

# MAGMA ECONOMICS

## Steel Casting

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### International MAGMA User Meeting 2024

October 9-11, Frankfurt



# What Is MAGMA ECONOMICS?

- ▮ Allows users to estimate automatically costs and environmental impact (CO<sub>2</sub>)
- ▮ Take advantage of existing data available in MAGMASOFT®
- ▮ Bridge the gap between technical and economical info
- ▮ Economic objectives can be considered in optimization - comparison of cost or CO<sub>2</sub> estimations across different designs or project versions

...not only quality

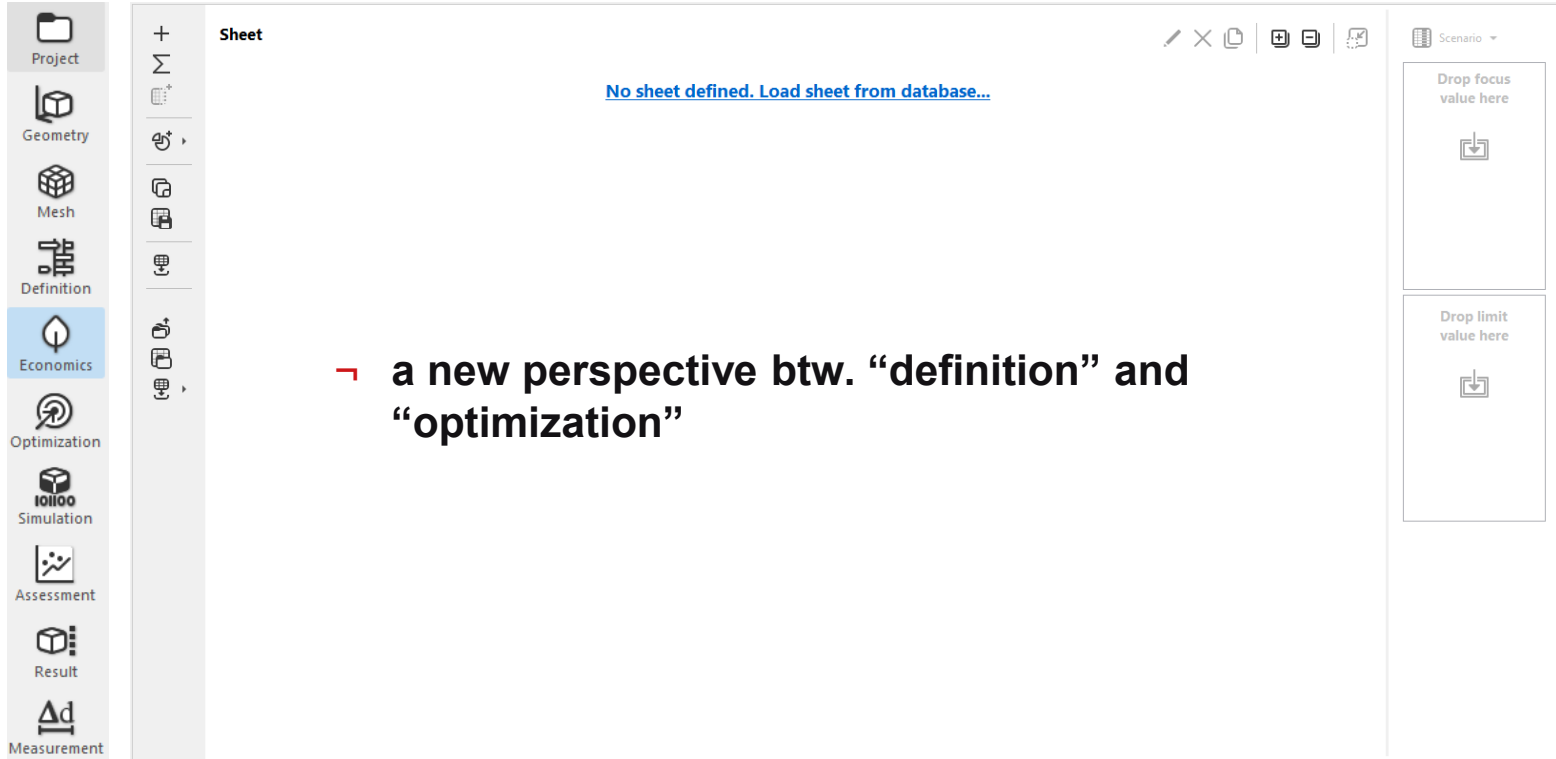


**...also costs & CO<sub>2</sub> are evaluated!**

- ← Material costs
- ← Melting costs
- ← Machining costs
- ← CO<sub>2</sub> emissions

# Introduction of a new Perspective

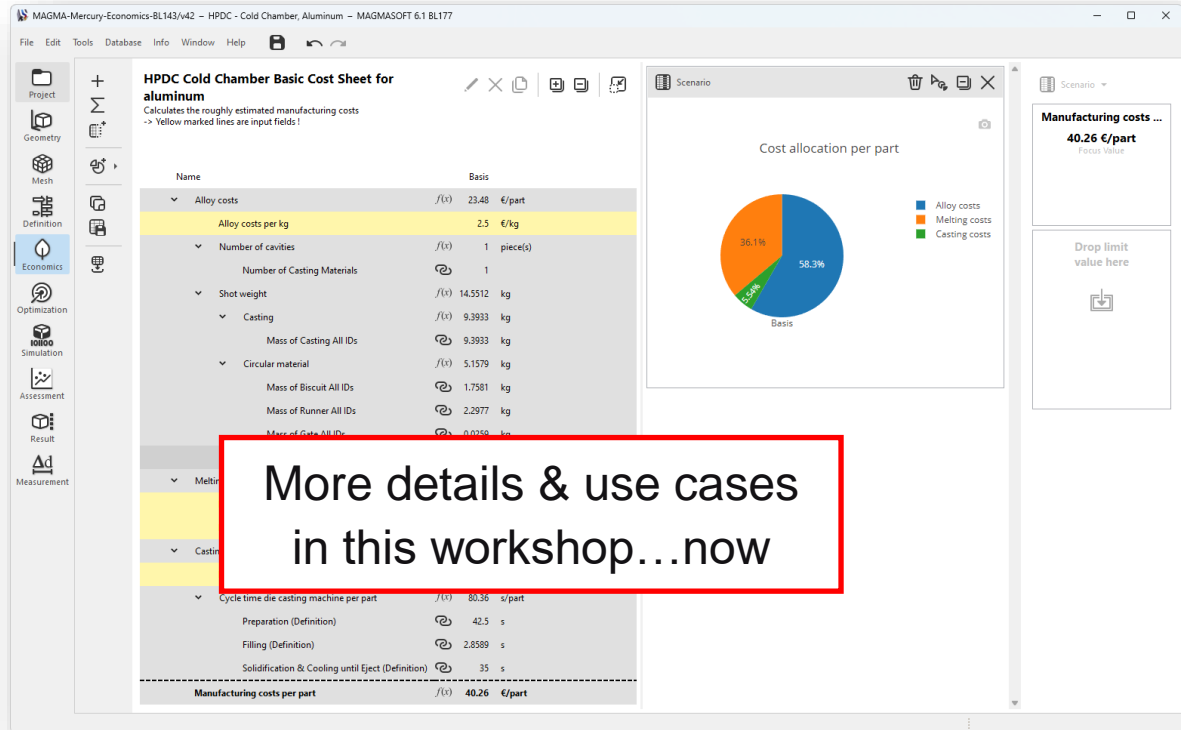
## The first page



# MAGMA ECONOMICS – Cost Sheet

## What Is a Cost Sheet?

... but how do I  
make this cost or  
CO<sub>2</sub> estimation in  
MAGMASOFT®?



# LIVE DEMO

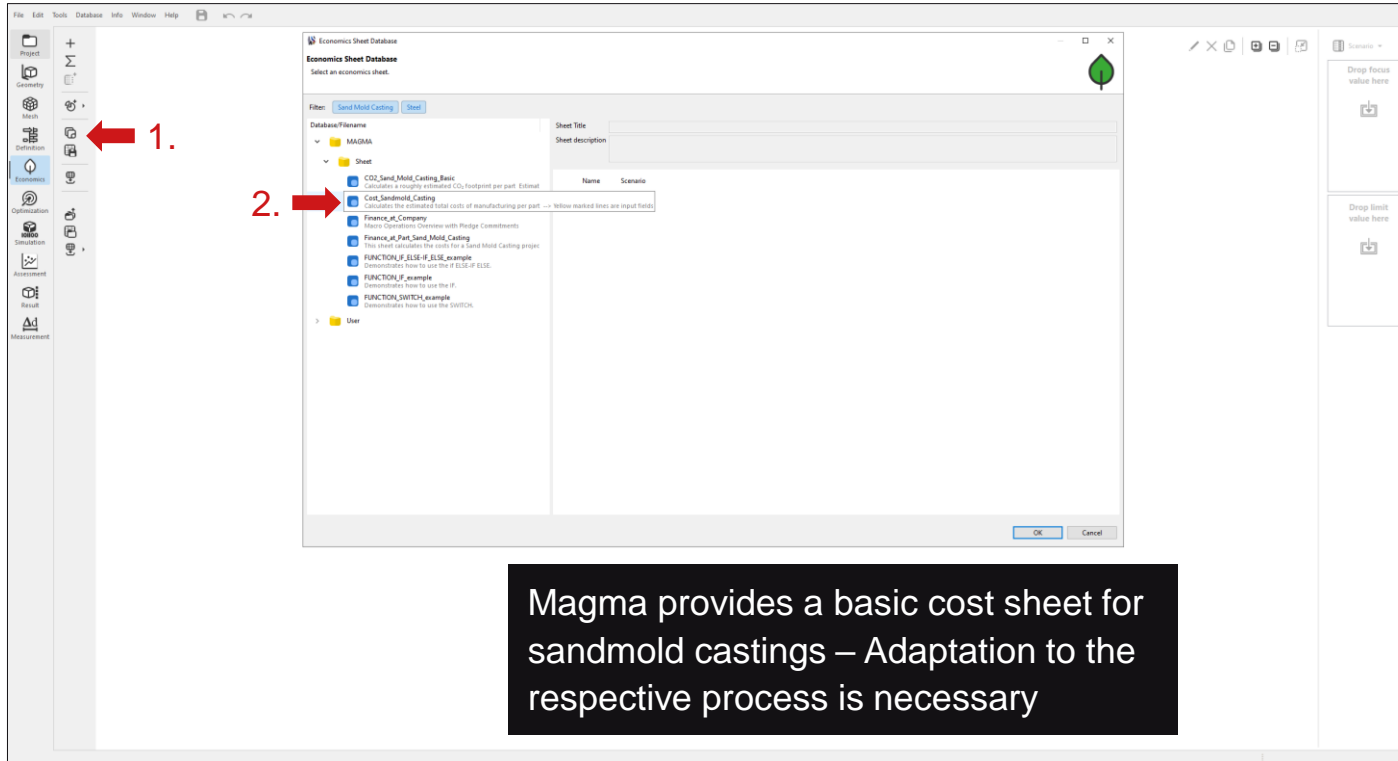
# MAGMA ECONOMICS

## Good to know for using Economics

- The user needs to make sure that the units fit together
- If using DoE: You have to add a cost sheet before you start the simulation. You cannot add it afterwards.
- If using DoE: The objective “cost” will not be updated, if you change the cost sheet after the simulation. You have to rerun the simulation.
- If using the version compare: You have to add a cost sheet before you start the simulation and you have to add the sheet in every version.
- **It is not a comprehensive cost-/CO<sub>2</sub>-calculation program**

# MAGMA ECONOMICS – STEEL CASTING

## Load basic cost-sheet from database



Magma provides a basic cost sheet for sandmold castings – Adaptation to the respective process is necessary

# MAGMA ECONOMICS – STEEL CASTING

## Economic Perspective: Add values to sheet

The screenshot displays the MAGMA Economics Steel Casting interface. The main window shows a table of costs for various materials and components. A pie chart titled 'Pie Chart of total Manufacturing costs' is visible, showing the distribution of costs across different scenarios. The 'Add Project Values' dialog box is open, allowing users to select volume values from the current project definition for single materials or groups of materials to add to the sheet. The dialog box lists various materials and their volumes, including 'Volume of All Materials', 'Volume of Cast Alloy', 'Volume of Casting', 'Volume of Casting All IDs', 'Volume of Casting ID 1', 'Volume of Casting System', 'Volume of Feeder All IDs', 'Volume of Feeder ID 1', 'Volume of Feeder ID 2', 'Volume of Feeder ID 3', 'Volume of Filter', 'Volume of Filter All IDs', 'Volume of Filter ID 1', 'Volume of Sand Mold', and 'Volume of Core Box All IDs'. The 'Volume of All Materials' is highlighted, showing a value of 939,999.9993 cm³. The dialog box also includes a 'Select / Unselect All' button and 'OK' and 'Cancel' buttons.

**Cost\_sandmold\_casting**  
Calculates the estimated total costs of manufacturing per part  
→ Yellow marked lines are input fields

Name	Scenario	Value	Unit
Total costs of cast alloy	f(x)	1,797,540.5	€
Unit cost of cast alloy	f(x)	1.490	€/t
Mass of Casting All IDs	f(x)	674,021.4	kg
Unit cost of melting	f(x)	950	€/t
Mass of Cast Alloy	f(x)	863,339	kg
Total costs of molding	f(x)	484,287.1	€
Unit cost of molding	f(x)	0.43	€/kg
Mass of Core Box All IDs	f(x)	402,431	kg
Mass of Drag Box All IDs	f(x)	593,7626	kg
Mass of Sand Mold All IDs	f(x)	0	kg

**Add Project Values**  
Select volume values from current project definition for single materials or for groups of materials to add to the sheet.

**Select / Unselect All**

Name	Value	Unit
Volume of All Materials	939,999.9993	cm³
Volume of Cast Alloy	110,282.1201	cm³
Volume of Casting	86,102.6953	cm³
Volume of Casting All IDs	86,102.6953	cm³
Volume of Casting ID 1	86,102.6953	cm³
Volume of Casting System	24,179.4248	cm³
Volume of Feeder All IDs	24,179.4248	cm³
Volume of Feeder ID 1	7,624.9922	cm³
Volume of Feeder ID 2	8,269.8369	cm³
Volume of Feeder ID 3	8,284.5957	cm³
Volume of Filter	656.9629	cm³
Volume of Filter All IDs	656.9629	cm³
Volume of Filter ID 1	656.9629	cm³
Volume of Sand Mold	717,921.6875	cm³
Volume of Core Box All IDs	321,876.5675	cm³

**Add Dataset Values**  
Add Dataset Values

**Add Value to Sheet**  
Specify a value for the sheet. Simple shares can be specified or mathematical expressions can be formulated based on other shares in the sheet.

**Name**  
New Value

**Value**  
0.0

**Unit**  
Define expression

**Border**  
With value range

**Background Color**

**Database/FileName**  
MAGMA

**Sheet**

- CO2\_HPDC\_Cold\_Chamber\_Basic  
Calculates a roughly estimated CO2
- CO2\_HPDC\_Hot\_Chamber\_Basic  
Calculates a roughly estimated CO2
- CO2\_Sand\_Mold\_Casting\_Basic  
Calculates a roughly estimated CO2
- CO2\_Semi\_Solid\_Basic  
Calculates a roughly estimated CO2
- Cost\_CC\_Basic  
Calculates the estimated manufact
- Cost\_Core\_Shooting\_Curing\_Inor
- Cost\_Core\_Shooting\_Curing\_PU
- Cost\_Die\_Casting\_Basic  
Calculates the estimated manufact
- Cost\_Die\_Casting\_Rotacast  
Calculates the estimated manufact
- Cost\_HPDC\_Cold\_Chamber\_Basic  
Calculates the roughly estimated r
- Cost\_HPDC\_Hot\_Chamber\_Basic  
Calculates the roughly estimated r
- Cost\_LPDC\_Basic  
Calculates the estimated manufact
- Cost\_Sandmold\_Casting  
Calculates the estimated total cost

**Select / Unselect All**

Name	Value	Unit
CO2_Estimation of the Cast Material	15,605.4	kg
CO2 emission factor of raw material (90% steel scrap + 10% pig iron)	15,605.4	kg
Mass of Cast Alloy	12,4296	kg
Mass of Casting All IDs	1	
Number of Casting Materials	5.051	kg CO2eq/part
CO2_Estimation of Melting	650	kg CO2eq/part
Power consumption of electrical furnace	498	kg CO2eq/part
CO2 emission factor of electricity	0	kg/t
Coal consumption of cupola furnace	5,000	kg CO2eq/part
CO2 emission factor of coal	0.513	kg CO2eq/part
CO2_Estimation of Preparation, Filling, Solidification	0.4203	kg
Mass of Core All IDs	19.9	kg CO2eq/kg
CO2 emission factor of silica sand	0.505	kg CO2eq/part
CO2_Estimation of Sand Mold and Core Production	8.106	kg CO2eq/part
CO2_Estimation per Part		



# MAGMA ECONOMICS – STEEL CASTING

## Save Economics Sheet Dataset

**Cost\_sandmold\_casting**  
Calculates the estimated total costs of manufacturing per part  
→ Yellow marked lines are input fields

Name	Scenario
Total costs of cast alloy	/t/ 1,797,5485 €
Unit cost of cast alloy	1,430 €/t
Mass of Casting All IDs	674,0514 kg
Unit cost of molting	950 €/t
Mass of Cast Alloy	389,949 kg
Total costs of molting	/t/ 484,2871 €
Unit cost of molting	0,45 €/kg
Mass of Core Box All IDs	482,431 kg
Mass of Drag Box All IDs	593,7626 kg
Mass of Sand Mold All IDs	0 kg
Total costs of cores	/t/ 210,5431 €
Unit cost of mixed core sand	0,85 €/kg
Mass of Core All IDs	247,7902 kg
Total costs of sleeve(s)	/t/ 19,1224 €
Unit cost of sleeve	5 €/kg
Mass of Sleeve All IDs	3,8245 kg
Total costs of chills	/t/ 52,3897 €
Unit cost of chill	0,5 €/kg
Mass of Chill All IDs	104,7794 kg
Total costs of filter(s)	/t/ 12 €
Unit cost per filter	12 €/t
Number of Filter Materials	1
Total cost of feedneck area cleaning	/t/ 674,0641 €
Unit cost per feedneck feeder area cleaning	0,01 €/mm2
Cast Contact Area of Feeder All IDs	67,406,4148 mm²
Cast Contact Area of Feedneck All IDs	0 mm²
Total costs of chill area cleaning	/t/ 79,5923 €
Unit costs of chill area cleaning	0,0002 €/mm2
Cast Contact Area of Chill All IDs	397,961,6211 mm²
Number of Casting Materials	1
Total costs of manufacturing per part	/t/ 1,329,5474 €

**Economics Sheet Dataset**  
Dataset already exists

Database: User

Name: Cost\_Sandmold\_Casting

Description: Calculates the estimated total costs of manufacturing per part  
→ Yellow marked lines are input fields

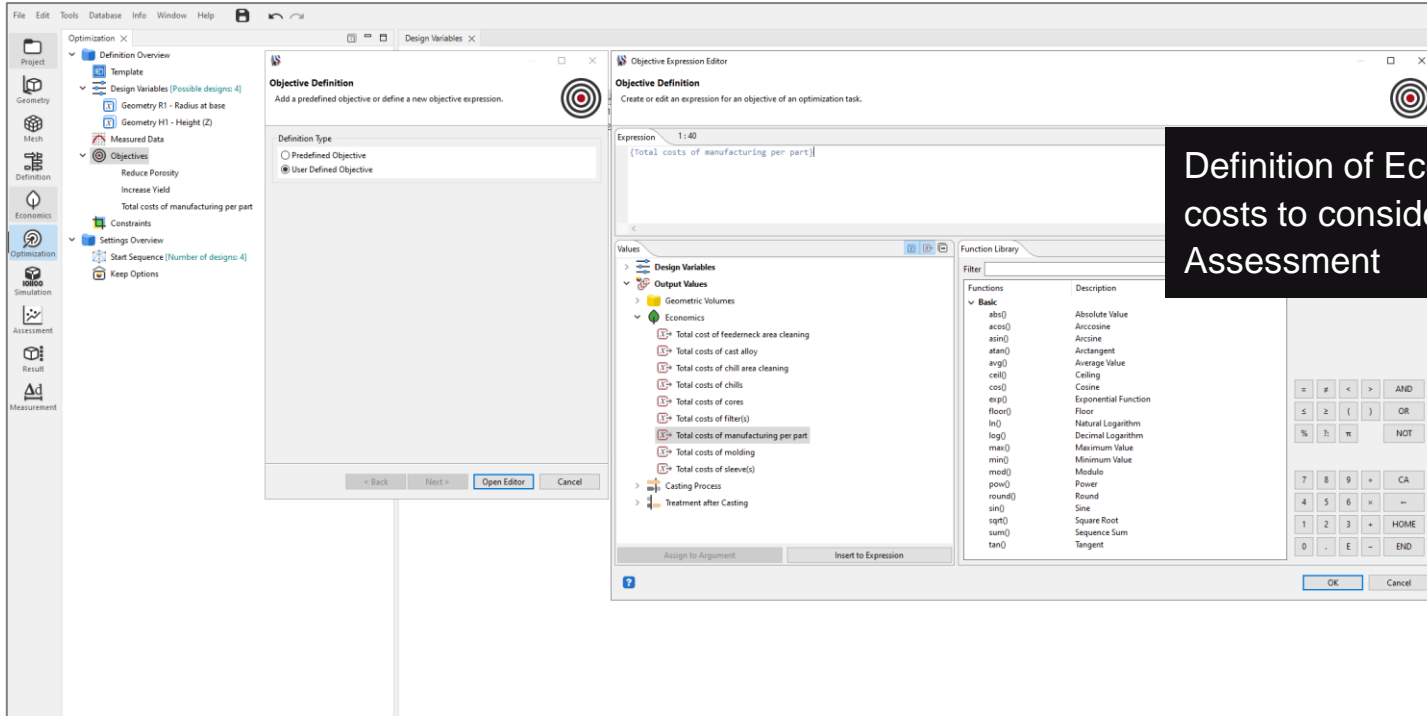
Lost Mold Permanent Mold Continuous Casting Core Production

Aluminum Cobalt Copper Iron Magnesium Nickel Steel Zinc Other Alloy

After customizing the basic cost sheet, it is useful to save the dataset in order to import it for other calculations.

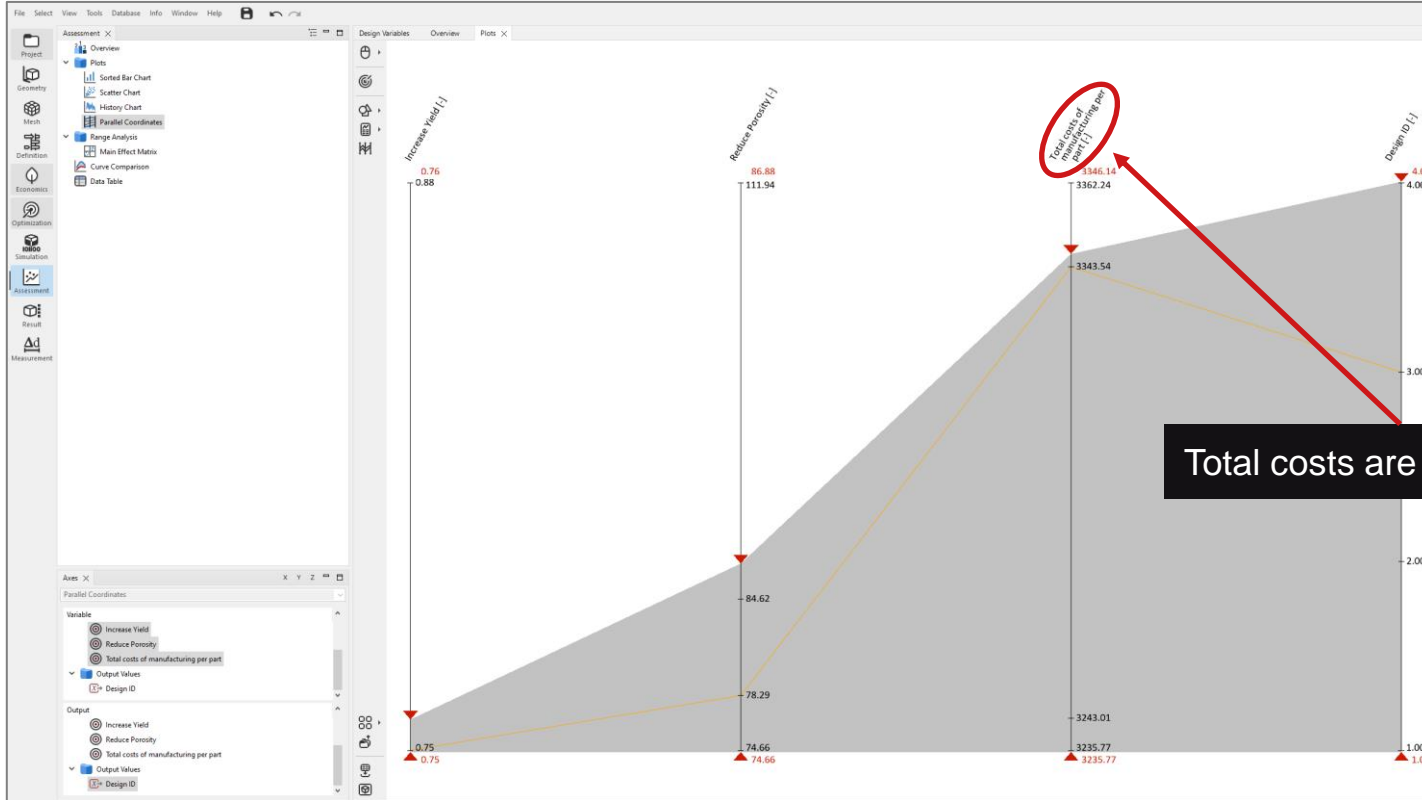
# MAGMA ECONOMICS – STEEL CASTING

## Economics and Optimization



# MAGMA ECONOMICS – STEEL CASTING

## Economics and Optimization (Parallel Coordinates in Assessment)



# MAGMA ECONOMICS – STEEL CASTING

## Economics and Optimization – Compare Dialog

The screenshot displays the MAGMA Economics software interface. The top window shows a table with columns for Rank, Design, Increase Yield (-), Reduce Porosity (-), and Total costs of manufacturing per part (-). A context menu is open over the table, with the 'Compare' option highlighted. A red arrow points from this 'Compare' option to the 'Compare Dialog' window below.

**Compare Dialog**  
Compare your selection

Name	Design 2	Design 1	Design 3	Design 4
<b>Objectives</b>				
Total costs of manufacturing per part	3,243.0142	3,235.7681	3,343.5374	3,362.2363
Increase Yield	0.8797	0.8797	0.7528	0.7527
Reduce Porosity	84.6198	111.9371	78.2897	74.6612
<b>Output Values</b>				
<b>Constraints</b>				
<b>Economics</b>				
Total costs of cast alloy	/t(x) 1,705.3616 €	1,705.221 €	1,827.8378 €	1,828.013 €
Total costs of molding	/t(x) 534.631 €	537.2298 €	528.8672 €	523.7795 €
Total costs of cores	/t(x) 210.5306 €	210.4967 €	210.6911 €	210.7473 €
Total costs of sleeve(s)	/t(x) 9.5804 €	0 €	0 €	21.9681 €
Total costs of chills	/t(x) 52.5059 €	52.5131 €	52.3278 €	52.2009 €
Total costs of filter(s)	/t(x) 12 €	12 €	12 €	12 €
Total cost of feederneck area cleaning	/t(x) 682.0953 €	682.0142 €	675.1559 €	676.9224 €
Total costs of chill area cleaning	/t(x) 79.0088 €	78.9926 €	79.357 €	79.3045 €
Number of Casting Materials	1	1	1	1
Total costs of manufacturing per part	/t(x) 3,285.7136 €	3,278.4675 €	3,386.2368 €	3,404.9357 €

# Thank you for your attention.

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