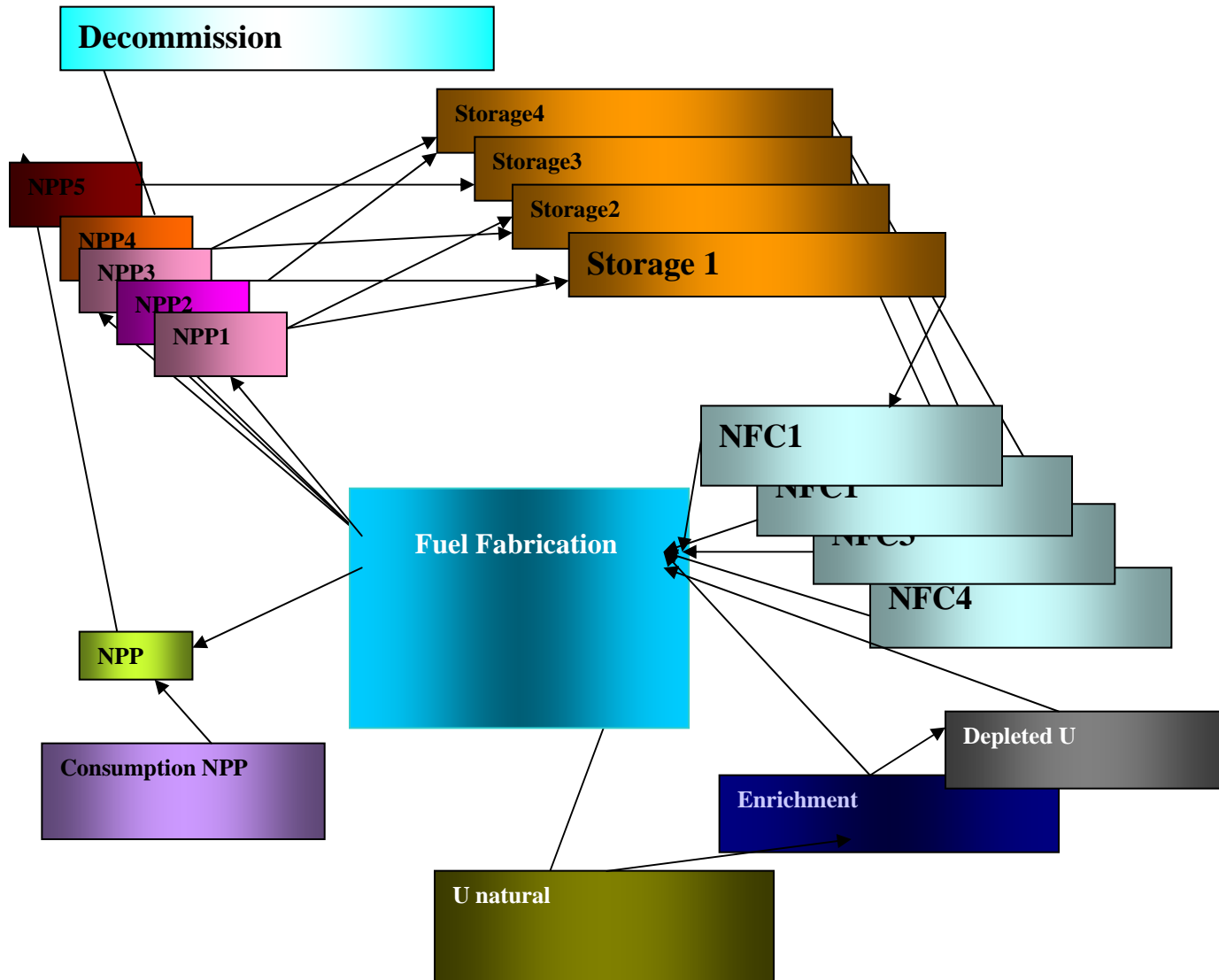
**(Dynamic of Energy System – Atom ic Energy created by unk groups)**

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# The block diagram of mathematical model

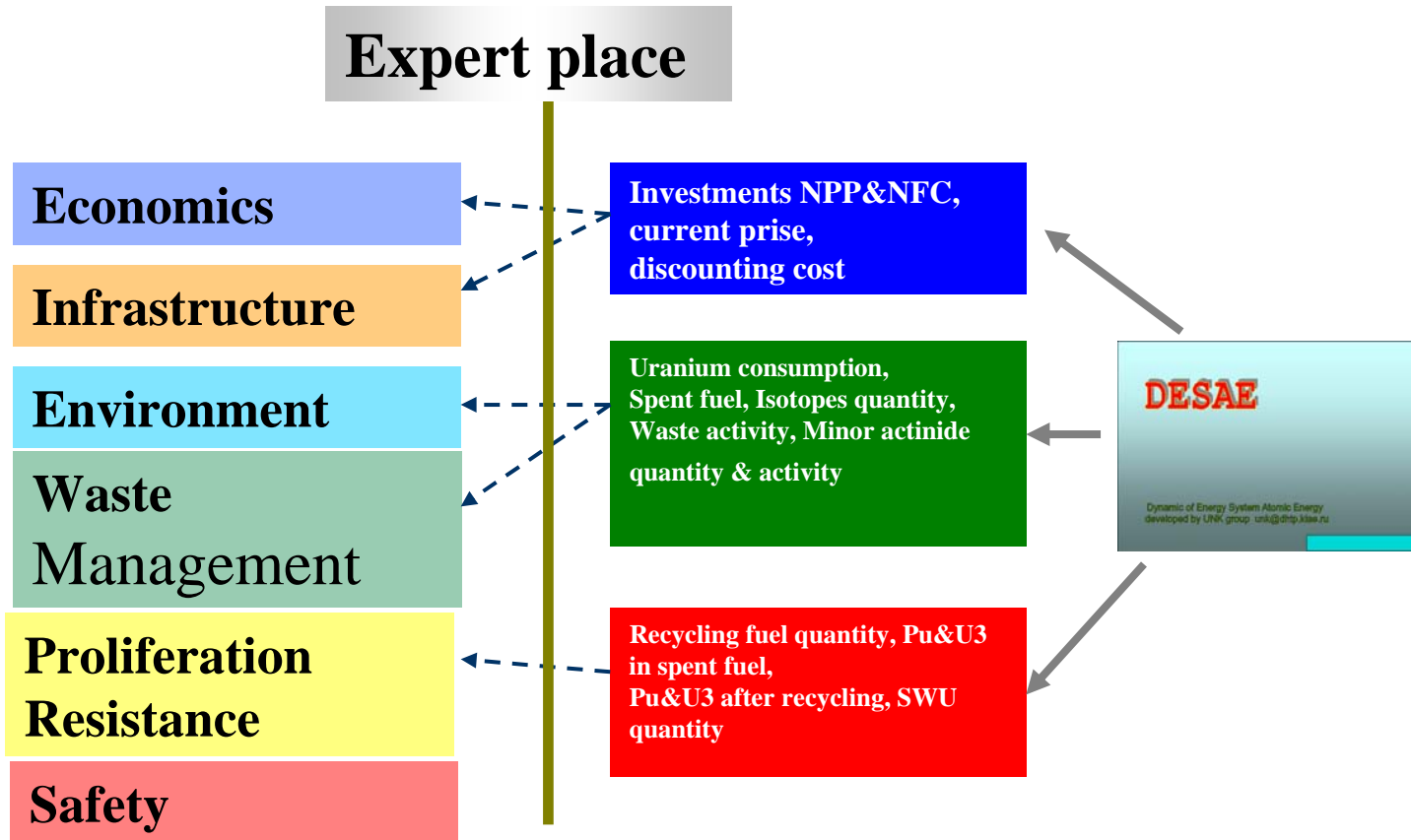


# The main tasks

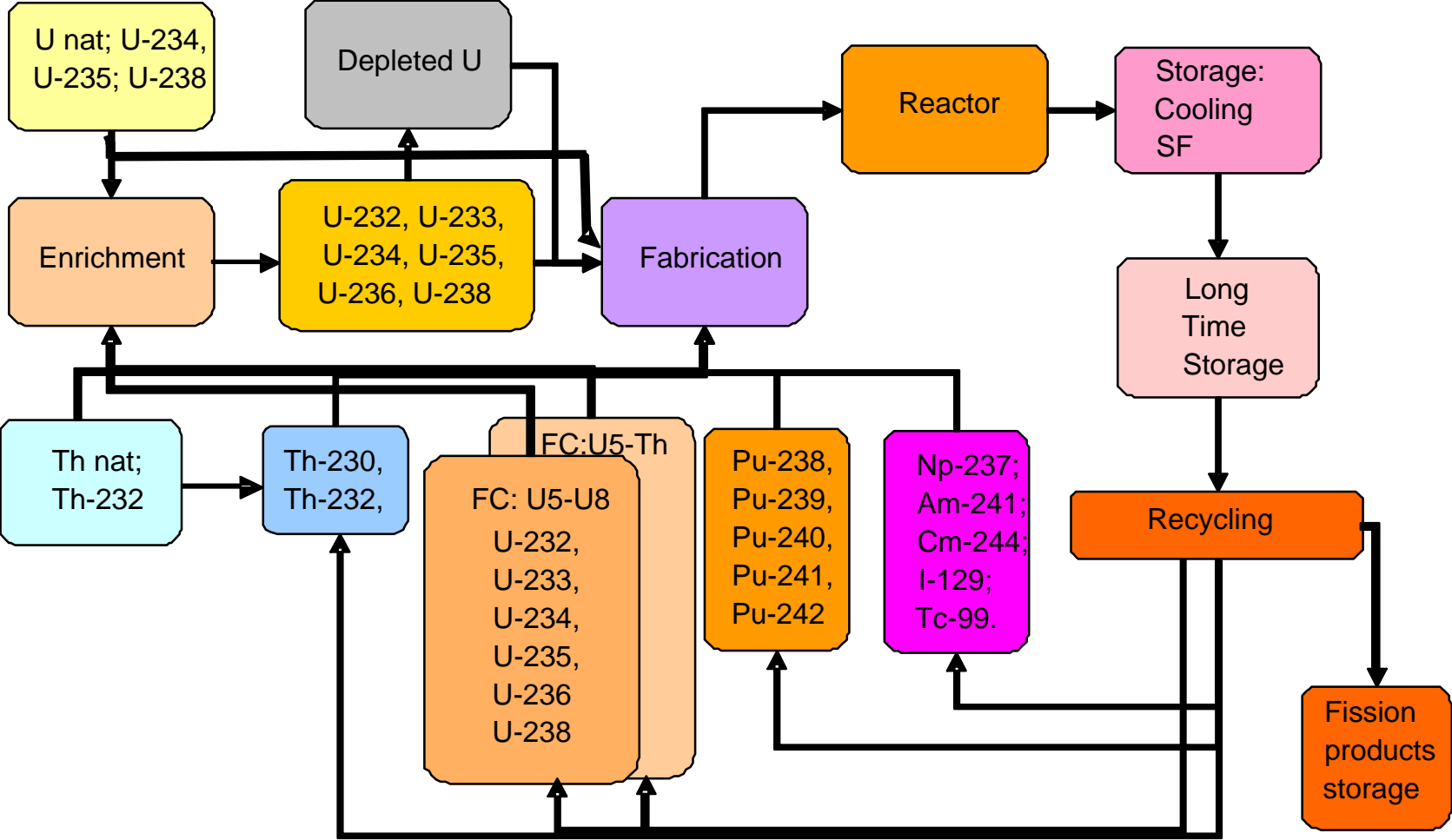


- 1) Calculations of material and economic resources for development AE.**
- 2) Comparison of various reactor types.**
- 3) Research of the closed fuel cycle.**
- 4) Comparison of NE structure for various regions.**
- 5) Definition of the most important for system the reactor characteristics.**
- 6) Definition of various factors of sensitivity (prices, time delay ...).**

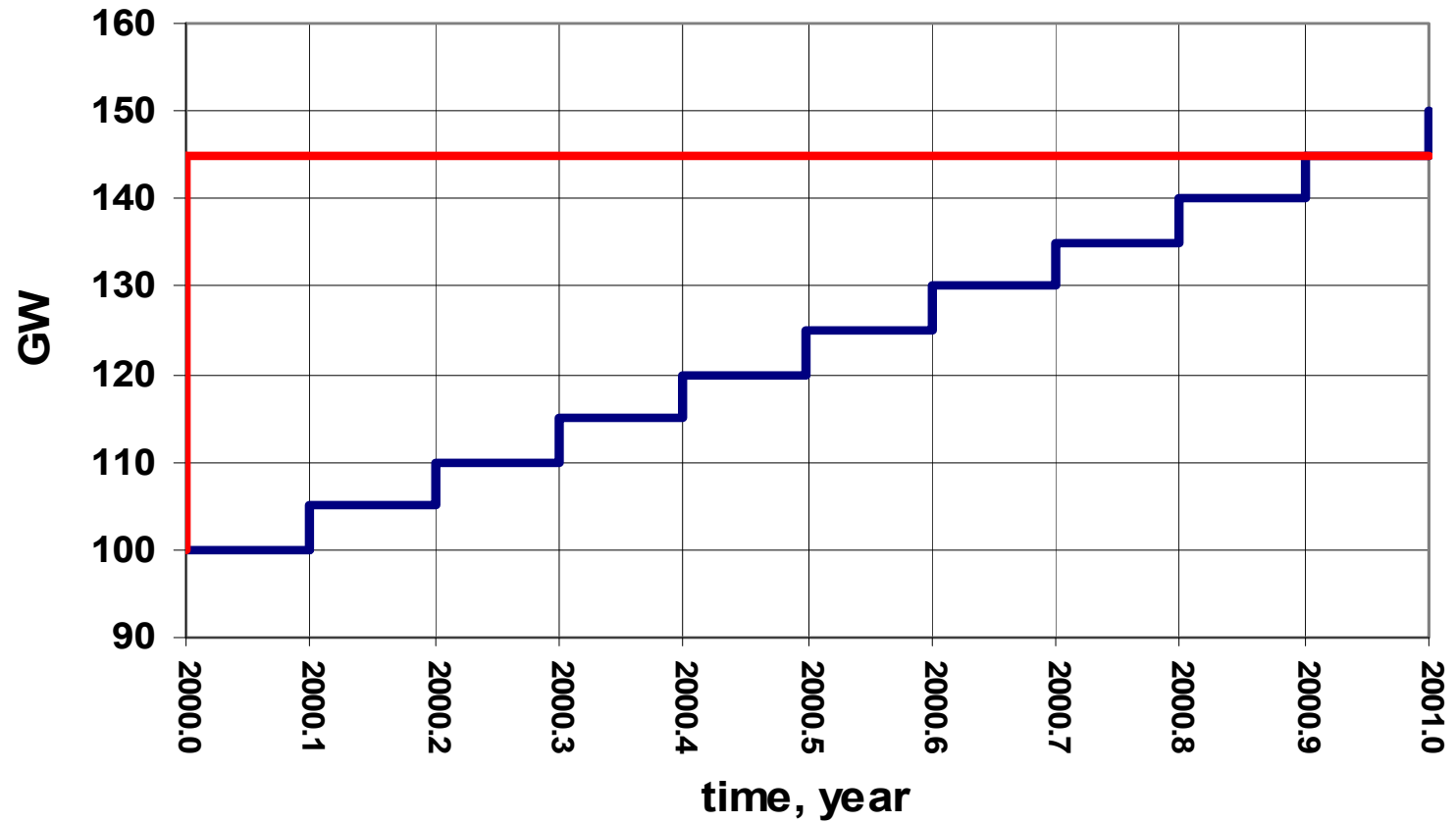
# DESAE code in INPRO methodology



# DESAE: Isotope flow scheme



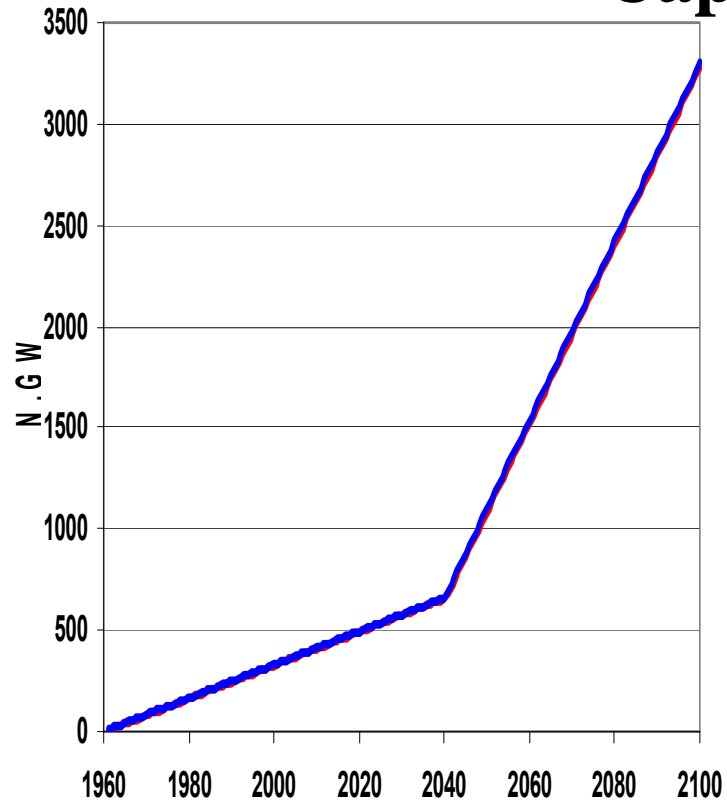
# DESAE: Two methods of capacity buildup



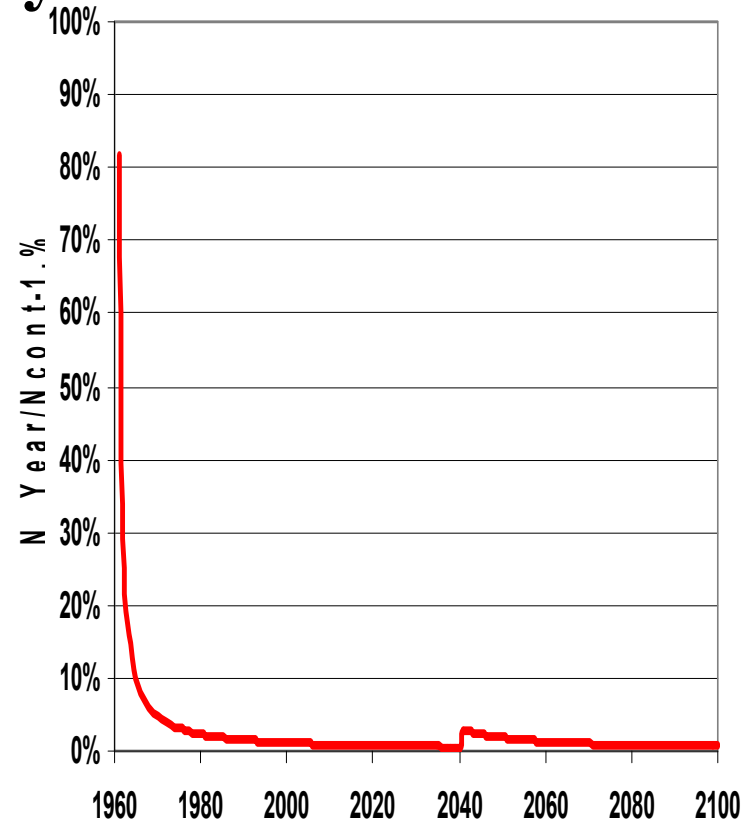
— Continue data set — Set data by year

# DESAE: Two methods of capacity buildup

## Capacity



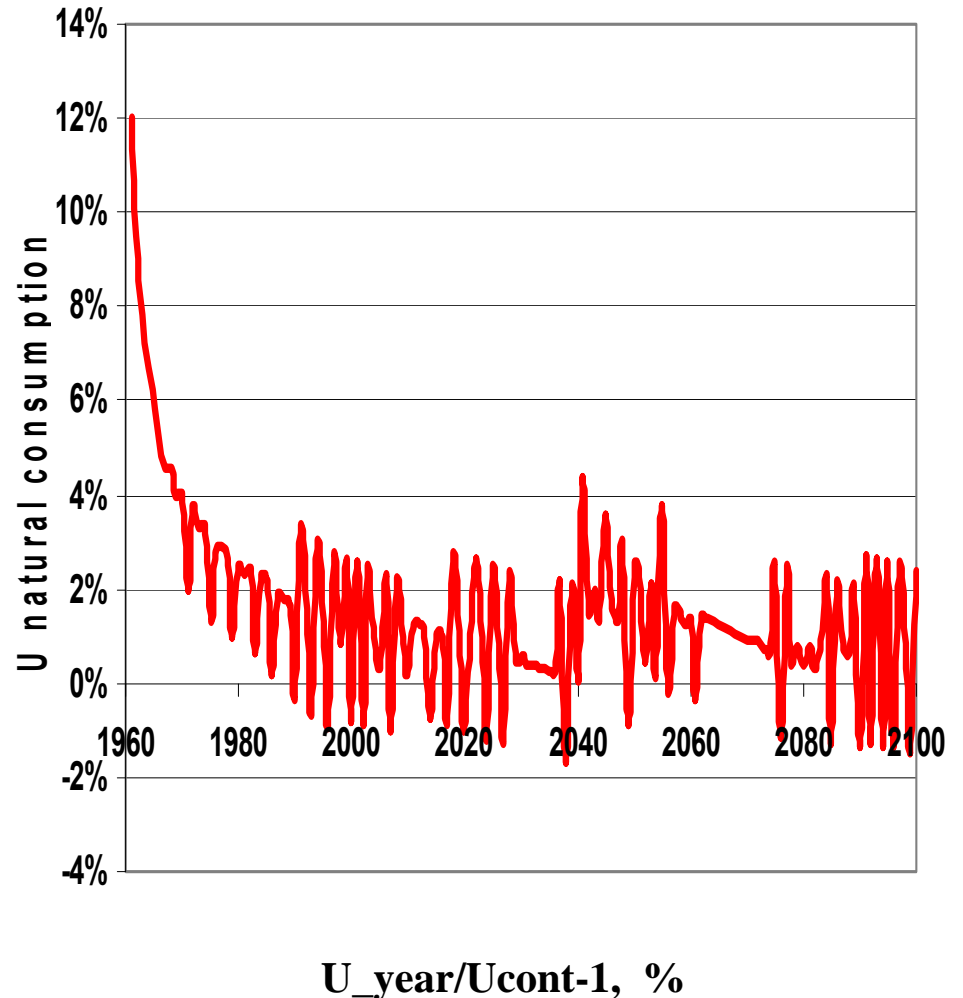
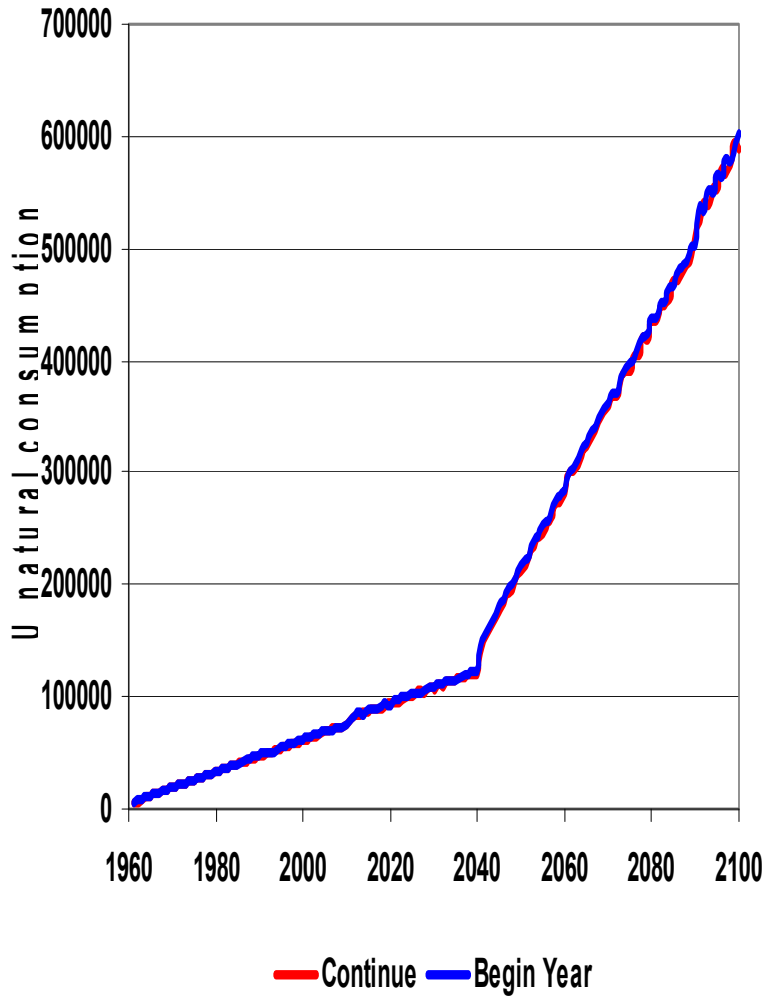
— Continue — Begin Year



$N_{Year}/N_{cont}$

# DESAE: Two methods of capacity buildup

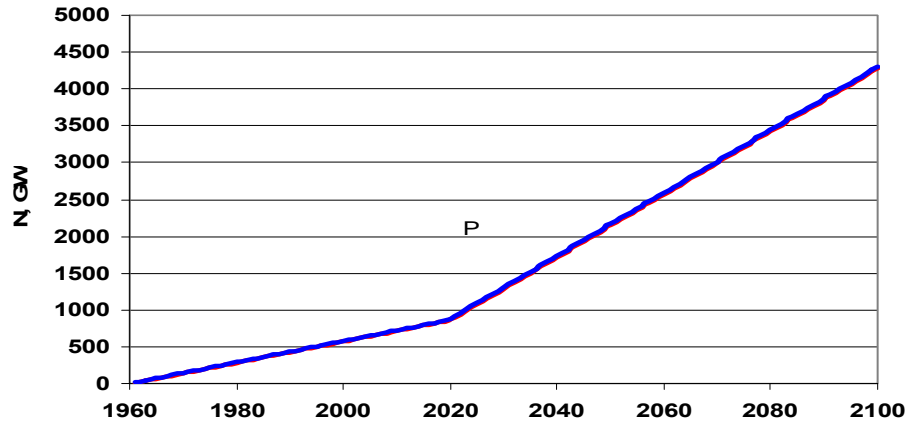
## U-annular consumption



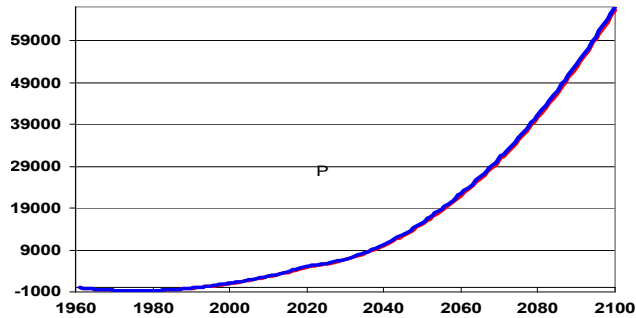
Total consumption: 26.926 mln.t–cont; 27.193mln.t – Beg year

# DESAE: Two methods of capacity buildup

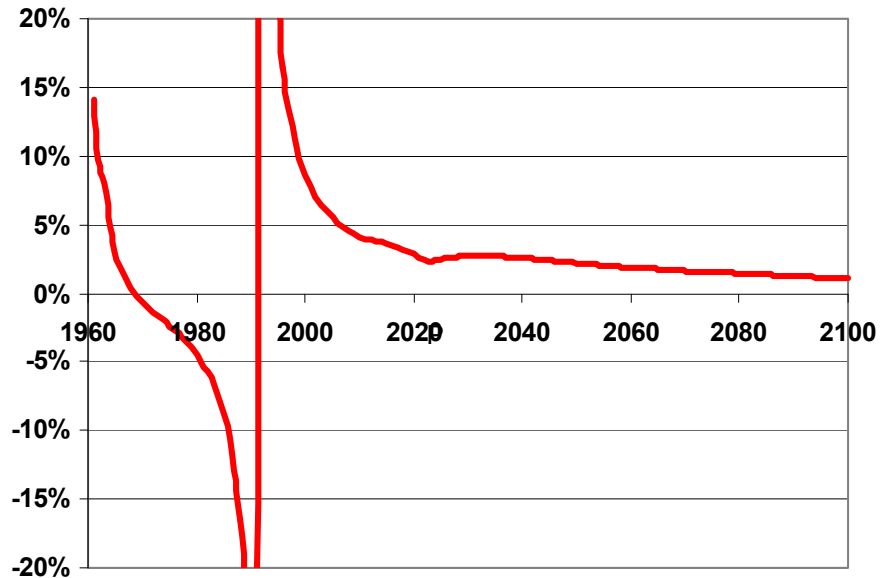
FBR-S BR=1.4



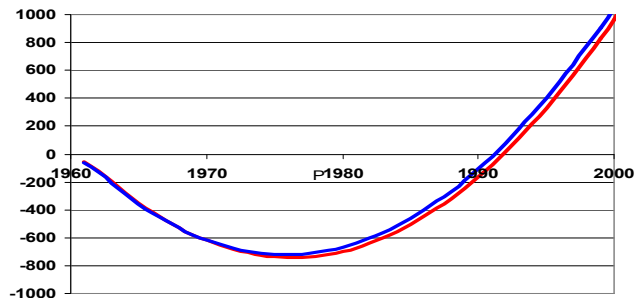
— N-continue — N-begin Year



— Pu\_year/Pu\_cont-1,% — Ряд2

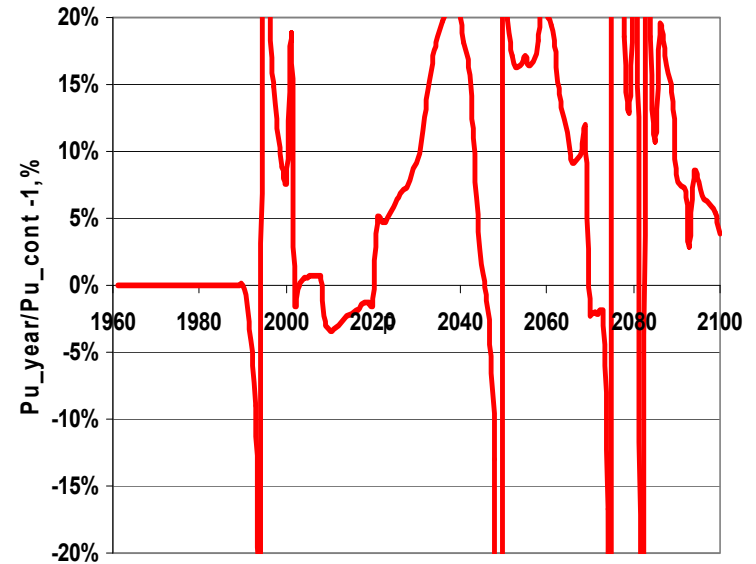
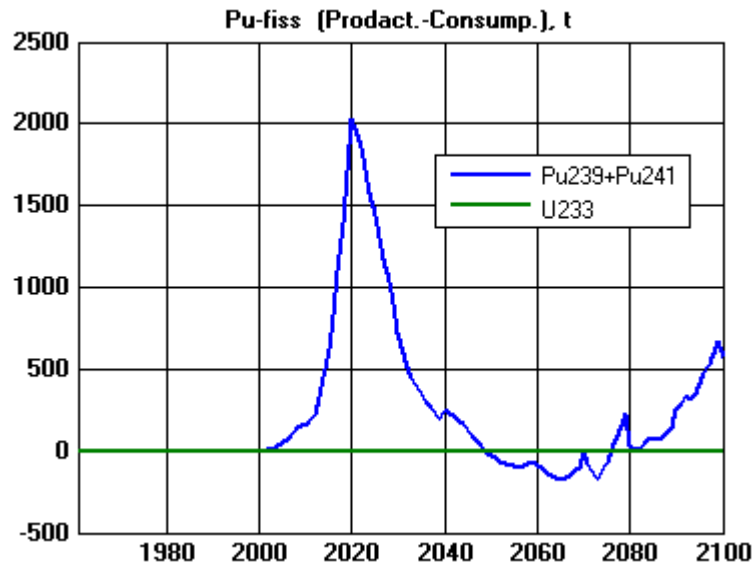
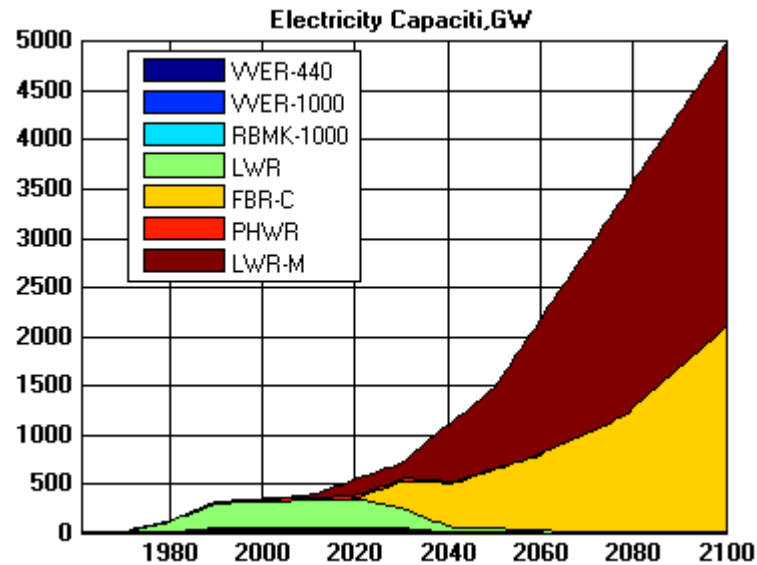


— Pu\_year/Pu\_cont-1,%

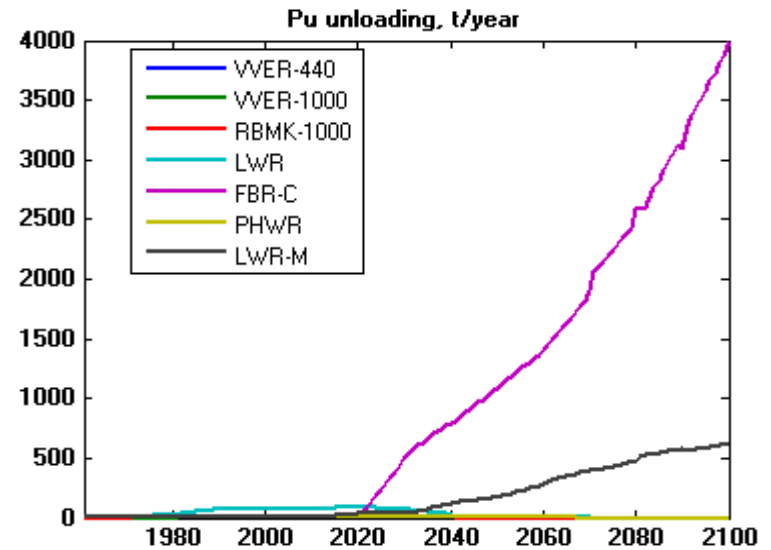
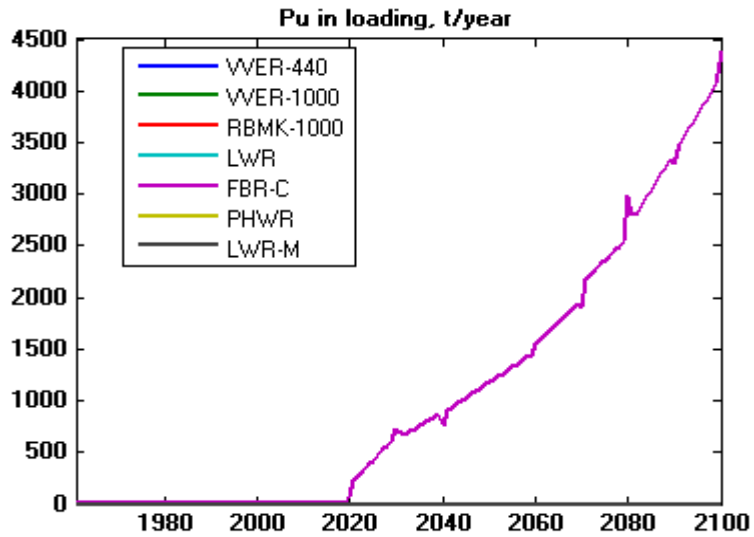


— Pu\_year/Pu\_cont-1,% — Ряд2

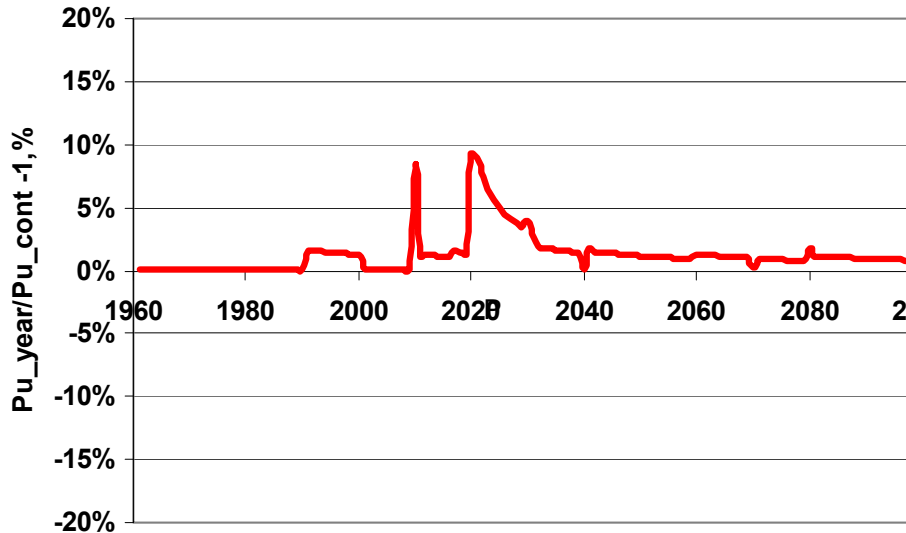
# DESAE: Two methods of capacity buildup



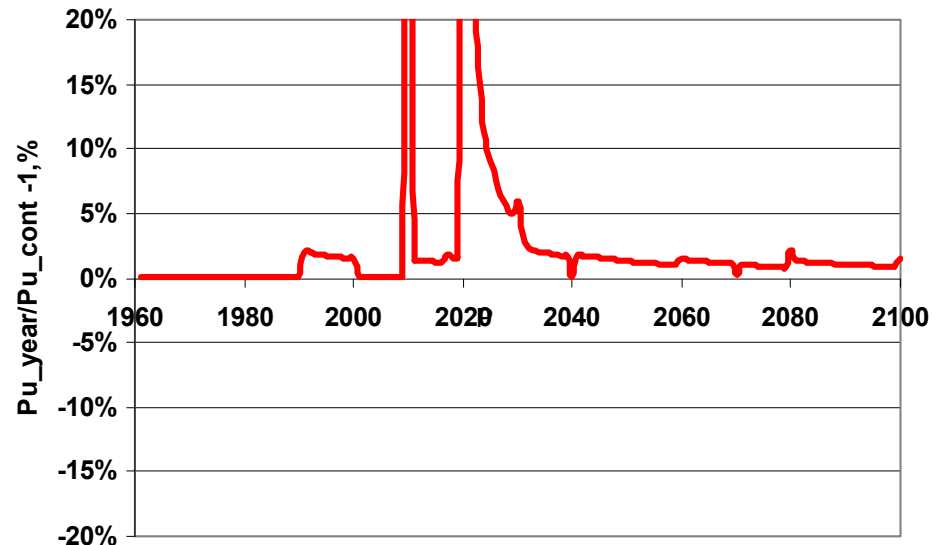
# DESAE: Two methods of capacity buildup



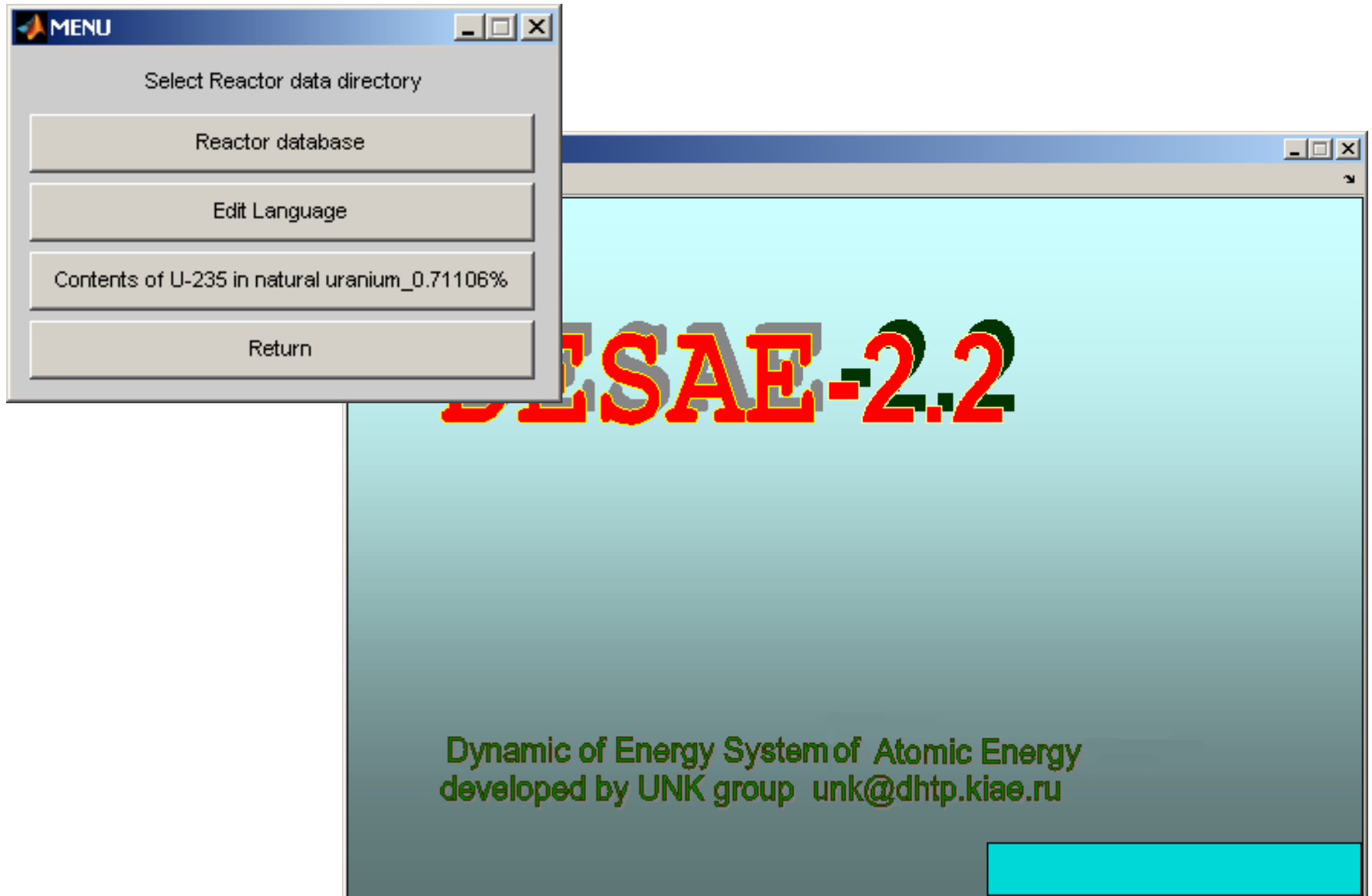
**Pu-loading**



**Pu-unloading**



# Creation of DESAE- 2.2 Data Base



# Structure of reactor data (1)

**MENU** Reactor features .LWR

Reactor power,GW	Resource & materials
Capacity factor	Economic
Efficiency (electricity)	Core, isotopic composition'
Efficiency (high temperature)	Axial blanket, isotopic composition'
Efficiency (low temperature)	Radial blanket, isotopic composition'
Efficiency (water production)	Look&Edit Excel
Fuel loading(core), t	return
Fuel loading(top & bottom blanket), t	
Fuel loading(side blanket),t	
Company core, days	
Company top & bottom blanket, days	
Company side blanket, days	
Cooling fuel time, year	
Cooling spent fuel time top & bottom blanket, year	
Cooling spent fuel time side blanket, year	
Building duration, year	
Exploitation duration, year	
Decommissioning duration, year	

**MENU** Reactor features .LWR

Contents of U-235 in depleted uranium
The number of staff, man/GW
Steel consumption, Kg(Fe)/KW(t)
Copper consumption, Kg(Cu)/KW(t)
Aluminium consumption, Kg(boxed)/KW(t)
Zr consumption, Kg (Zr)/Kg(fuel)
Water consumption, Kg(H2O)/KW(hl)
Heavy water consumption, Kg(D2O)/KW
Graphite consumption, Kg(C)/Kg(fuel)
Heavy metal consumption, Kg(metal)/KW
Electricity consumption, kWh(e)/KW(h)
User material, Kg/GWh(e)'
return

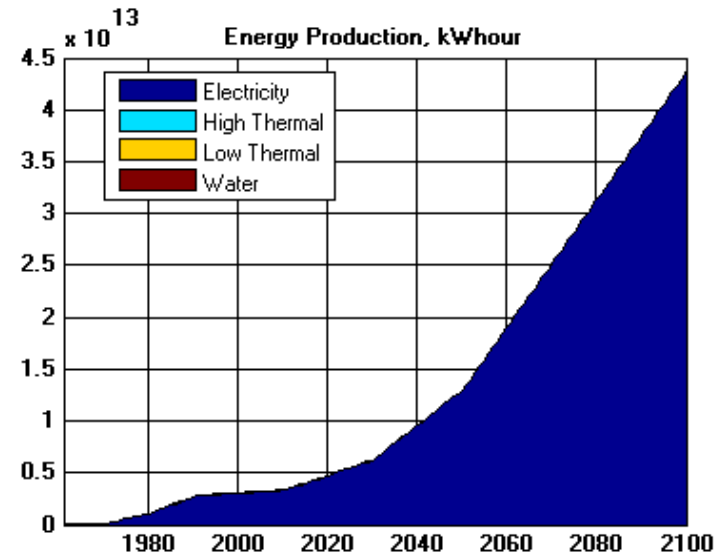
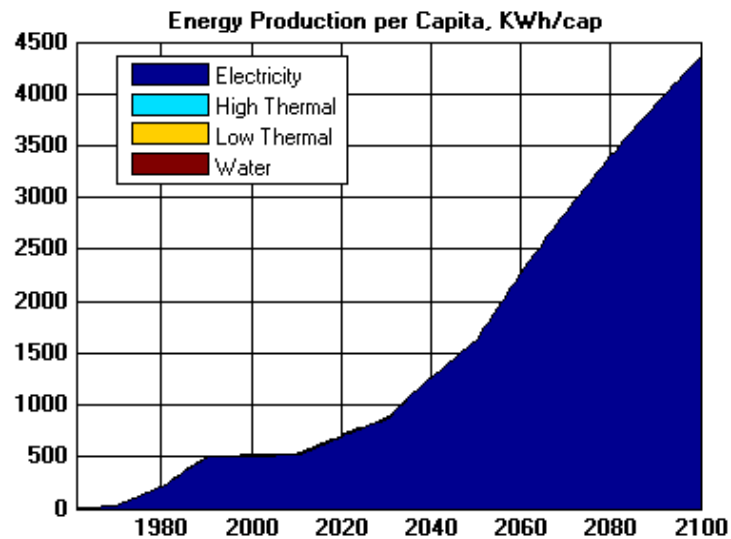
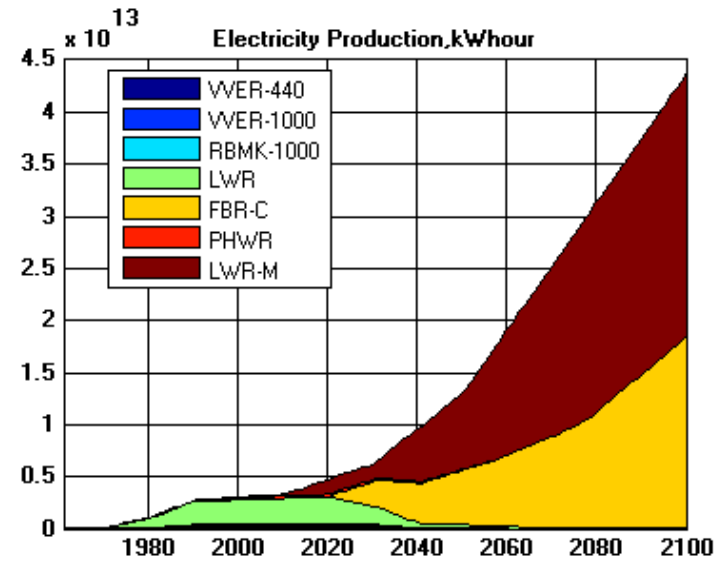
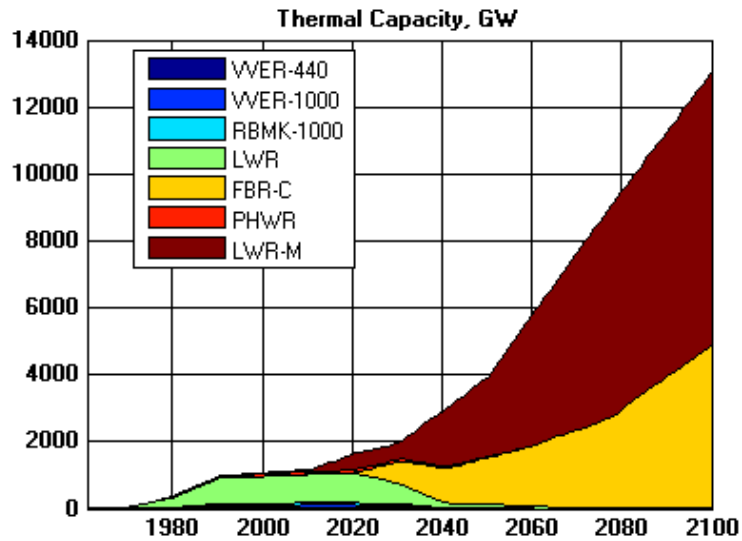
**MENU** Reactor features .LWR

Natural uranium price, \$/Kg
Separative work price, \$/Kg
Natural thorium price, \$/Kg
Reprocessed Pu fission price, \$/Kg
Reprocessed U-233 price, \$/Kg'
Fuel fabrication price, \$/Kg'
Spent fuel storing at NPP, \$/Kg/year'
Spent fuel storing at long-time storage, \$/Kg/year'
Back end dumping of spent fuel, \$/Kg'
Construction cost of 1 KW plant, \$/KW'
Decommissioning cost of 1 KW plant, \$/KW'
Monthly salary paid in plant, \$(man *month)'
Amortisation, \$/KW/h
return

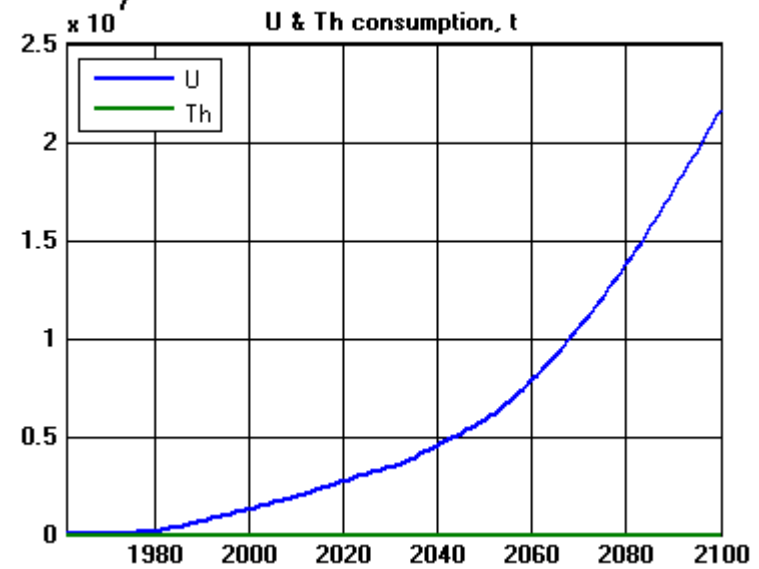
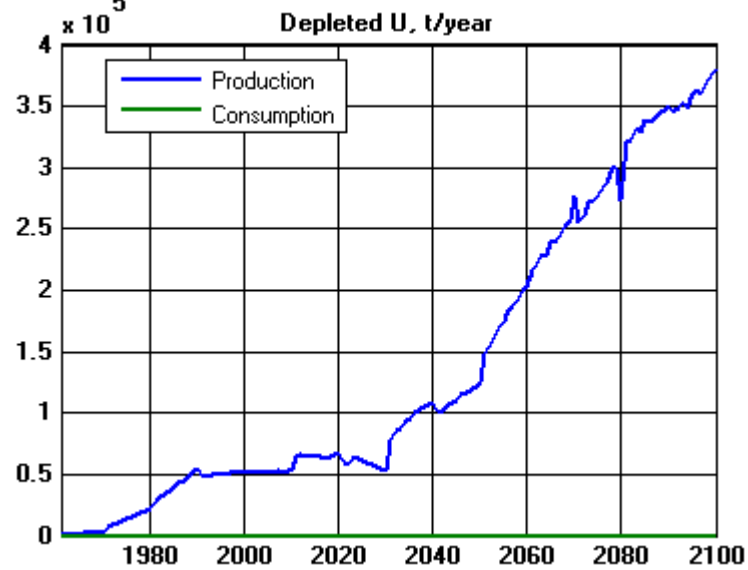
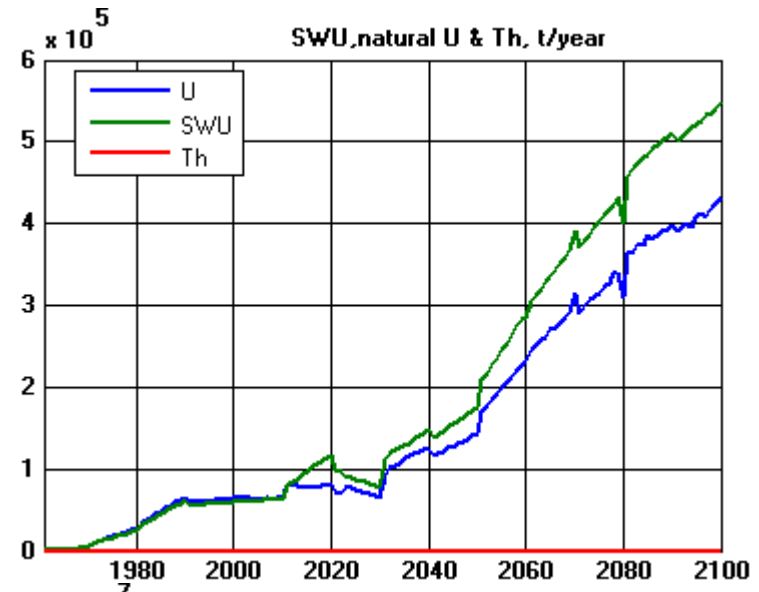
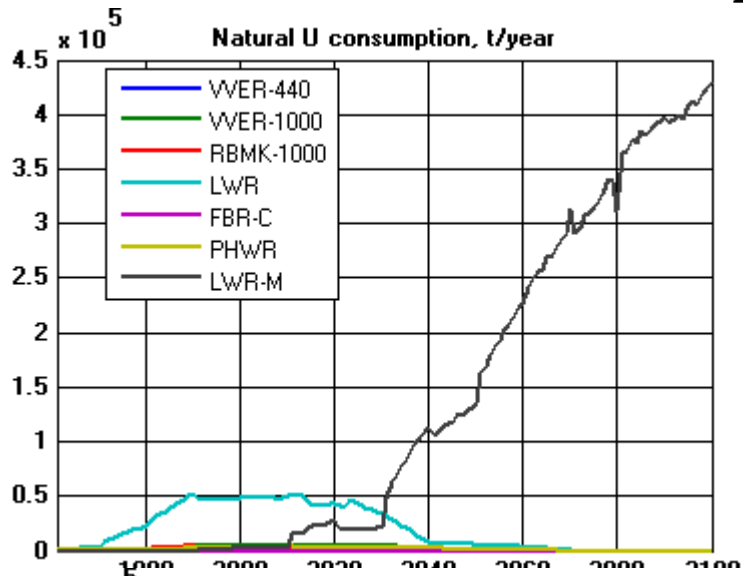
# Structure of reactor data (2)

Reactor features .LWR			
Contents of Th-230 in first loading	Contents of xp1- in the first loading	Contents of Tc-99 in the equilibrium loading	Contents of I-129 in the spent fuel
Contents of Th-232 in first loading	Contents of Th-230 in equilibrium loading	Contents of xp1- in the equilibrium loading	Contents of Tc-99 in the spent fuel
Contents of U-232 in the first loading	Contents of Th-232 in equilibrium loading	Contents of Th-230 in spent fuel	Contents of xp1- in the spent fuel
Contents of U-233 in the first loading	Contents of U-232 in the equilibrium loading	Contents of Th-232 in spent fuel	return
Contents of U-234 in the first loading	Contents of U-233 in the equilibrium loading	Contents of U-232 in the spent fuel	
Contents of U-235 in the first loading	Contents of U-234 in the equilibrium loading	Contents of U-233 in the spent fuel	
Contents of U-236 in the first loading	Contents of U-235 in the equilibrium loading	Contents of U-234 in the spent fuel	
Contents of U-238 in the first loading	Contents of U-236 in the equilibrium loading	Contents of U-235 in the spent fuel	
Contents of Np-237- in the first loading	Contents of U-238 in the equilibrium loading	Contents of U-236 in the spent fuel	
Contents of Pu-238 in the first loading	Contents of Np-237- in the equilibrium loading	Contents of U-238 in the spent fuel	
Contents of Pu-239 in the first loading	Contents of Pu-238 in the equilibrium loading	Contents of Np-237- in the spent fuel	
Contents of Pu-240 in the first loading	Contents of Pu-239 in the equilibrium loading	Contents of Pu-238 in the spent fuel	
Contents of Pu-241 in the first loading	Contents of Pu-240 in the equilibrium loading	Contents of Pu-239 in the spent fuel	
Contents of Pu-242 in the first loading	Contents of Pu-241 in the equilibrium loading	Contents of Pu-240 in the spent fuel	
Contents of Am-241 in the first loading	Contents of Pu-242 in the equilibrium loading	Contents of Pu-241 in the spent fuel	
Contents of Cm-244 in the first loading	Contents of Am-241 in the equilibrium loading	Contents of Pu-242 in the spent fuel	
Contents of I-129 in the first loading	Contents of Cm-244 in the equilibrium loading	Contents of Am-241 in the spent fuel	
Contents of Tc-99 in the first loading	Contents of I-129 in the equilibrium loading	Contents of Cm-244 in the spent fuel	

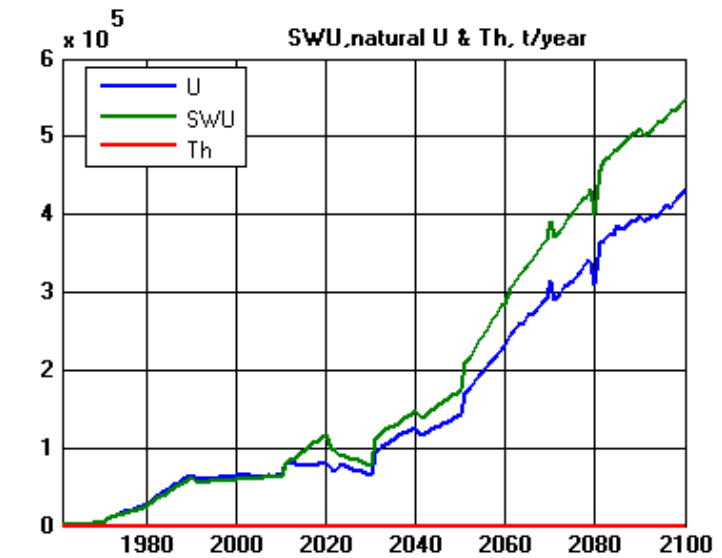
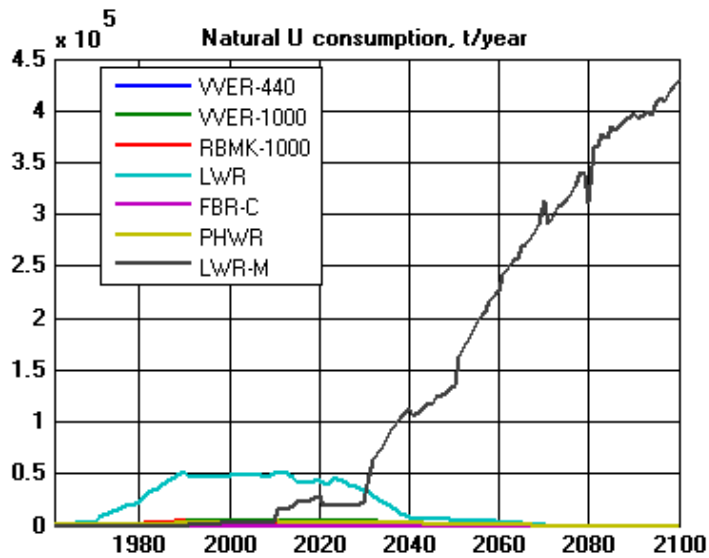
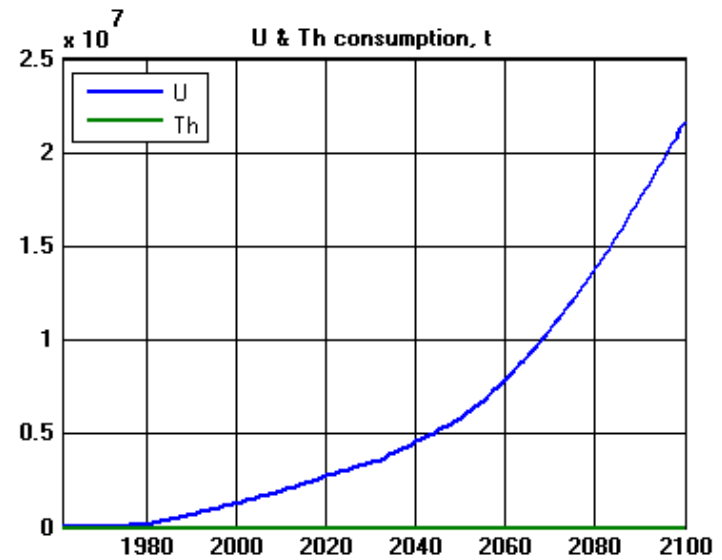
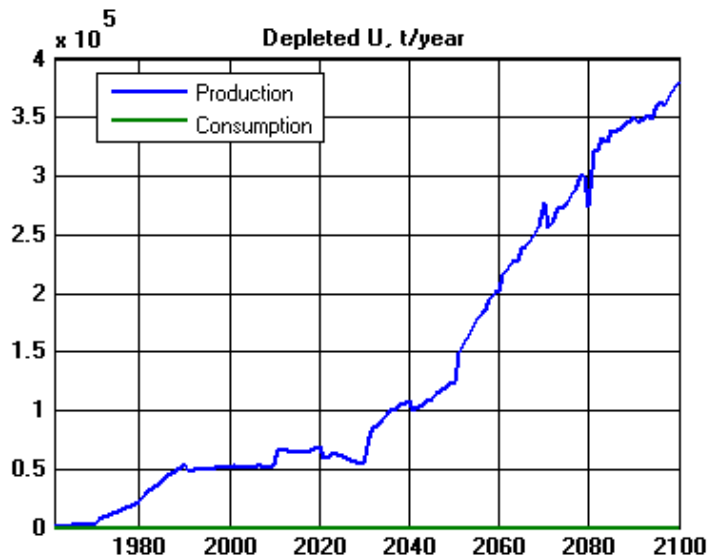
# Output data



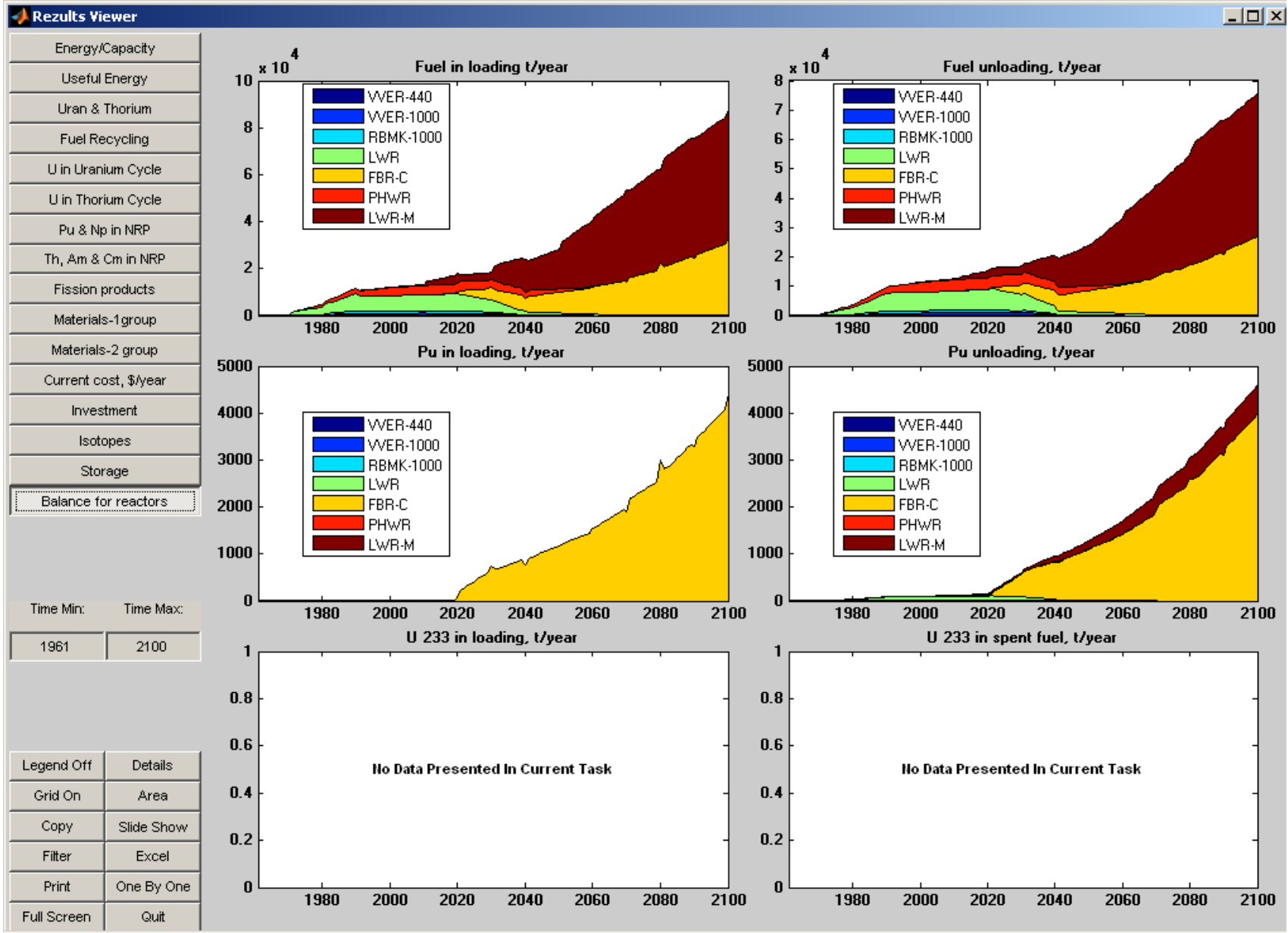
# Output data



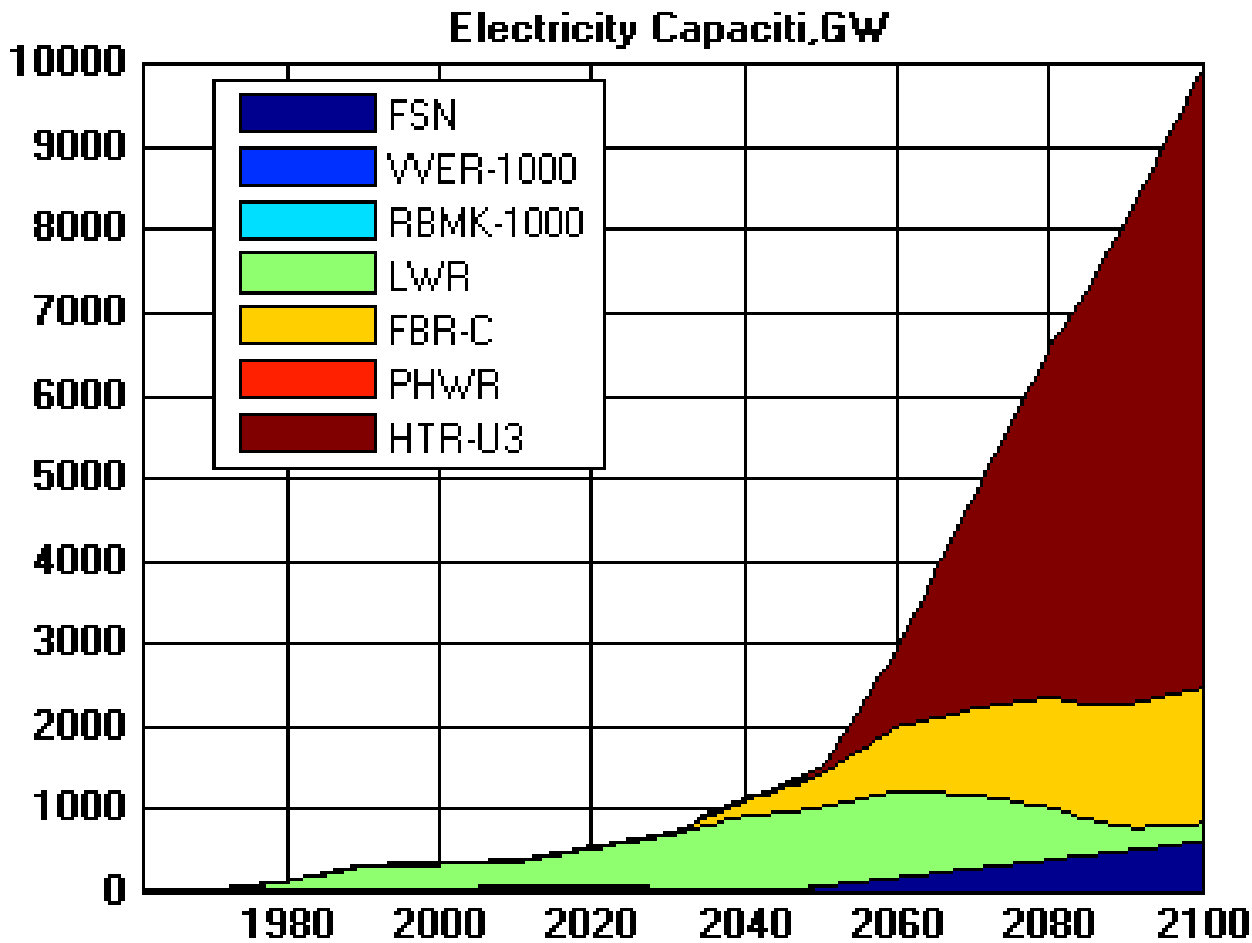
# Output data



# Output data



# Computations with other types Nuclear Systems



FSN- Fusion  
Sours of Neutrons

