



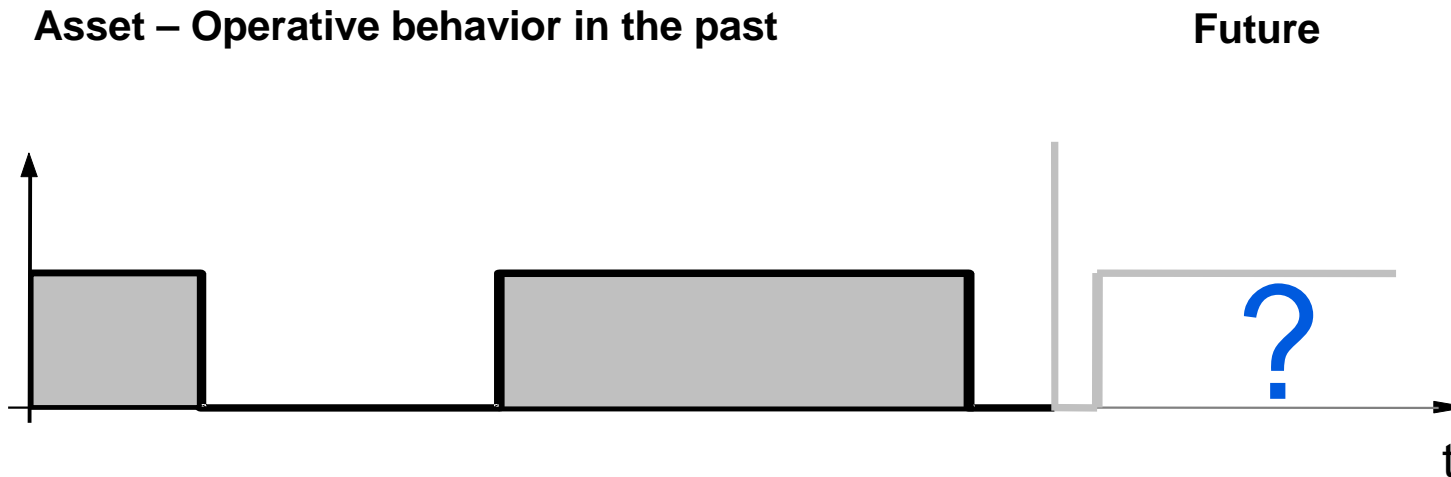
## Power System Analysis Software



Successfully applied all over the world

# Asset Simulation

## Asset Simulation Goal



- Simulation of future behavior of network components based on experience of the past.
- Definition of the minimum necessary CAPEX/OPEX to ensure the system's functionality in the future.
- Compare different strategies.

## Input Data and Results

### Actual situation

#### Components

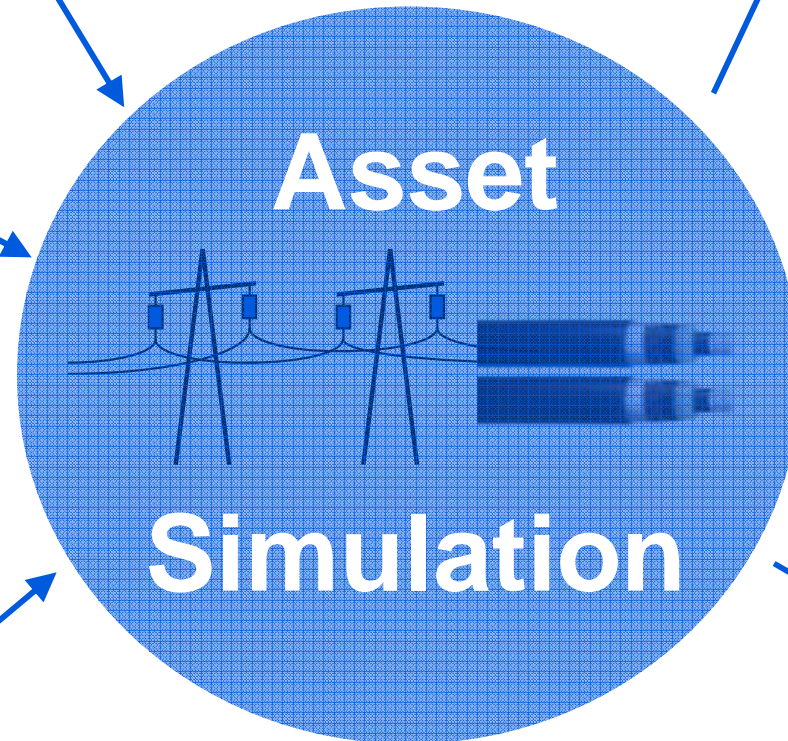
- Distribution of different types
- Age distribution
- Network losses

#### Replacement and maintenance

- Influence of target grid
- Maintenance cycles
- Premature replacement

#### Failure data

- Number of failures
- Energy not supplied
- Age depending failure rates



### Future

#### Re-Investments

- Replacement rate
- Component type
- Age distribution
- Max. component life time

#### OPEX

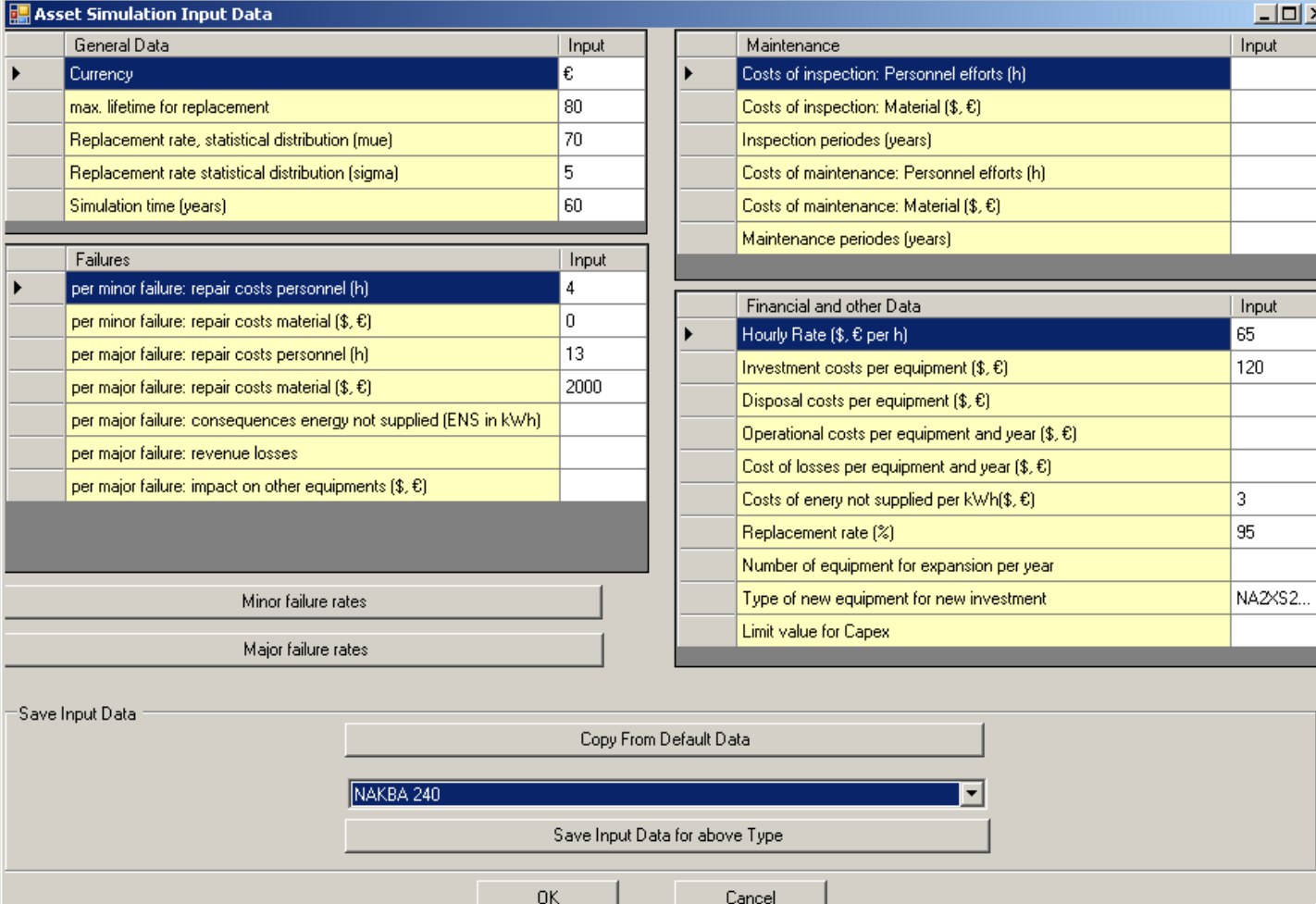
- Network losses
- Maintenance
- Fault clearing

#### Quality

- Energy not supplied
- Frequency of interruption
- Non-Availability

## Input Data in NEPLAN-Maintenance

Input data will be assigned to each component type



The screenshot shows the 'Asset Simulation Input Data' dialog box with the following sections:

General Data		Input
Currency	€	
max. lifetime for replacement		80
Replacement rate, statistical distribution (mue)		70
Replacement rate statistical distribution (sigma)		5
Simulation time (years)		60

Failures		Input
per minor failure: repair costs personnel (h)		4
per minor failure: repair costs material (\$, €)		0
per major failure: repair costs personnel (h)		13
per major failure: repair costs material (\$, €)		2000
per major failure: consequences energy not supplied (ENS in kWh)		
per major failure: revenue losses		
per major failure: impact on other equipments (\$, €)		

Minor failure rates:

Major failure rates:

Maintenance		Input
Costs of inspection: Personnel efforts (h)		
Costs of inspection: Material (\$, €)		
Inspection periods (years)		
Costs of maintenance: Personnel efforts (h)		
Costs of maintenance: Material (\$, €)		
Maintenance periods (years)		

Financial and other Data		Input
Hourly Rate (\$, € per h)		65
Investment costs per equipment (\$, €)		120
Disposal costs per equipment (\$, €)		
Operational costs per equipment and year (\$, €)		
Cost of losses per equipment and year (\$, €)		
Costs of energy not supplied per kWh(\$, €)		3
Replacement rate (%)		95
Number of equipment for expansion per year		
Type of new equipment for new investment		NA2XS2...
Limit value for Capex		

Save Input Data

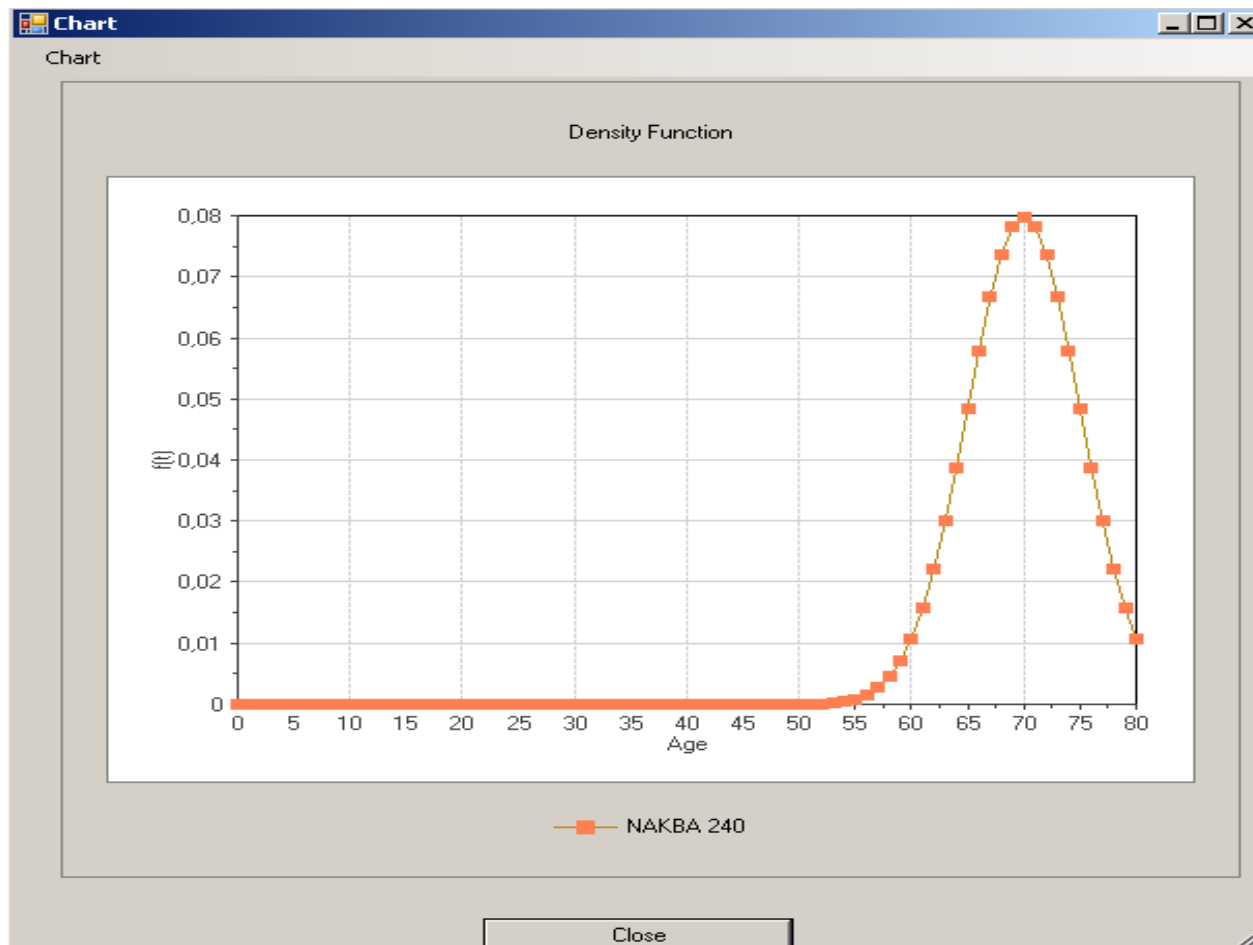
Copy From Default Data

NAKBA 240

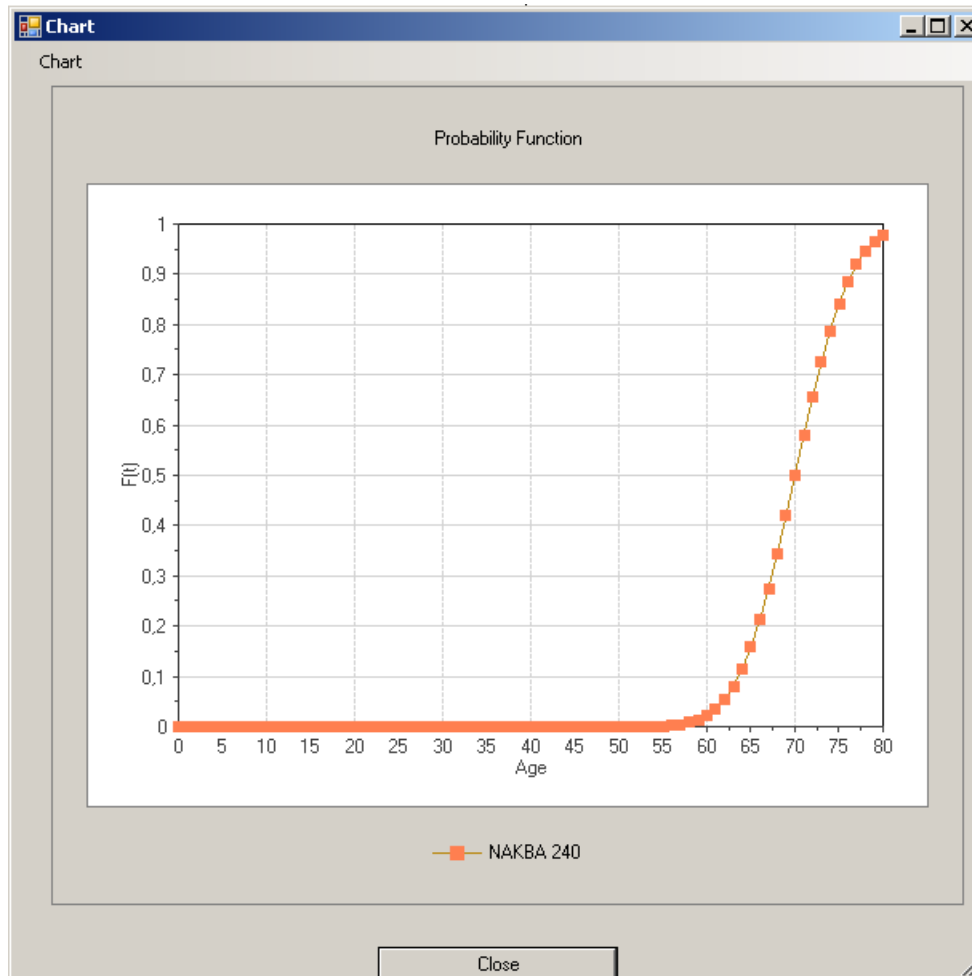
Save Input Data for above Type

OK  Cancel

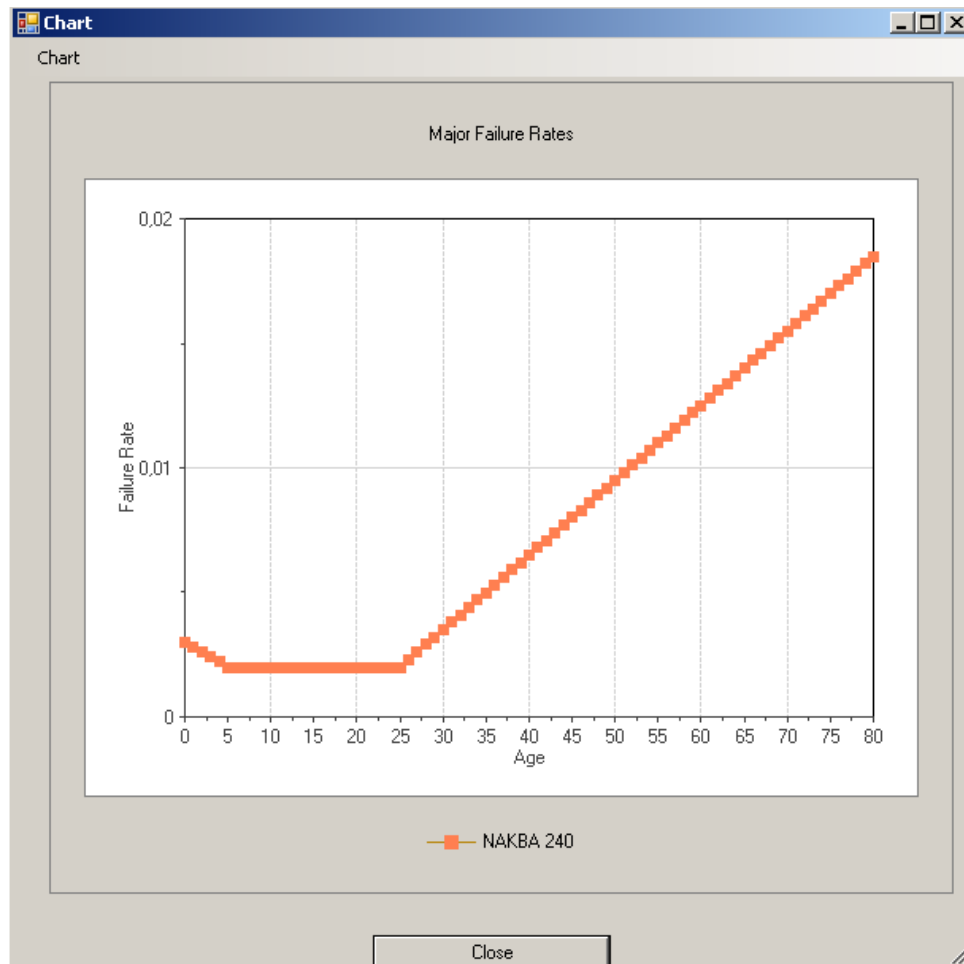
## Component lifetime Density function in NEPLAN-Maintenance



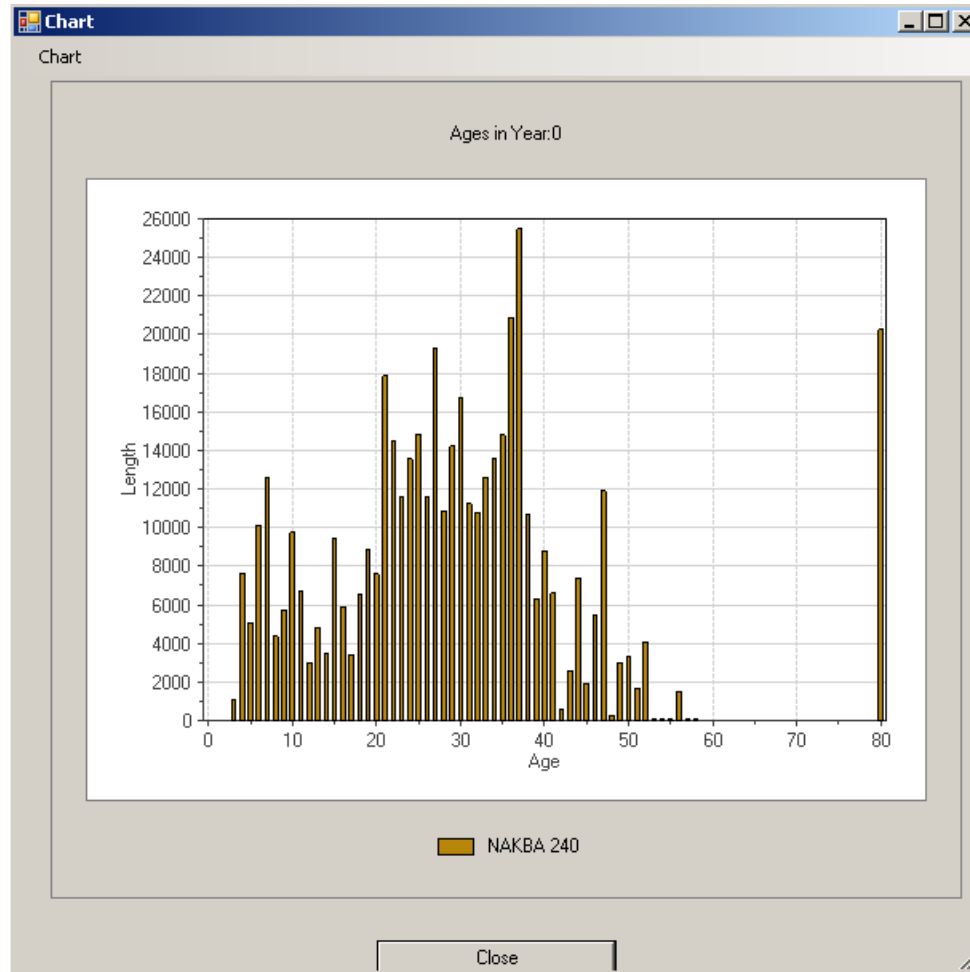
## Component lifetime Probability function in NEPLAN-Maintenance



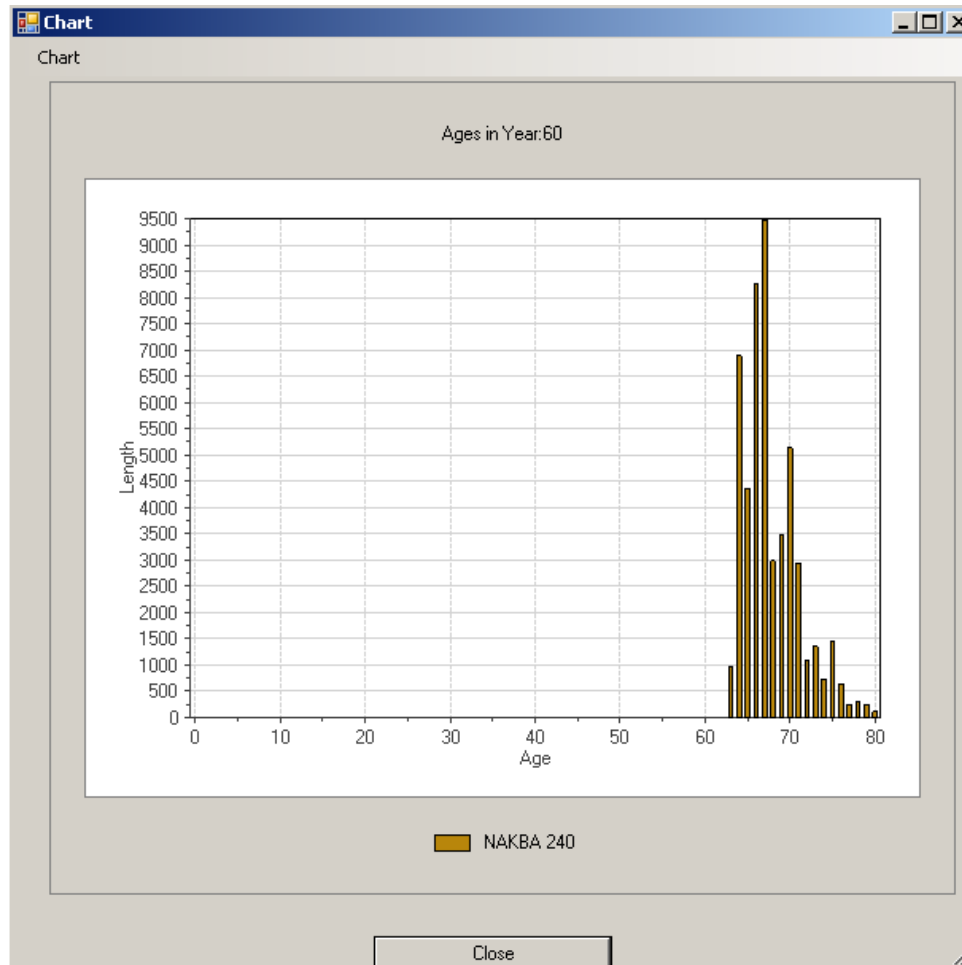
## Component failure rates in NEPLAN-Maintenance



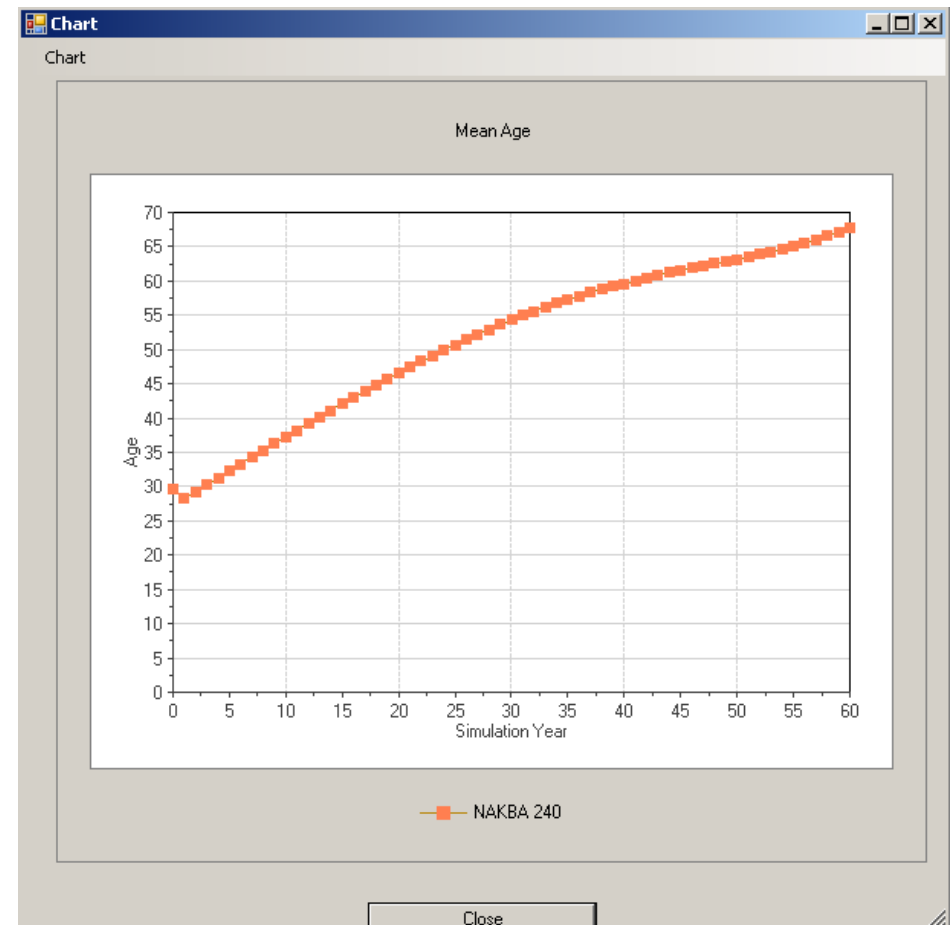
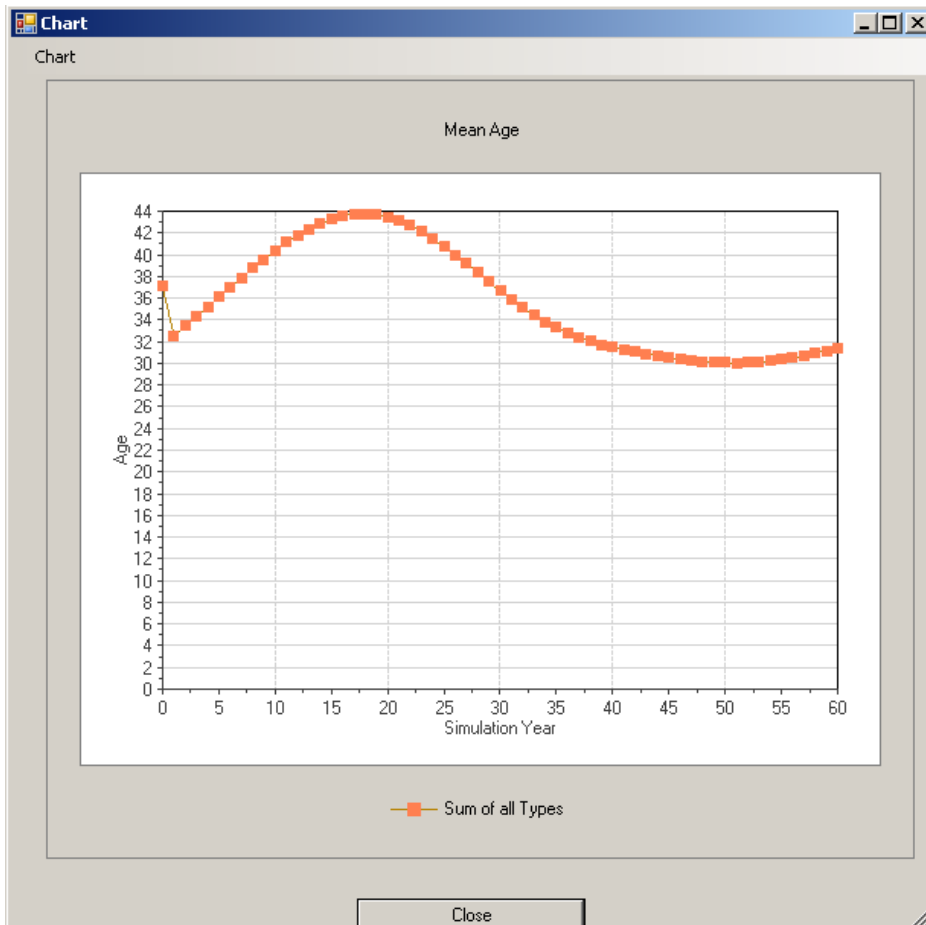
## Initial Age Distribution in NEPLAN-Maintenance



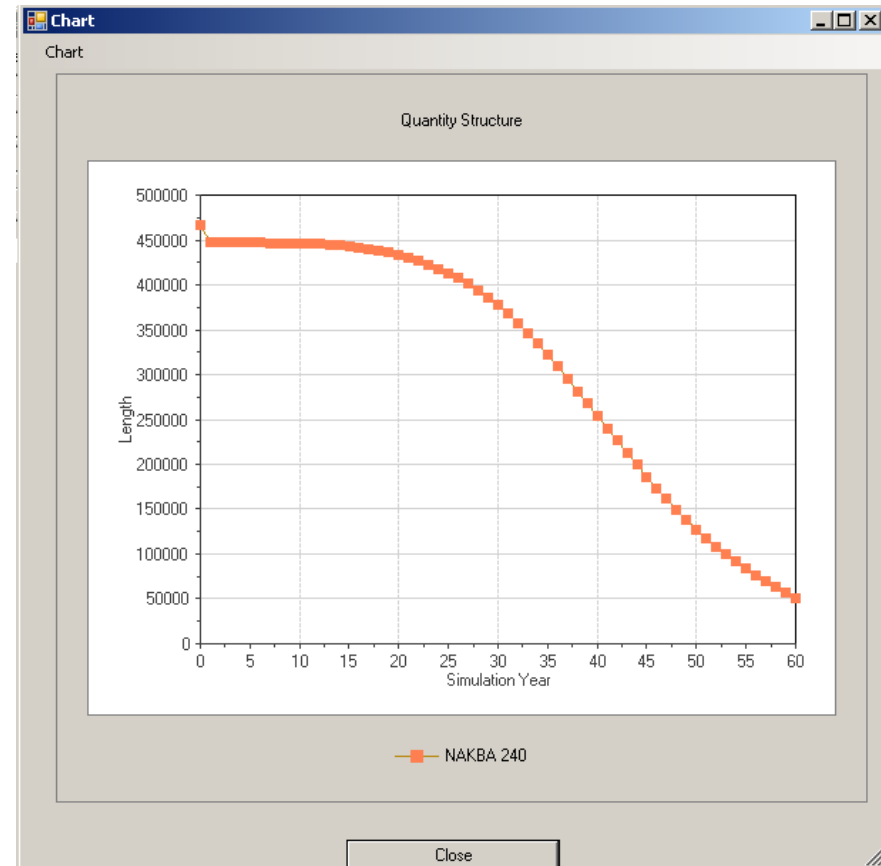
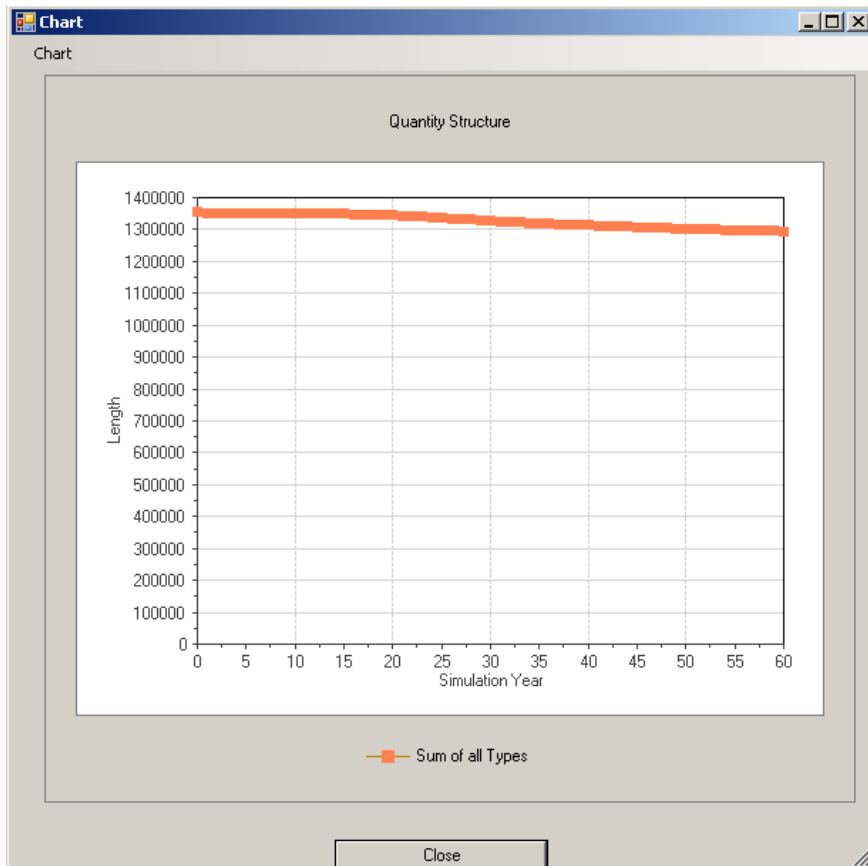
## Results in NEPLAN-Maintenance Age distribution at the end of simulation period



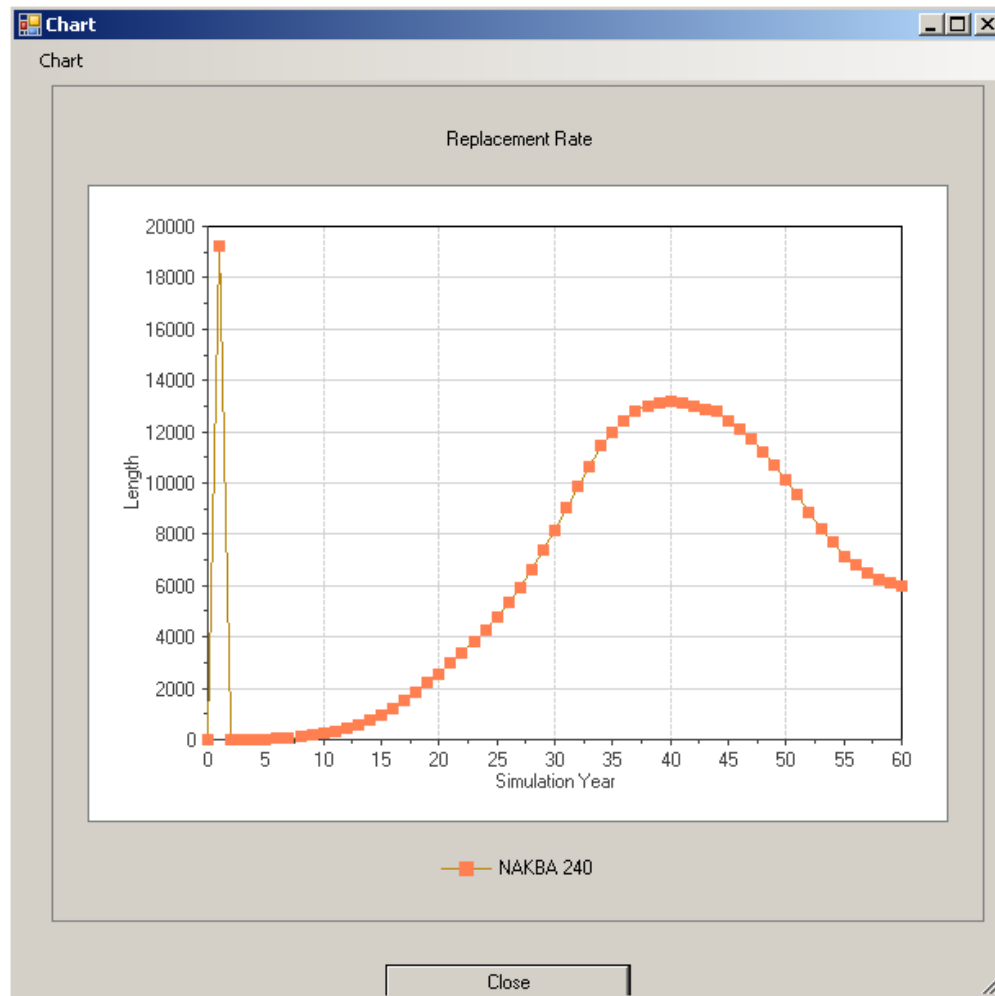
## Results in NEPLAN-Maintenance Mean age versus simulation time



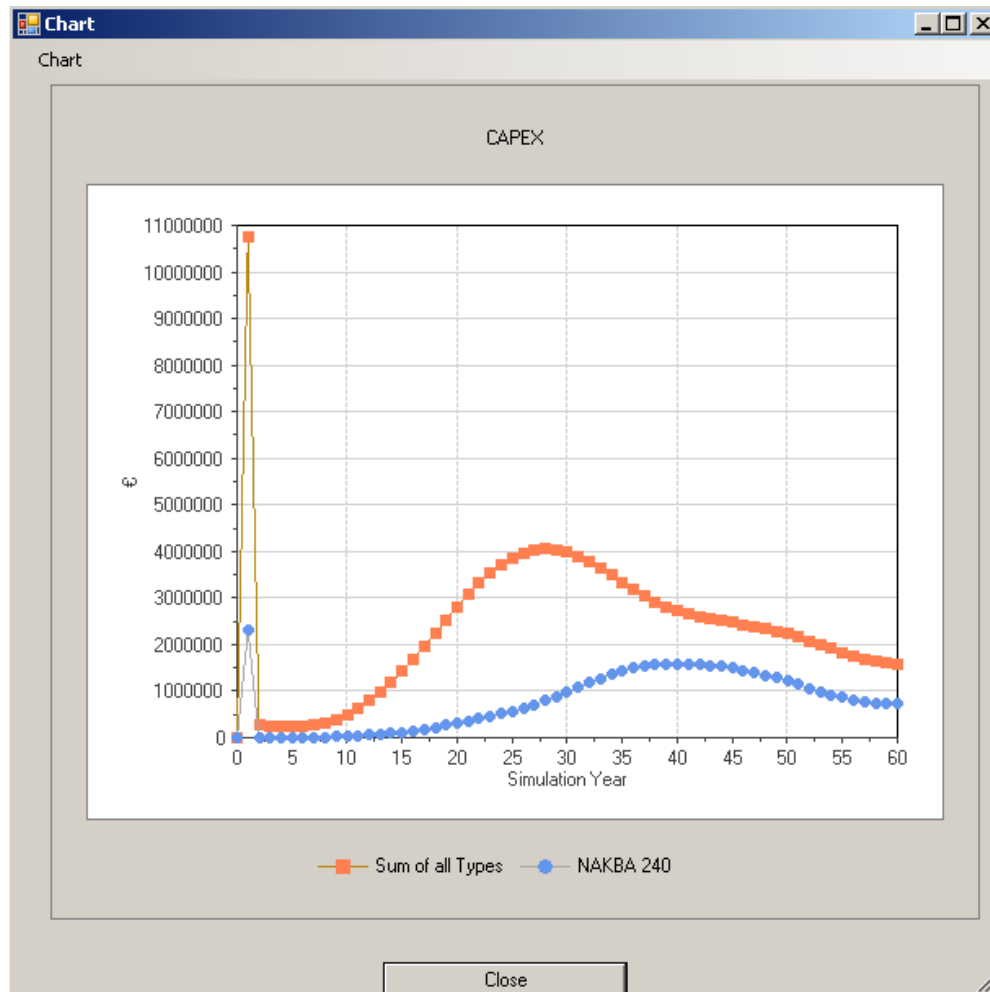
## Results in NEPLAN-Maintenance Quantity versus simulation time



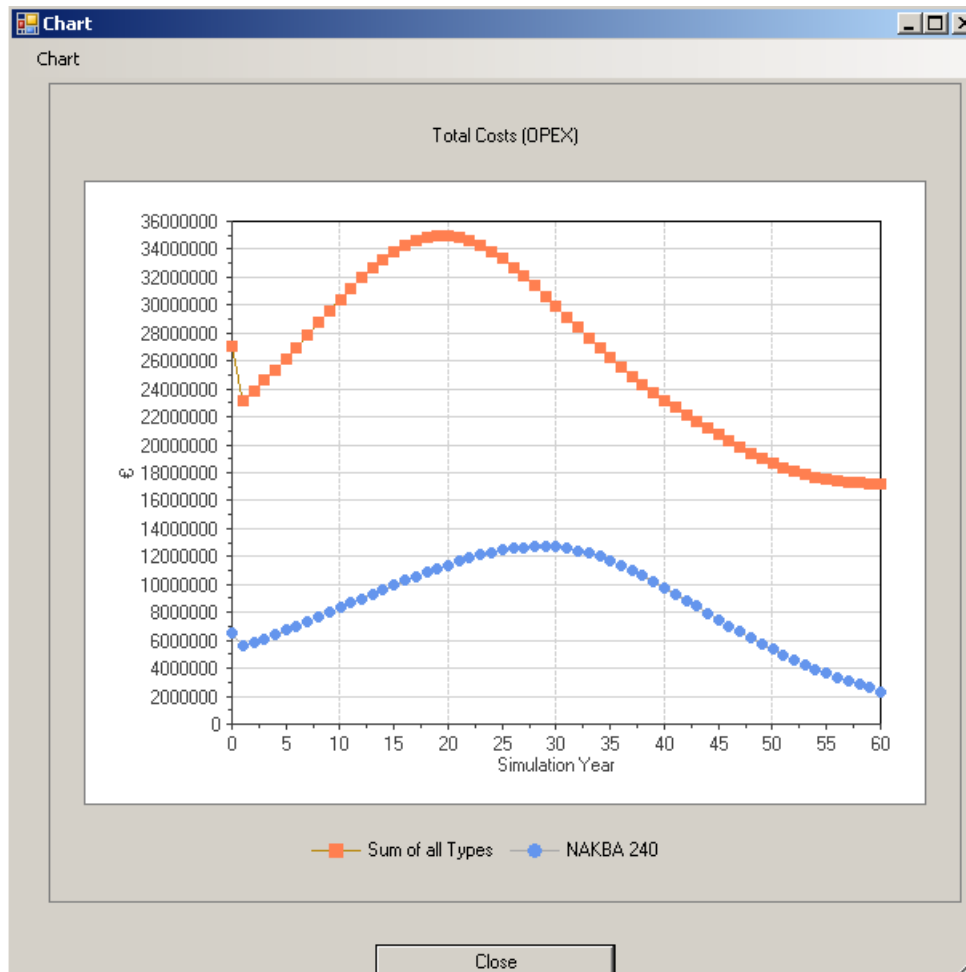
## Results in NEPLAN-Maintenance Replacement rate versus simulation time



## Results in NEPLAN-Maintenance Investment costs versus simulation time



## Results in NEPLAN-Maintenance Operational costs versus simulation time



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