Training session SHIPLYS LCT Software

University of Strathclyde

13 May 2019

Materials Joining and Engineering Technologies

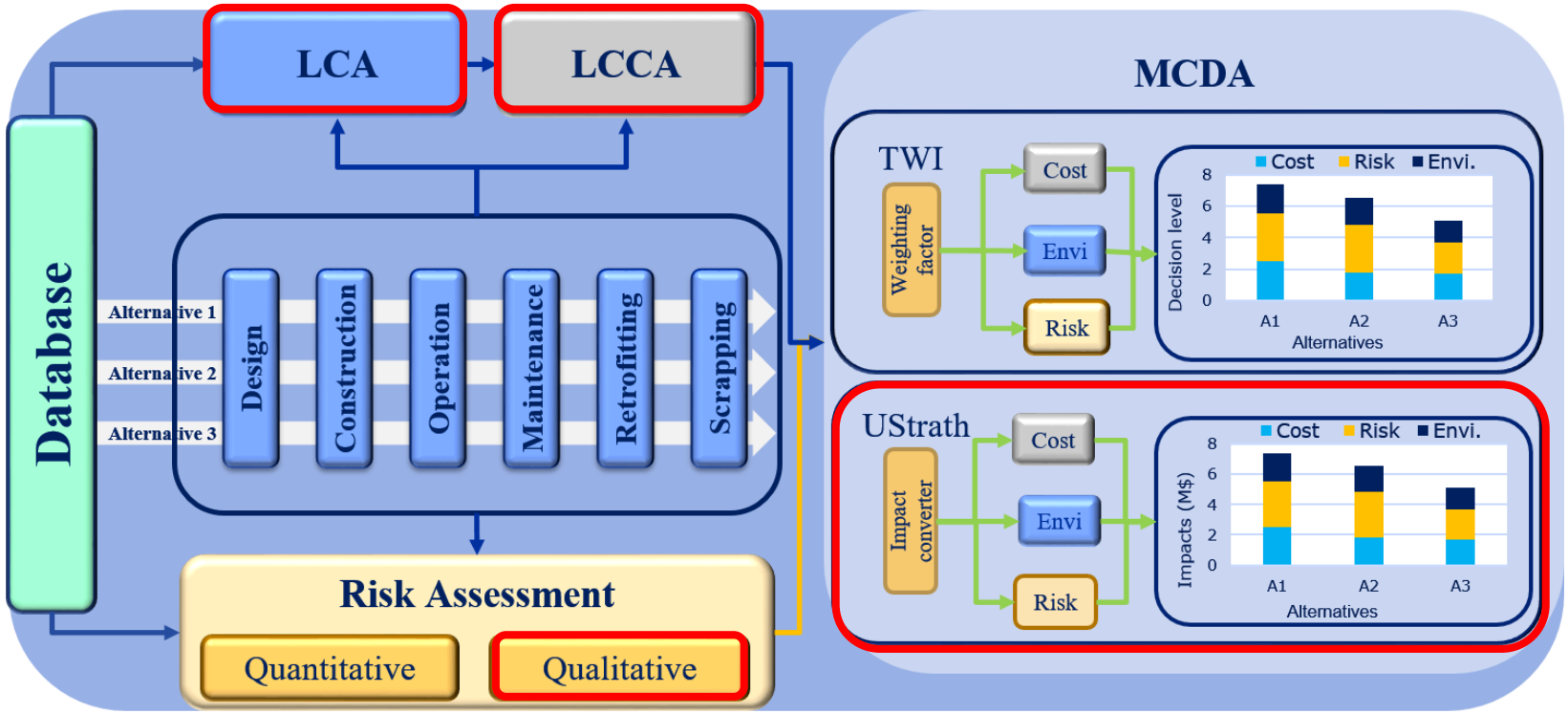
Overview

- Functionality introduction
- Software installation (integrated with SHIPLYS platform or used individually)
- Carry out a full case study
- Results comparisons
- Data exchange with SHIPLYS platform

Functionality Introduction

- Considering life cycle of products (ships);
- Use designed and collected database;
- Estimation of life cycle impact (environmental);
- Estimation of life cycle cost;
- Estimation of life cycle risk impact;
- Make multi-criteria decisions to determine optimal alternative.

Functionality Introduction



Software Installation

- **Requirements**:
  - 64-bit Java 8 for Windows (not available for Java 11)
- **Installations:**
  - Right click to open the installation package with the "Administrator" account;
  - Select and go next based on user preference, such as language, installation location, create desktop shortcut, launch after installation, etc.;
  - Software will be run after installation; if not running, use the shortcut/executable file (SHIPLYS LCT.exe) from desktop, window menu or installation folder to start.

Case Study

- Case ship specification

MV Hallaig
Shipyard: Ferguson Marine
Operator: Caledonian MacBrayne

Length × Breadth × Depth	39.99 m × 12.2 m × 3 m		
Draft	1.73 m		
Displacement	389 ton		
Deadweight	135 ton		
Engine configuration alternatives	Hybrid (Actual)	Alternative 1 (Diesel Electric)	Alternative 2 (Diesel Mechanic)
	360 kW × 3 sets (3.2 tons) + 350 kW lithium-ion battery × 2 sets (3.5 tons)	360 kW × 3 sets (3.2 tons)	450 kW × 2 sets (4 tons)

Case Study

- Case ship operational information

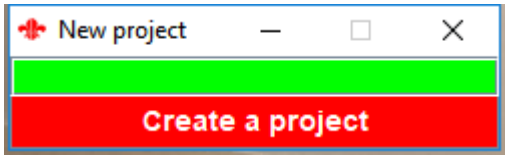
Category		Transit	Manoeuvring	Slip
Daily operation hours		6	0.6	3.72
DE (1 engine running)	Total ME power demand (kW)	322	144	87
	Fuel Consumptions (Litres/day)	434	19	85
	Estimated Total Daily Fuel Consumption (Litres/day)	538		
	Annual Fuel Consumption (ton/year)	157.37		
DM (2 engines running)	Total ME power demand (kW)	291	130	78
	Fuel Consumptions (Litres/day)	441	22	
	Estimated Total Daily Fuel Consumption (Litres/day)	548		
	Annual Fuel Consumption (ton/year)	160.29		

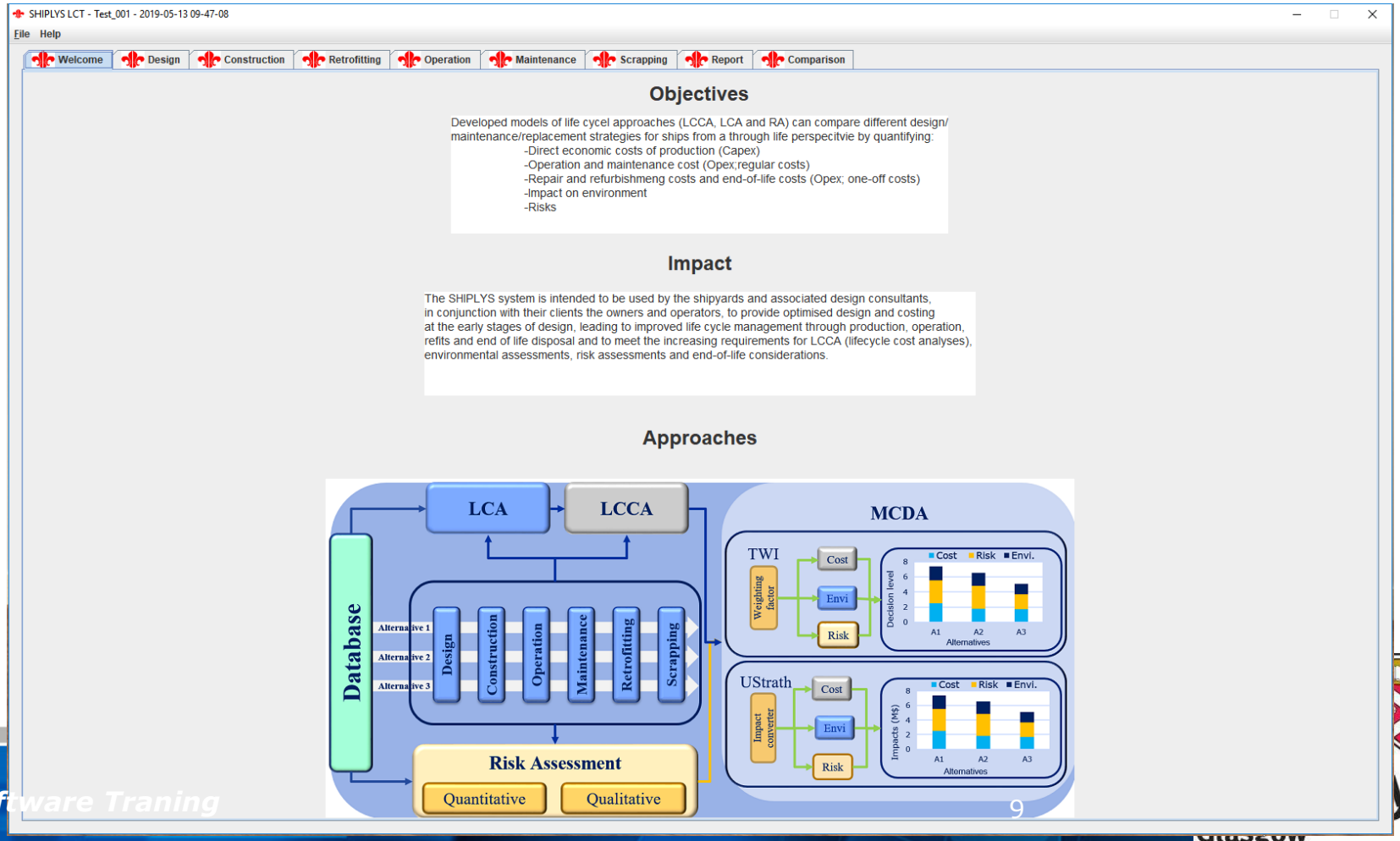
Case Study

- Run software;
- Design and general information;
- Follow the life stages and select or fill in data;
- Run calculation;
- Interact with SHIPLYS platform;
- Compare alternatives.

Run Software

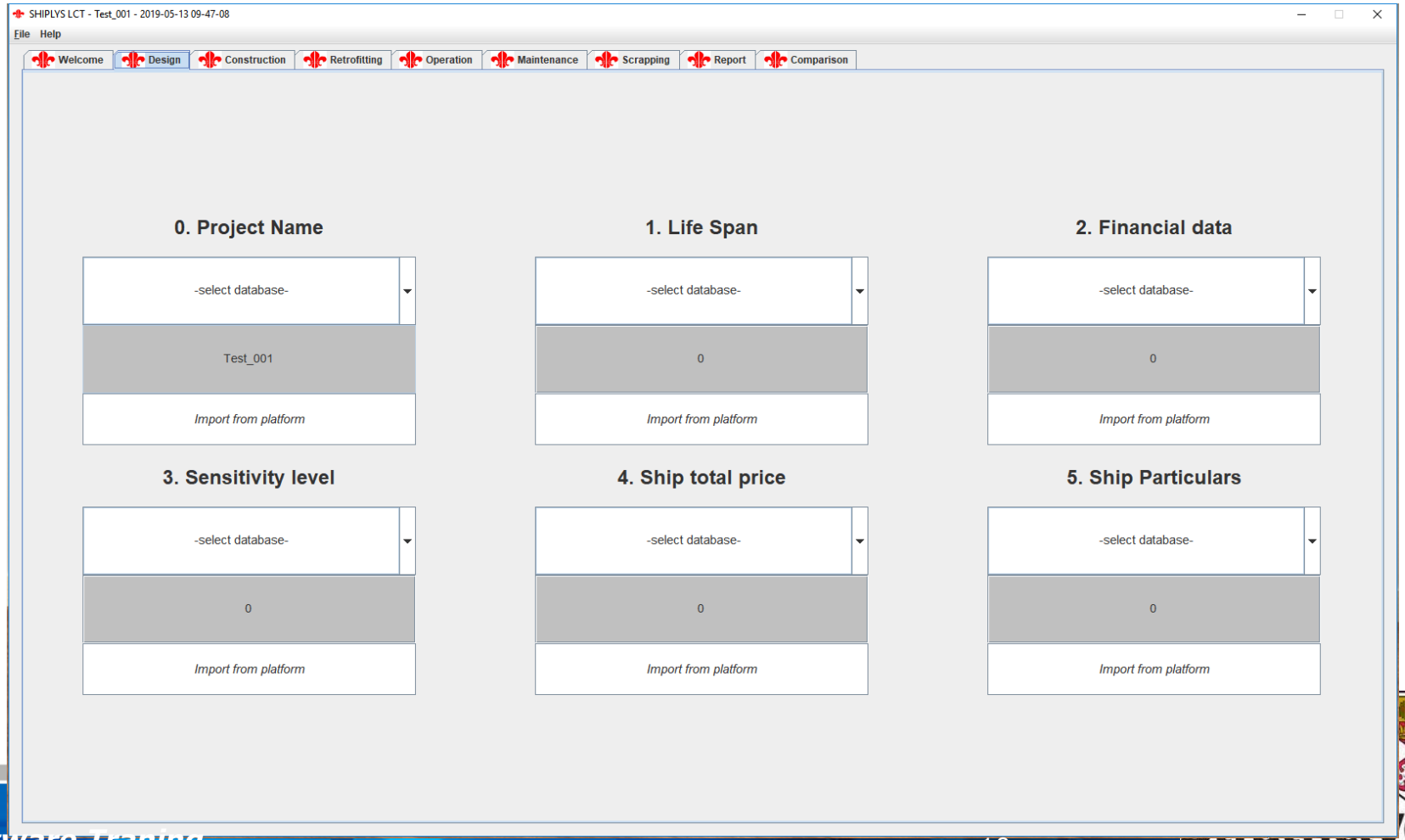
- Front welcome page





Design & General Information

- Design panel interface

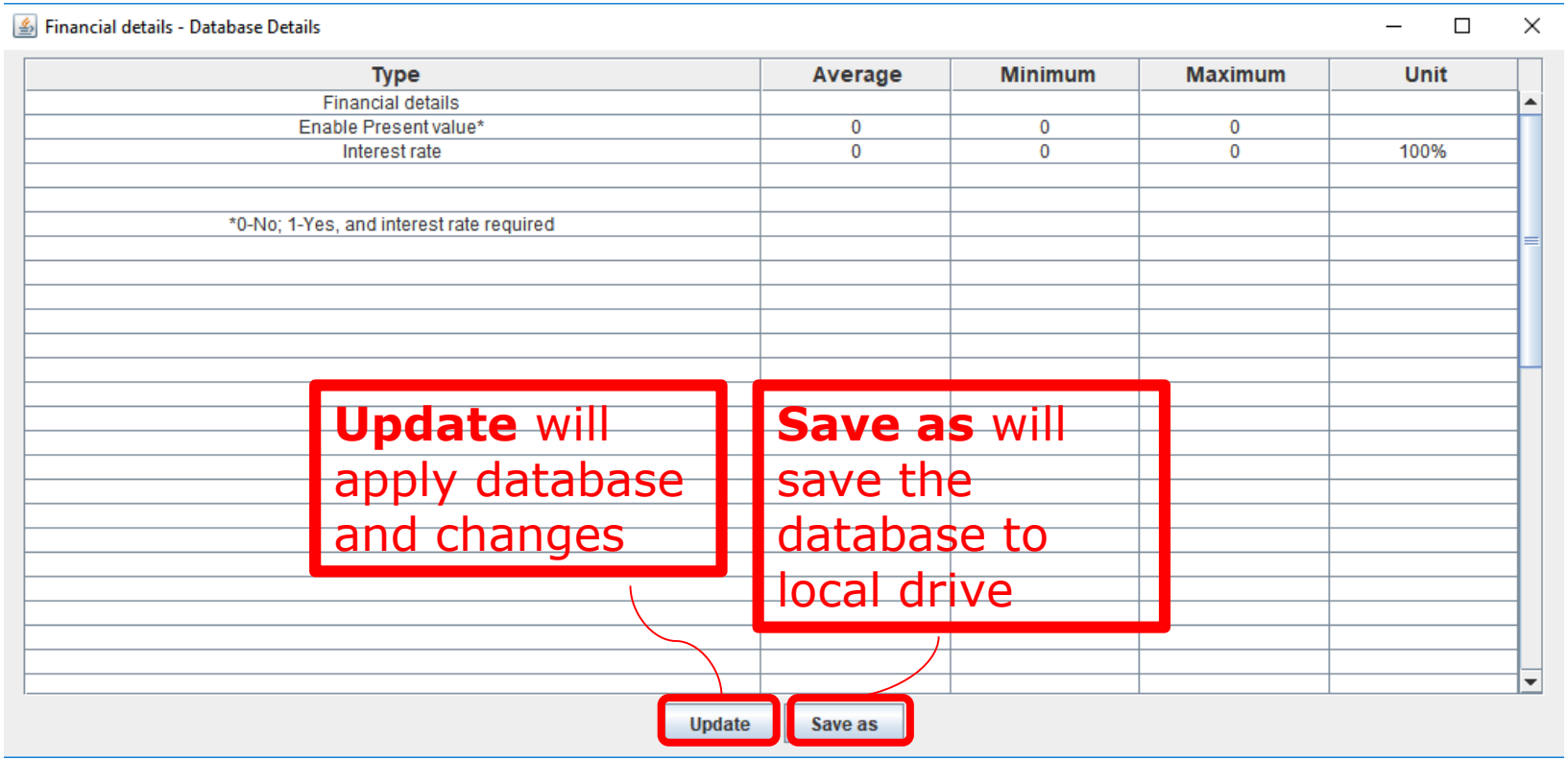


Design & General Information

1. Give a name for your case; this will use what is given previously and to save your data/results;
2. Fill in the total life years of the case ship in the project;
3. Use the drop list for *financial data* to set whether present value (PV) is applied and the interest rate used to calculate PV;
    1. Fill in the present value column: *0 – no PV applied; 1 – PV applied;*
    2. Fill in the interest rate in the second row;
    3. Click **update,** otherwise use default (no PV applied and interest rate is 0);
4. Fill in sensitivity level: 0 – average; 1- Min; 2- Max; This will indicate which set of data will be used for calculation;
5. Fill in the estimated ship total price for the purpose of risk assessment
6. Use the drop list to select and modify existing ship particulars; **Cont.**

Design & General Information

- *Financial data*



Design & General Information

- *Ship particulars*

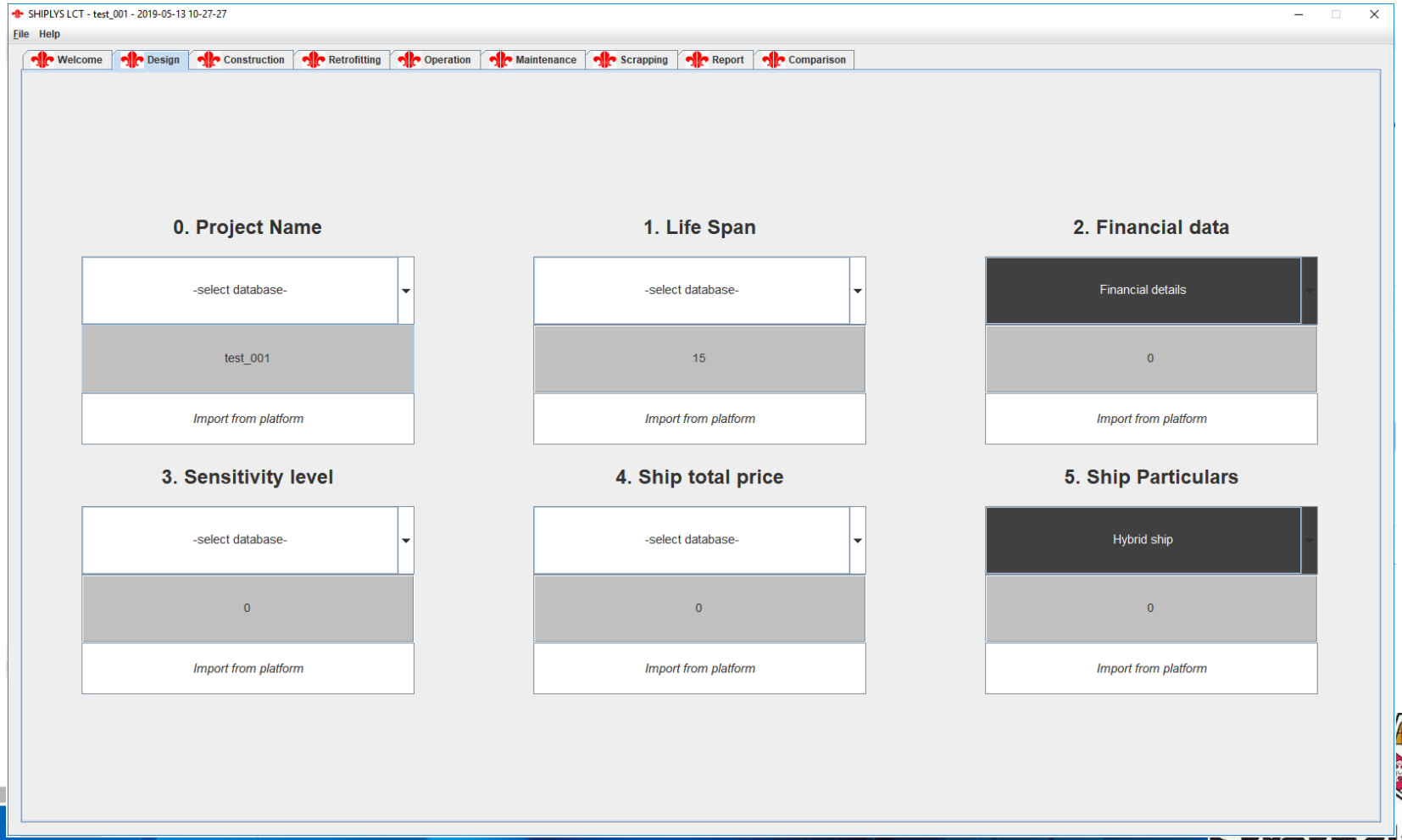
MPC 9800t - Database Details

Type	Average	Minimum	Maximum	Unit
Ship Name				
Length overall	126.08	113.472	138.688	m
Length between perpendiculars	113.75	102.375	125.125	m
Breadth	20.00	18	22	m
Depth	10.40	9.36	11.44	m
Draught	8.30	7.47	9.13	m
Block Coefficient	0.7	0.63	0.77	
Service speed	14	12.6	15.4	knot
Deck No. in superstructure	6	5.4	6.6	
Number of crews	20	18	22	
Steel price	534	480.6	587.4	€/tonne
Power	5400	4860	5940	kW
Steel weight*	0	0	0	tonne
Retrofitting steel weight**	0	0	0	tonne
*If steel weight is given, it will be used; otherwise estimated using empirical equations.				
**For retrofitting case only.				

Update Save as

Design & General Information

- An example



Life Stages

- There are **five** stages with **activities** in the software and user could use some of them or all to carry out their study:
  - Construction: material, machinery, outfitting;
  - Retrofitting: material, machinery, outfitting;
  - Operation: fuel and lubricating Oil consumption;
  - Maintenance: machinery, hull;
  - Scrapping: machinery, hull.

Construction/Retrofitting

- **Construction/Retrofitting involves: Hull, Machinery and Outfitting;**
- **Hull**:
  - Select facilities for activities (cutting, bending, etc.);
  - Modify database based on practical facilities;
  - Update or save the modified database;
  - Select, modify, update and save transportation specification from database;
- **Machinery:**
  - Select, modify, update and save machinery specification from database;
  - Select, modify, update and save transportation specification from database;
  - Select, modify, update and save electricity specification from database;
- **Outfitting**
  - Input outfitting material weight for estimations;
  - Select, modify, update and save facilities for activities (cutting, bending, etc.);
  - Select, modify, update and save transportation specification from database;

Hull Related Activities

- Cutting, bending, welding, blasting, coating

Cutting details - Database Details

Type	Average	Minimum	Maximum	Unit
Cut				
Length	13242	11917.8	14566.2	m
Speed	0.72	0.648	0.792	m/h
Specific material consumption	0.03	0.027	0.033	kg/m
Material price	0	0	0	€/kg
Power requirement	6.5	5.85	7.15	kW
Labour price	20	18	22	€/h
Cutting hours*	0	0	0	h
Specific cutting hour per tonne**	20	20	20	h/tonne
*The hours will be used first if given;				
**If no hours available, use specific hour/tonne above to estimate;				
If none available, default value would be used.				

Update Save as

Hull Related Activities

- Transportation

Container ship 27500 dwt payload - Database Details

Type	Average	Minimum	Maximum	Unit
Transportation type	Container ship 2750...			
Transportation distance	100	100	100	km
Trans. Fee*	0	0	0	€/km
Trans.SFOC	1.90E-04	1.71E-04	2.09E-04	kg/km
Fuel price	0	0	0	€/tonne
GWP (incl. biogenic CO2)	1.26E-03	1.26E-03	1.26E-03	kg CO2 Equiv./kg fuel
AP	4.22E-05	4.22E-05	4.22E-05	kg SO2 Equiv./kg fuel
EP	4.32E-06	4.32E-06	4.32E-06	kg PO4 Equiv./kg fuel
POCP	2.19E-06	2.19E-06	2.19E-06	kg C2H6 Equiv./kg f...
GWP (excl. biogenic CO2)	1.26E-03	1.26E-03	1.26E-03	kg CO2 Equiv./kg fuel
*Aware fuel price may be covered in Transportation fee.				

Update Save as

Machinery Related Activities

- Machinery details

Caterpilar M20C - Database Details

Type	Average	Minimum	Maximum	Unit
Engine_construction	Caterpilar M20C			
No. of Engines	1	1	1	
Engine weight	10.9	9.81	11.99	tonne
Engine price	0	0	0	€
Maximum engine output	1800	270	330	kW
Specific installation energy per tonne*	0	0	0	kWh/tonne
Risk hazard	Frequency	Consequence	Mitigation	
No.1 G/E fails	2	2	1	
No.2 G/E fails	2	2	1	
No.3 G/E fails	2	2	1	
No.1 Motor Fails during normal operation	2	6	2	
No.2 Motor Fails during normal operation	2	6	2	
No.1 DC Variable speed drives fails during normal operation	1	6	2	
No.2 DC Variable speed drives fails during normal operation	1	6	2	
*This is used for energy consumption estimation;				
If not given, default value will be used.				

Update Save as

Machinery Related Activities

- Electricity by source

Electricity_Wind - Database Details

Type	Average	Minimum	Maximum	Unit
Installation type	Wind	Min	Max	
Price		0.018	0.022	€/kWh
GWP (incl. biogenic CO2)	2.40E-03	2.40E-03	2.40E-03	kg CO2 Equiv./kWh
AP	6.67E-06	6.67E-06	6.67E-06	kg SO2 Equiv./kWh
EP	7.50E-07	7.50E-07	7.50E-07	kg PO4 Equiv./kWh
POCP	2.63E-07	2.63E-07	2.63E-07	kg C2H6 Equiv./kWh
GWP (excl. biogenic CO2)	2.37E-03	2.37E-03	2.37E-03	kg CO2 Equiv./kWh

Update Save as

Machinery Related Activities

- Transportation

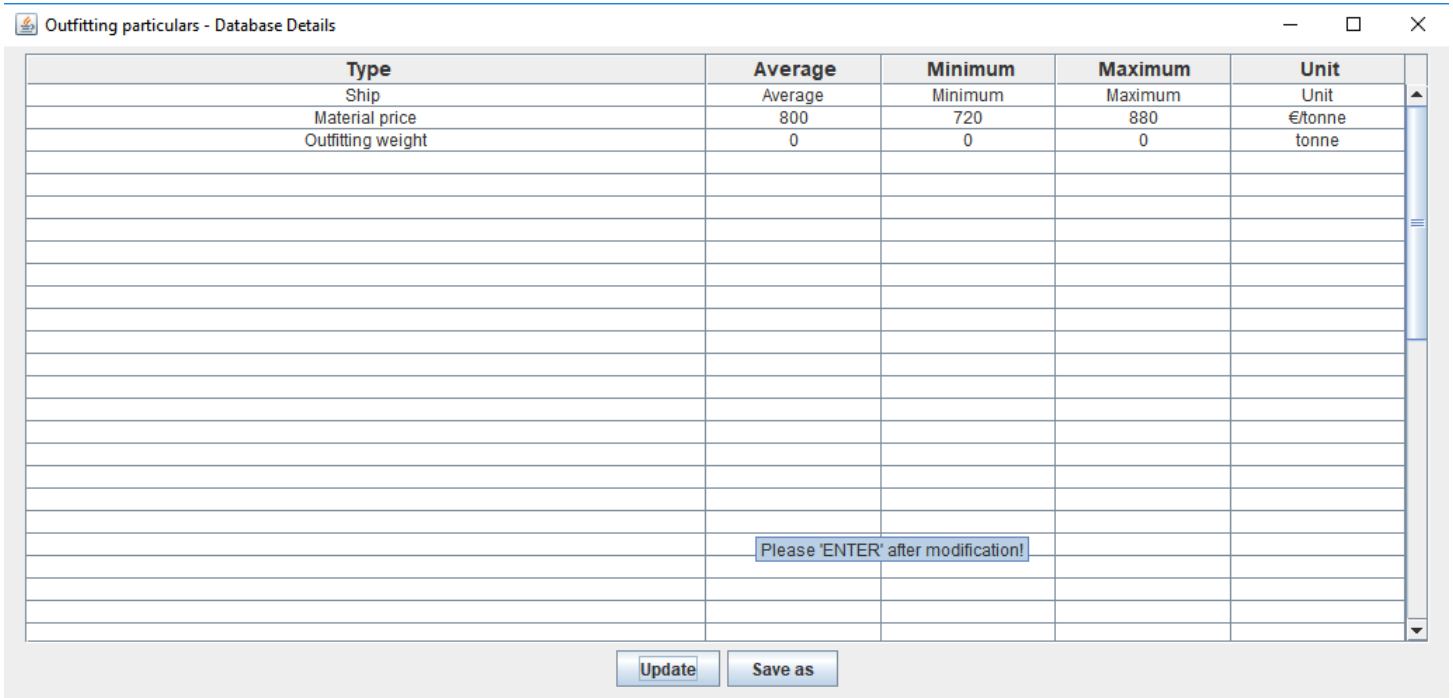
Container ship 27500 dwt payload - Database Details

Type	Average	Minimum	Maximum	Unit
Transportation type	Container ship 2750...			
Transportation distance	100	100	100	km
Trans. Fee*	0	0	0	€/km
Trans.SFOC	1.90E-04	1.71E-04	2.09E-04	kg/km
Fuel price	0	0	0	€/tonne
GWP (incl. biogenic CO2)	1.26E-03	1.26E-03	1.26E-03	kg CO2 Equiv./kg fuel
AP	4.22E-05	4.22E-05	4.22E-05	kg SO2 Equiv./kg fuel
EP	4.32E-06	4.32E-06	4.32E-06	kg PO4 Equiv./kg fuel
POCP	2.19E-06	2.19E-06	2.19E-06	kg C2H6 Equiv./kg f...
GWP (excl. biogenic CO2)	1.26E-03	1.26E-03	1.26E-03	kg CO2 Equiv./kg fuel
*Aware fuel price may be covered in Transportation fee.				

Update Save as

Outfitting Related Activities

- Outfitting weights are estimated using particulars from **Design** panel
  - Outfitting price is required



  - Cutting, welding, coating & Transportation

Operation

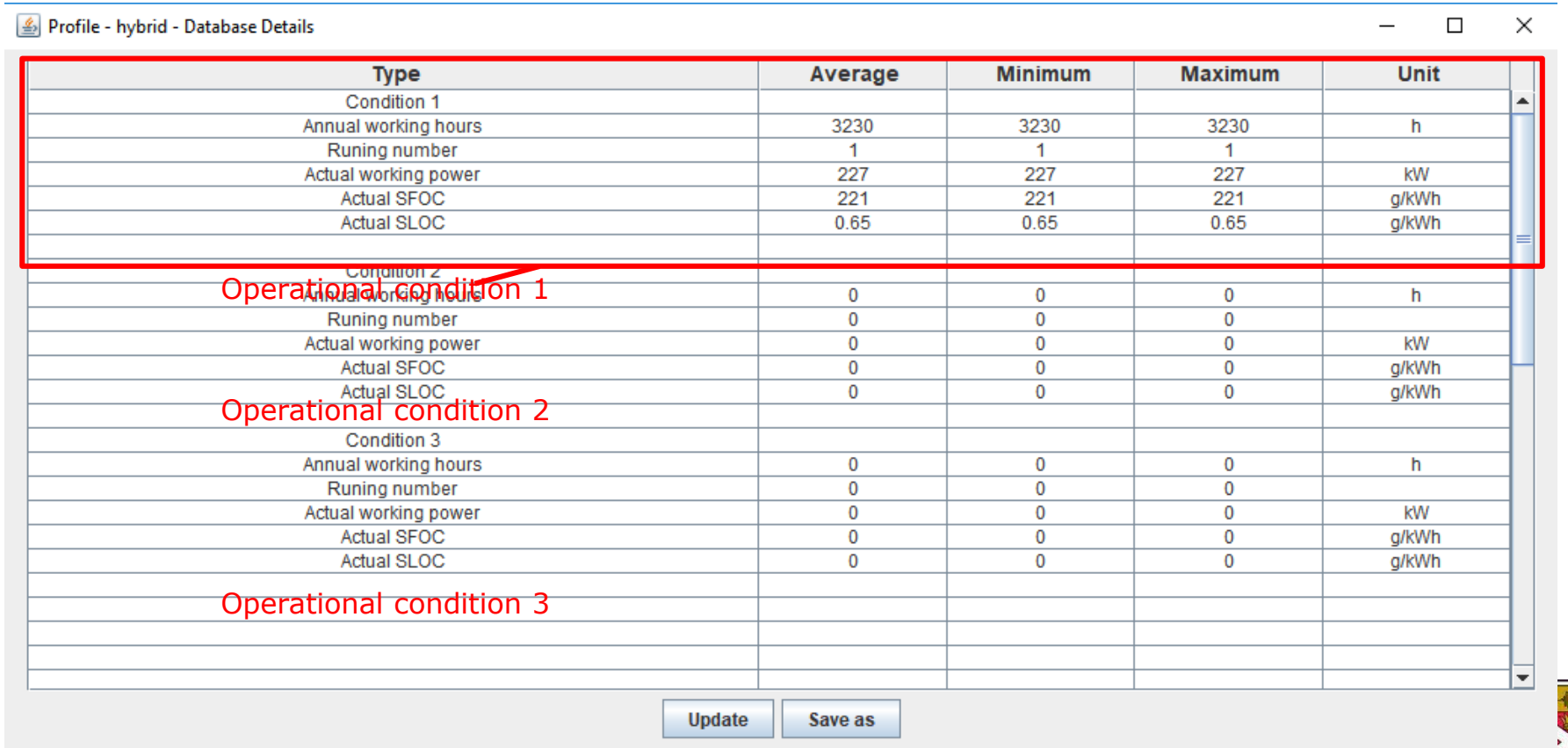
- Equation used here for oil consumption:

$$\sum_1^m FC_i = P_i \times SOC_i \times h_i \times n_i \times 1000000$$

  - FC is the fuel consumption (ton);
  - P is the power required (kW);
  - SOC is the specific oil consumption (g/kWh);
  - h is the operating hours;
  - n is the number of engine running;
  - m is the number of operation conditions.

Operation

- Operational profile



Type	Average	Minimum	Maximum	Unit
Condition 1				
Annual working hours	3230	3230	3230	h
Runing number	1	1	1	
Actual working power	227	227	227	kW
Actual SFOC	221	221	221	g/kWh
Actual SLOC	0.65	0.65	0.65	g/kWh
Condition 2				
Annual working hours	0	0	0	h
Runing number	0	0	0	
Actual working power	0	0	0	kW
Actual SFOC	0	0	0	g/kWh
Actual SLOC	0	0	0	g/kWh
Condition 3				
Annual working hours	0	0	0	h
Runing number	0	0	0	
Actual working power	0	0	0	kW
Actual SFOC	0	0	0	g/kWh
Actual SLOC	0	0	0	g/kWh

Operation

- Oil type

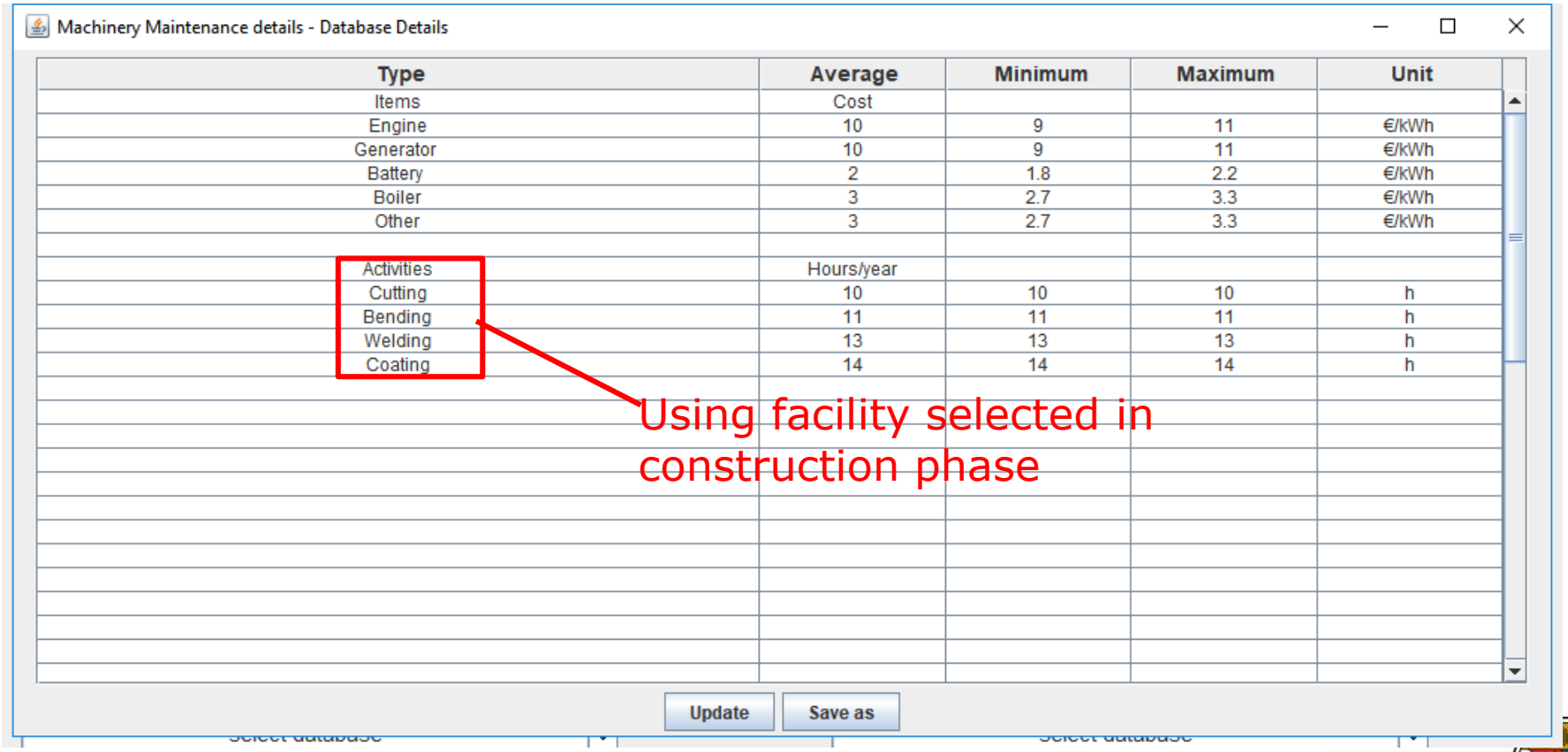
AU HFO at refinery (1.0wt. % S) - Database Details

Type	Average	Minimum	Maximum	Unit
Fuel type	AU HFO at refinery (...			
Fuel price	0	0	0	tonne
GWP	0.368	0.368	0.368	kg CO2 Equiv./kg fuel
AP	1.89E-03	0.002	0.002	kg SO2 Equiv./kg fuel
EP	1.55E-04	0	0	kg PO4 Equiv./kg fuel
POCP	2.51E-04	0	0	kg C2H6 Equiv./kg f...
Carbon emission factor	3.114	0	0	kg CO2/kg fuel
Sulfer content	0.01	0	0	kg SO2/kg fuel
NOx factor	0.052	0	0	kg NOx/kg fuel

Update | Save as

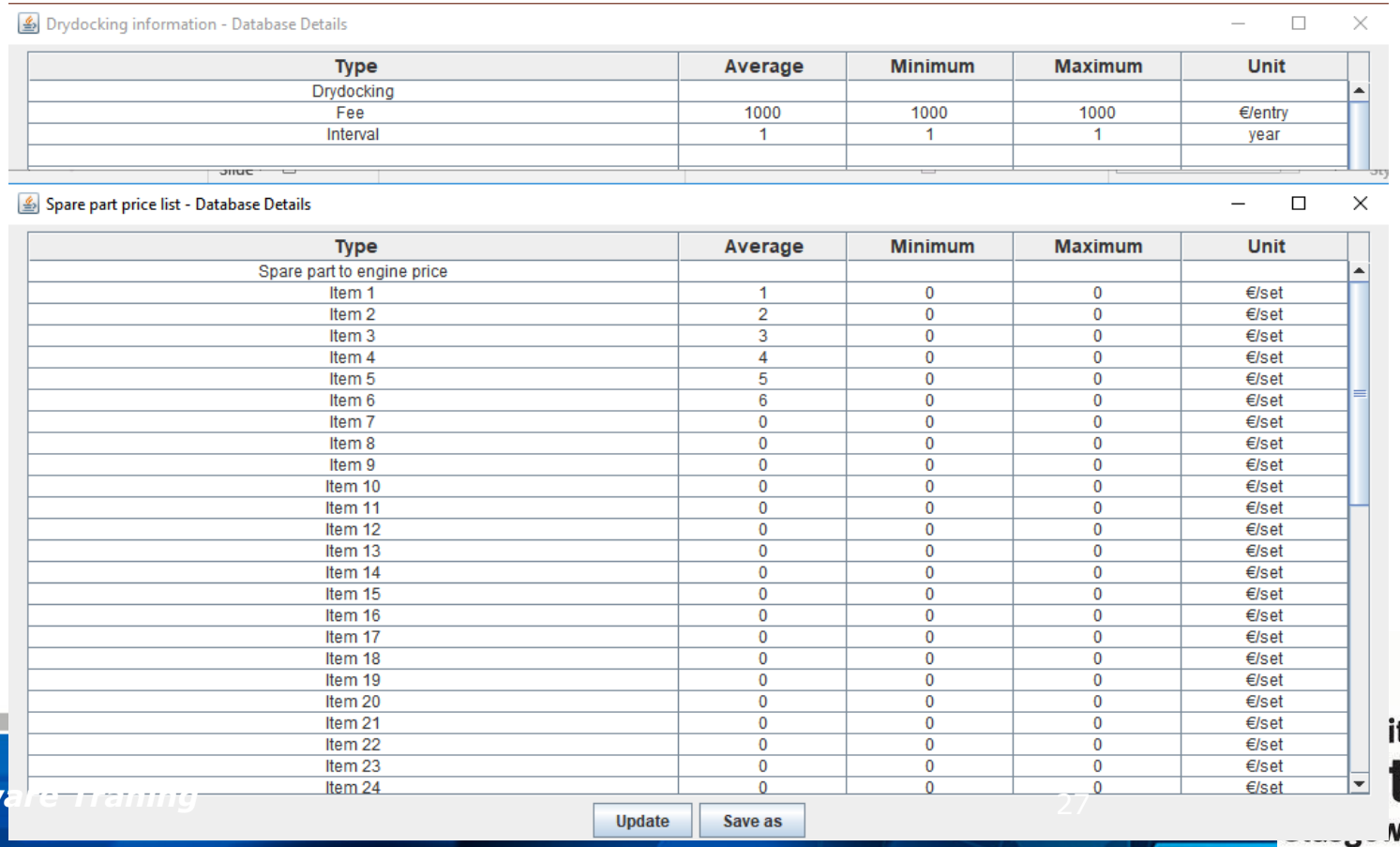
Maintenance Activities

- Machinery



Maintenance Activities

- Dry-docking & Spare
  - You can include spare parts with their prices into this list to estimated the spare part cost.



Drydocking information - Database Details

Type	Average	Minimum	Maximum	Unit
Drydocking				
Fee	1000	1000	1000	€/entry
Interval	1	1	1	year

Spare part price list - Database Details

Type	Average	Minimum	Maximum	Unit
Spare part to engine price				
Item 1	1	0	0	€/set
Item 2	2	0	0	€/set
Item 3	3	0	0	€/set
Item 4	4	0	0	€/set
Item 5	5	0	0	€/set
Item 6	6	0	0	€/set
Item 7	0	0	0	€/set
Item 8	0	0	0	€/set
Item 9	0	0	0	€/set
Item 10	0	0	0	€/set
Item 11	0	0	0	€/set
Item 12	0	0	0	€/set
Item 13	0	0	0	€/set
Item 14	0	0	0	€/set
Item 15	0	0	0	€/set
Item 16	0	0	0	€/set
Item 17	0	0	0	€/set
Item 18	0	0	0	€/set
Item 19	0	0	0	€/set
Item 20	0	0	0	€/set
Item 21	0	0	0	€/set
Item 22	0	0	0	€/set
Item 23	0	0	0	€/set
Item 24	0	0	0	€/set

Update Save as

Scrapping Activities

- Scrapping admin fee

Scrapping - Database Details

Type	Average	Minimum	Maximum	Unit
Price of scrapping Materials				
Hull materials	20	20	20	€/tonne
Price of scrapping machinery				
Main engine	1000	900	1100	€/set
Generator	1100	990	1210	€/set
Battery	500	450	550	€/set
Boiler	800	720	880	€/set
*Energy cost are included in scrapping fees.				

Update Save as

Scrapping Activities

- Transportation

Truck 17.3 ton - Database Details

Type	Average	Minimum	Maximum	Unit
Transportatio...	Truck_17.3 ton			
Transportatio...	1000	1000	1000	km
Trans. Fee	1.62	1.458	1.782	€/km
Trans.SFOC	2.84E-01	2.56E-01	3.12E-01	kg/km
Fuel price	1350	1215	1485	€/ton
GWP	5.23E-03	5.23E-03	5.23E-03	kg CO2 Equiv....
AP	1.21E-06	1.21E-06	1.21E-06	kg SO2 Equiv....
EP	2.94E-07	2.94E-07	2.94E-07	kg PO4 Equiv....
POCP	1.87E-07	1.87E-07	1.87E-07	kg C2H6 Equi...

- Electricity by source

Electricity - Database Details

Type	Average	Minimum	Maximum	Unit
Installation type	Wind			
Price	0.01	0.009	0.011	€/kWh
GWP	8.43E-03	8.43E-03	8.43E-03	kg CO2 Equiv....
AP	2.09E-05	2.09E-05	2.09E-05	kg SO2 Equiv....
EP	1.69E-06	1.69E-06	1.69E-06	kg PO4 Equiv....
POCP	1.84E-06	1.84E-06	1.84E-06	kg C2H6 Equi...

- Hull, Machinery and Outfitting

Hull scrapping details - Database Details

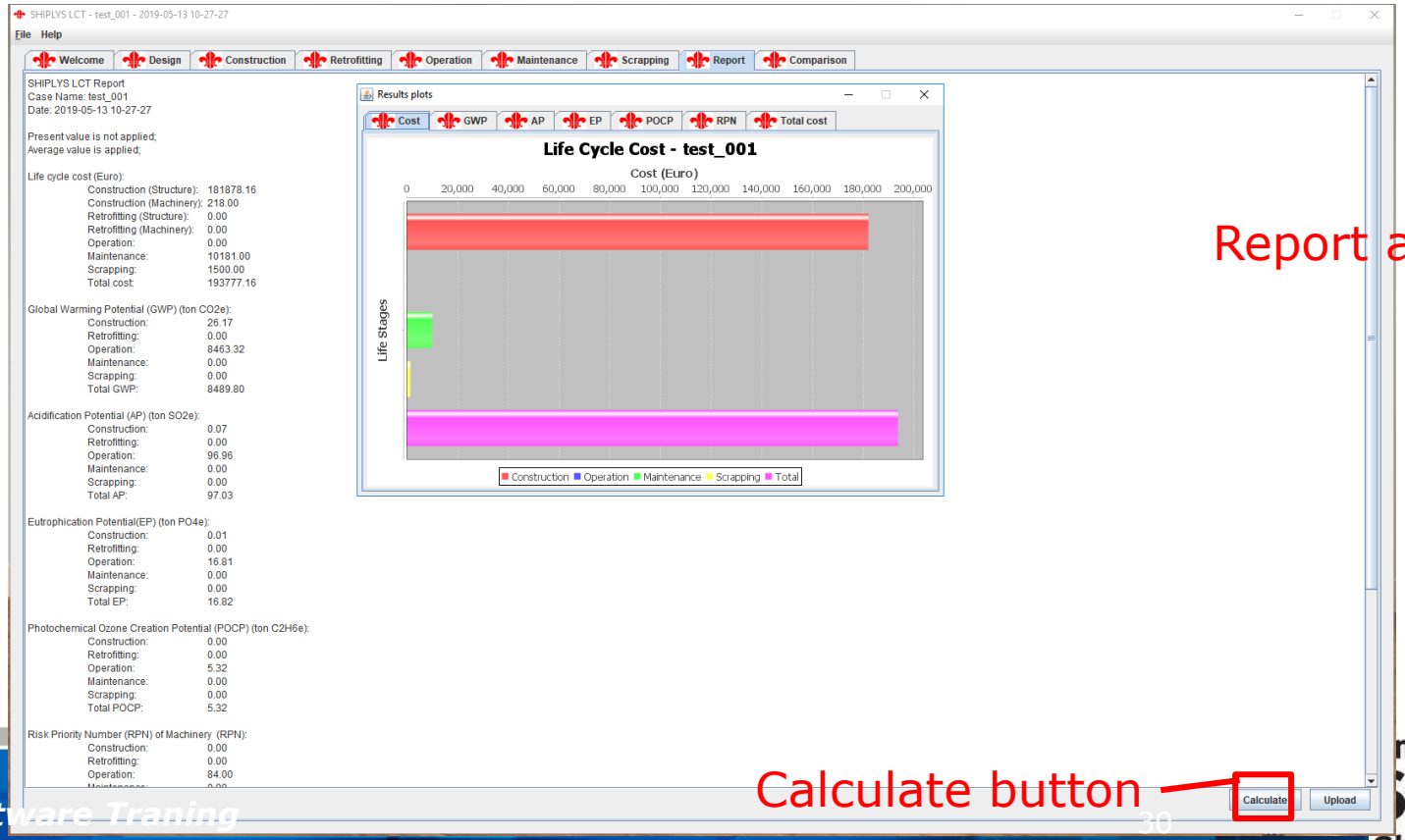
Type	Average	Minimum	Maximum	Unit
Hull scrappin...	Avg	Min	Max	Units
Cutting	100	100	100	hours
Cleaning	100	100	100	hours

Using facility selected in construction phase

Calculation & Report

- After selection, modifying and updating, the calculation will be triggered by calculate button in Report tab.

- An excel file will be generated and saved at "*INSTALL DICTIONARY\reports*"; named using your inputted case name in **Design** panel.

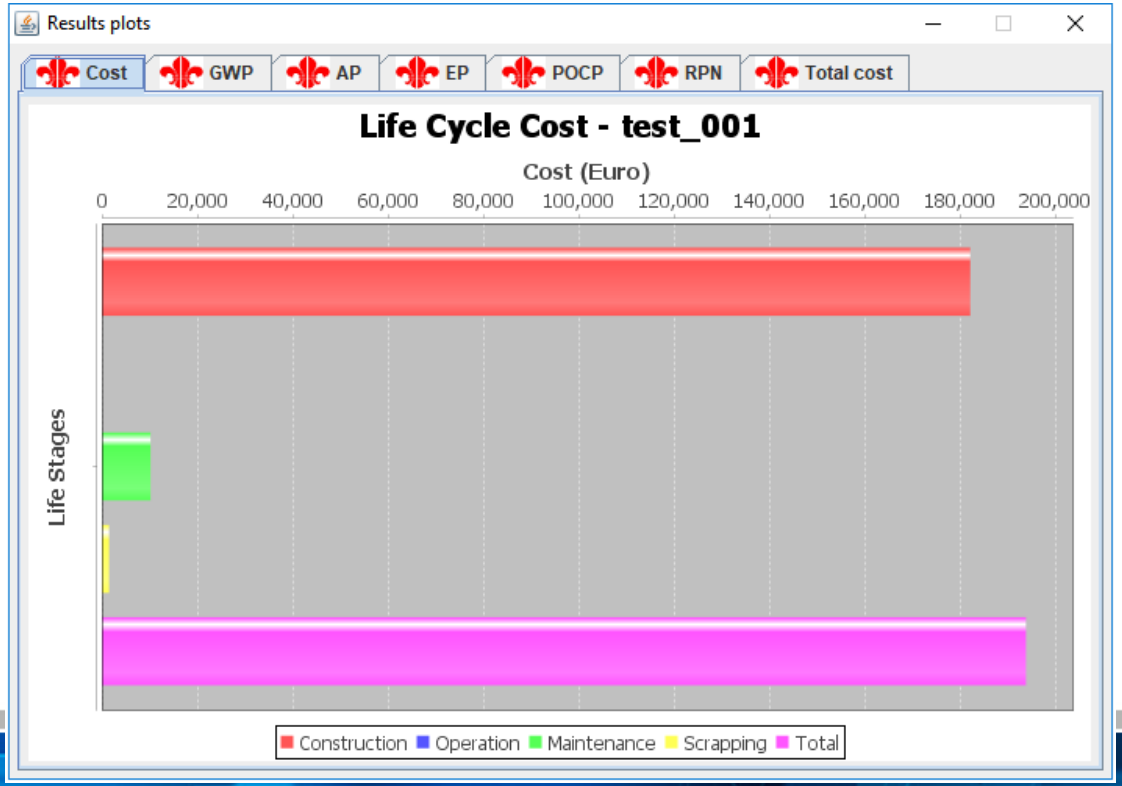


Report area

Calculate button

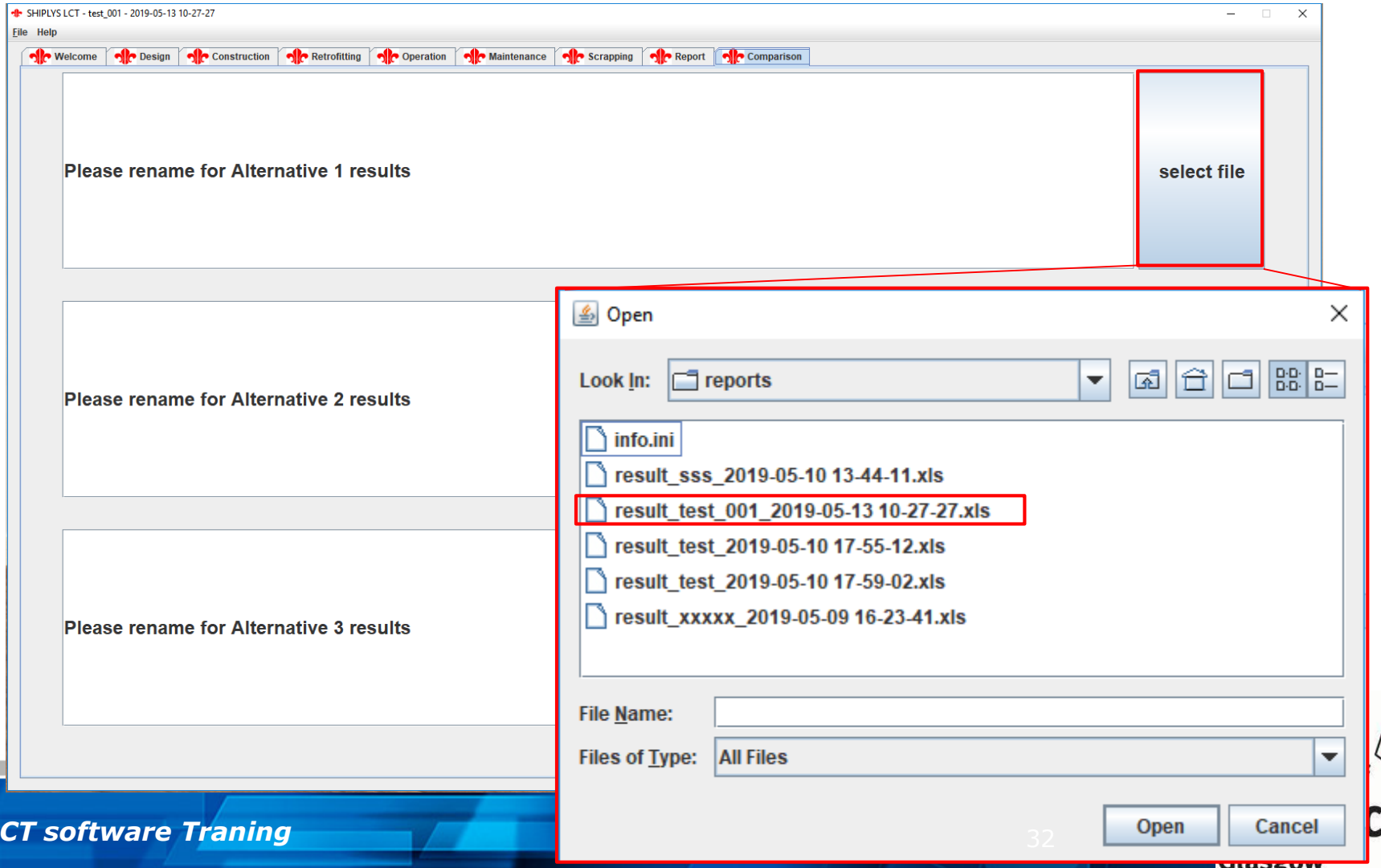
Calculation & Report

- A series of plots will be displayed in a separated window;
- It can be copied and exported by users.



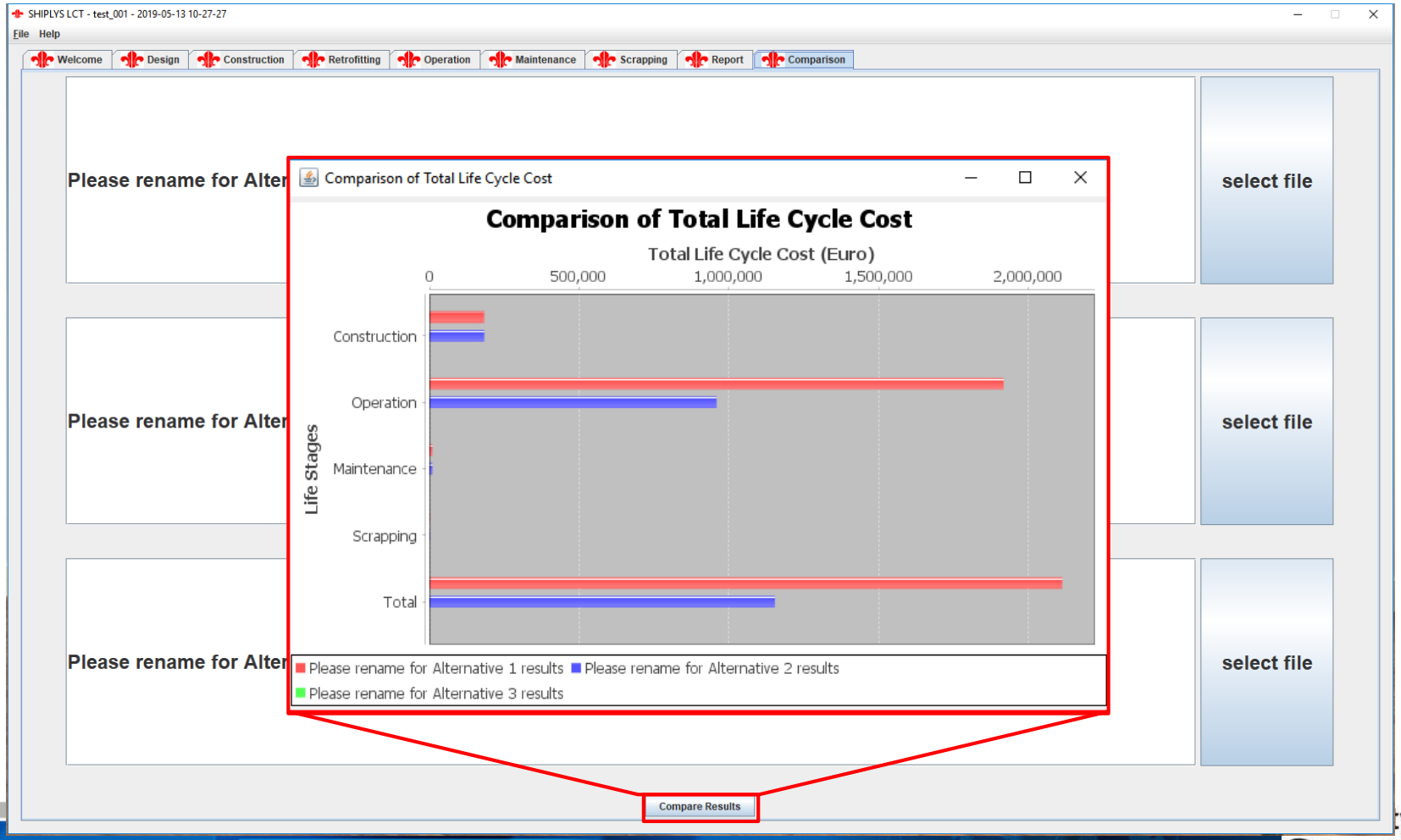
Comparison

- Select saved report files



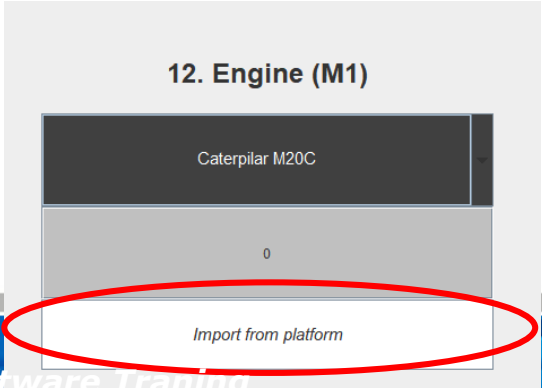
Comparison

- Compare results to determine the optimal

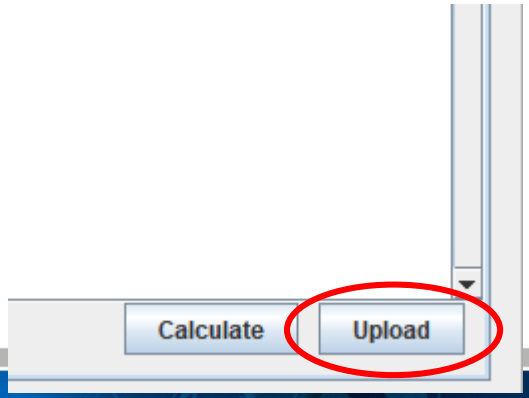


Connect SHIPLYS Platform

- **Download** existing database from platform
  - Platform connected using **DMT** software;
  - Use the import from server button;
  - Database will be saved in "*INSTALL DICTIONARY\db\import database*"



- **Upload** calculated results to platform
  - Use the "Upload" button in **Report** tab;
  - Results will be uploaded and saved in platform using the case name given in **Design** panel



Thank you for your attention!

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13 May 2019

Any questions?