

Material Flow Analysis Exercise

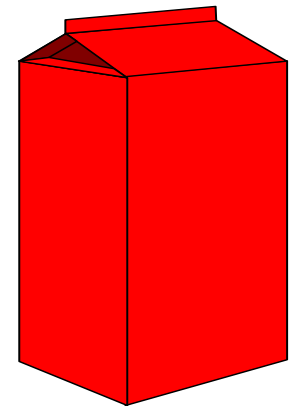
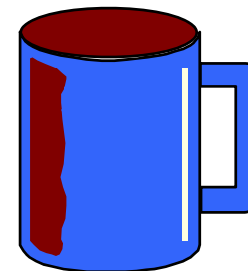


STENUM Ltd.

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Actual Situation

- You are an process engineer in a coffee shop
- The process of coffee cooking is running bad
- Raw materials: coffee beans, water
- Process materials: filter
- Equipment: coffee grinder, coffee machine including coffee pot



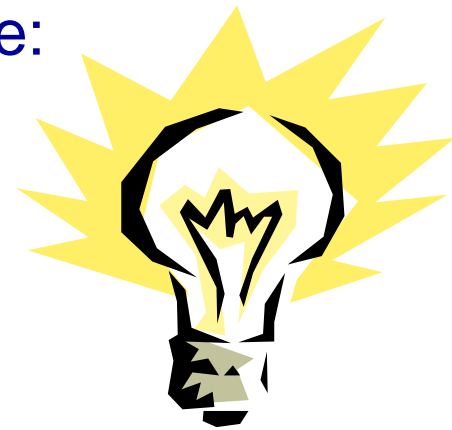
Weighing test have provided the following data:

- Coffee beans 40 g
 - Water introduced to coffee machine 950 g
 - Dry filter 2 g
 - Residues from grinding 1 g
 - Coffee made 876 g
 - Residual water in coffee machine 2 g
 - Coffee grounds (filter, coffee, water) 105 g
 - Evaporated water ?
- A chemical analysis has led to the following results: about 7.5% of coffee are extracted
 - Reference value: humidity of coffee grounds: 60 – 70%

Your Task

The management has charged you to analyse and optimise the production of a pot of filter coffee:

- Draw a flow sheet of the process
- Draw an overall balance
- Edit data using the enclosed table
- Draw a Sankey diagram for water
- Demonstrate the composition of coffee-grounds and coffee using pie- or bar-charts
- Give three proposals for improvement
- Present the results to the management!

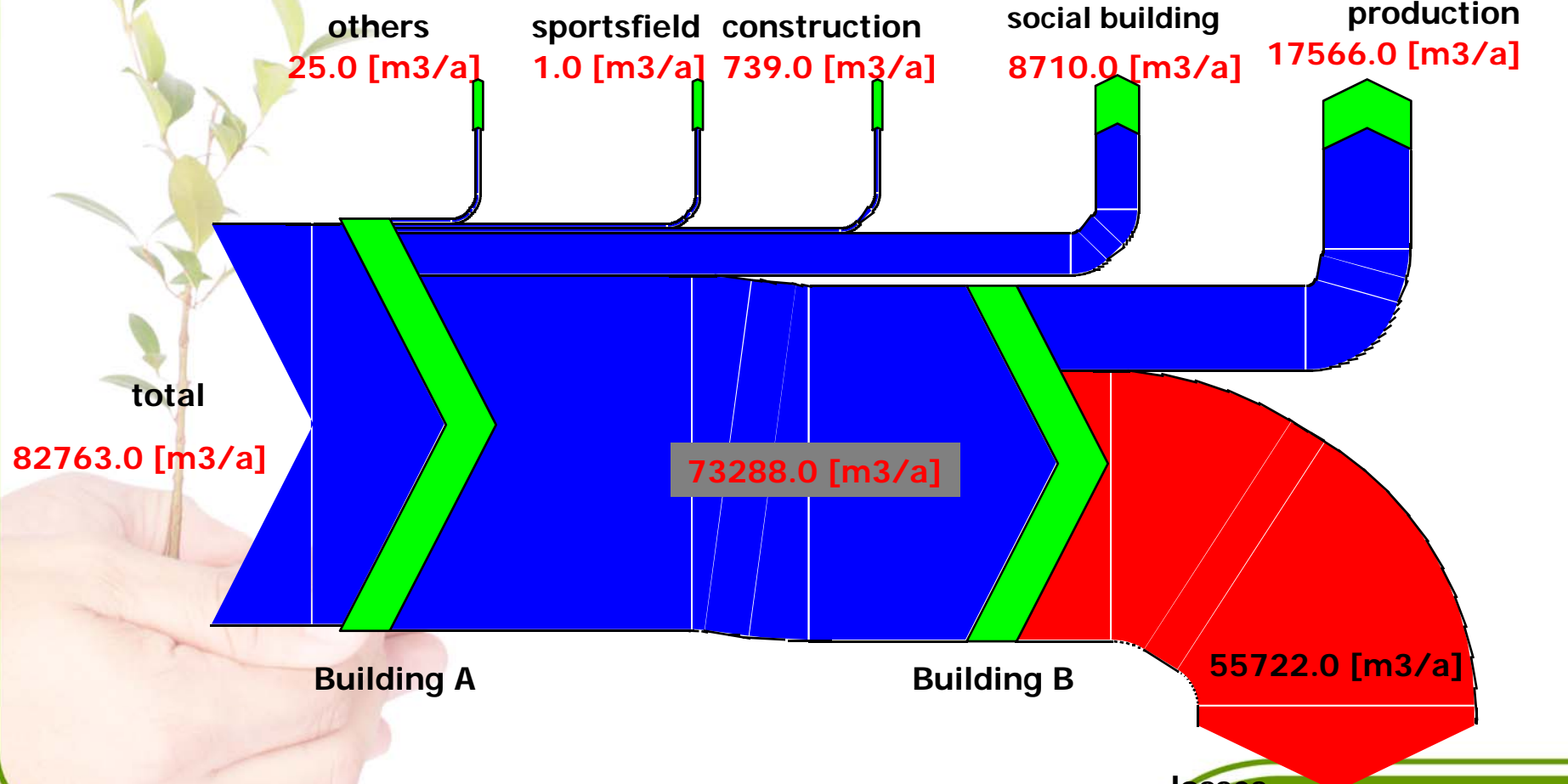


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Water flow analysis (steam boiler construction company)



Your Resources

- 60 minutes for group work and preparation of the presentation
- 5 minutes for presentation
- 1 exercise form
- 1 flip chart
- 4 markers



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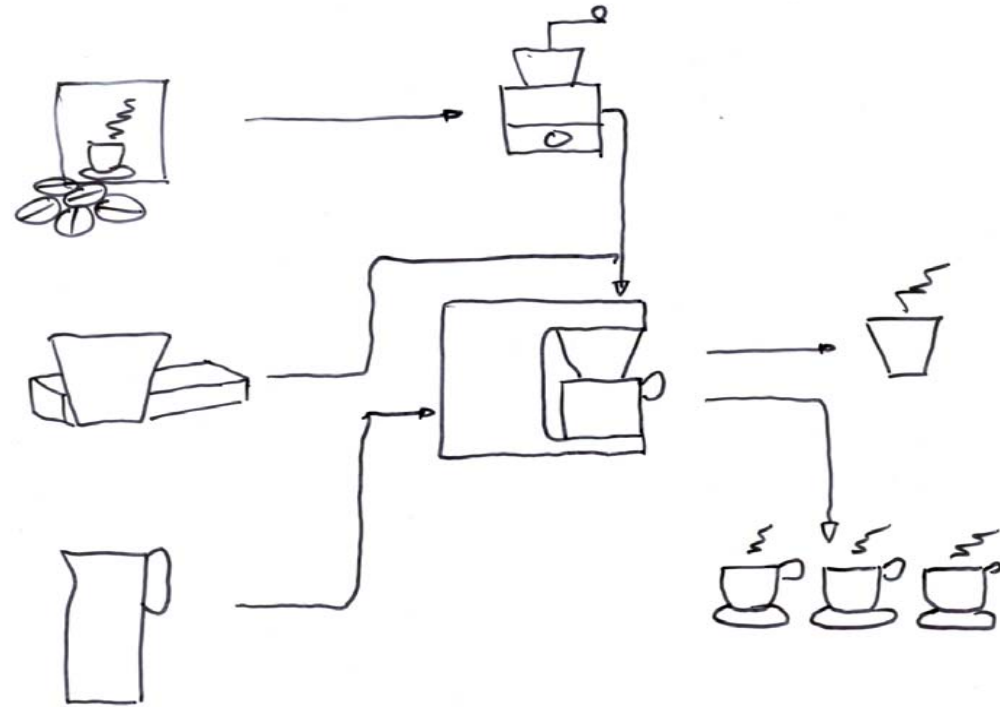


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CASE STUDY :

COFFEE MAKING



OUTPUT

- Coffee made	876 g
* Water	873 g
* Extraction	3 g
- Coffee grounds	105 g
* Coffee	36 g
* Water	67 g
(%-proportion H ₂ O)	(64%)
* Filter	2 g
- Residues from grinding	1 g
- Evaporated water	8 g
- Other	
* Residual water in coffee machine	2 g
* Spillage	
Σ out	992 g

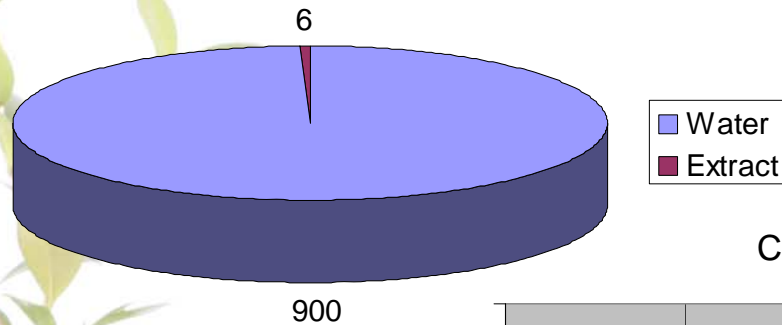
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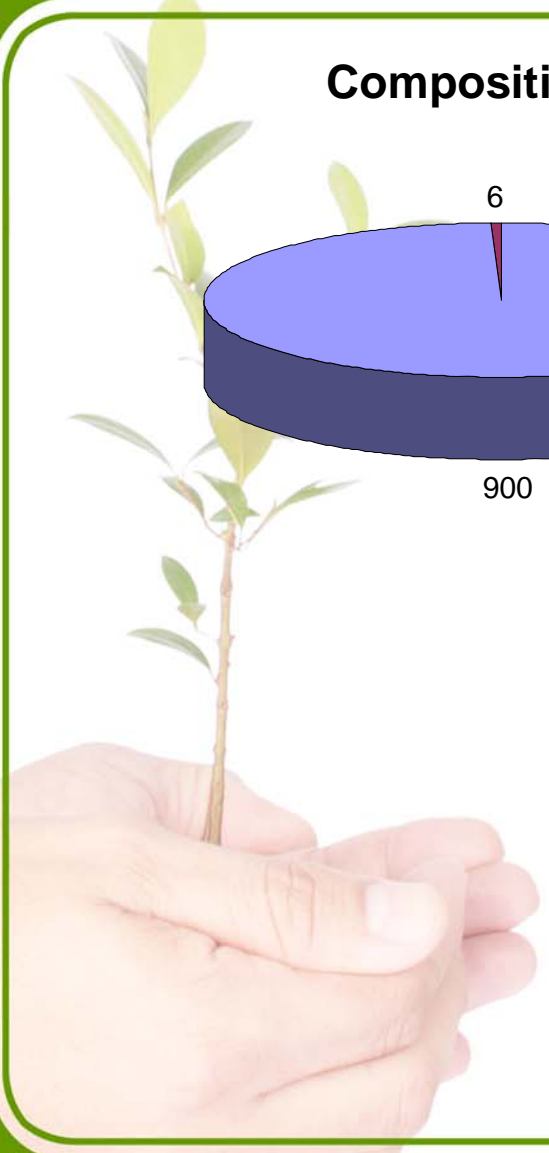
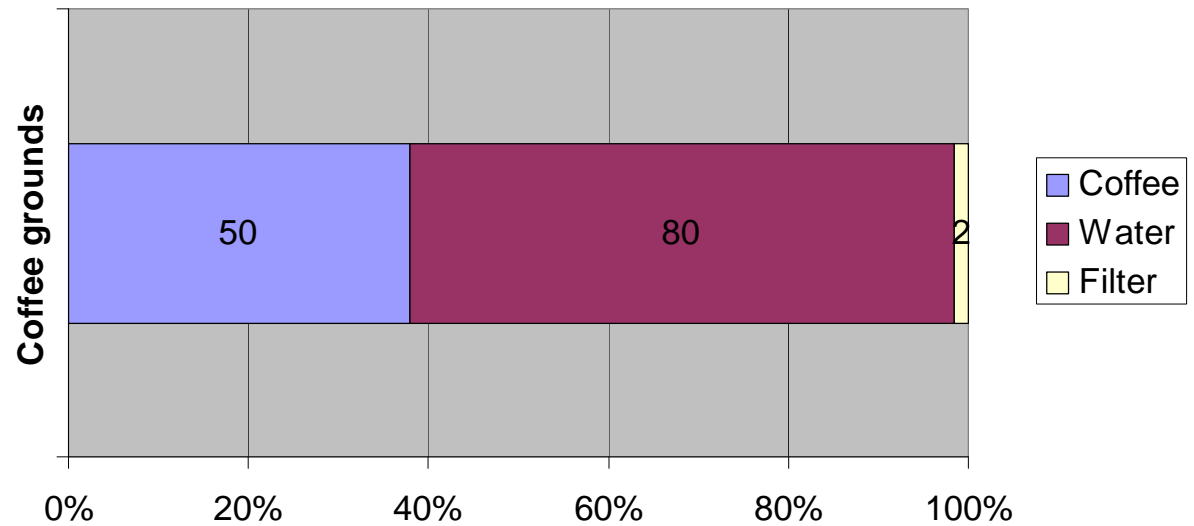


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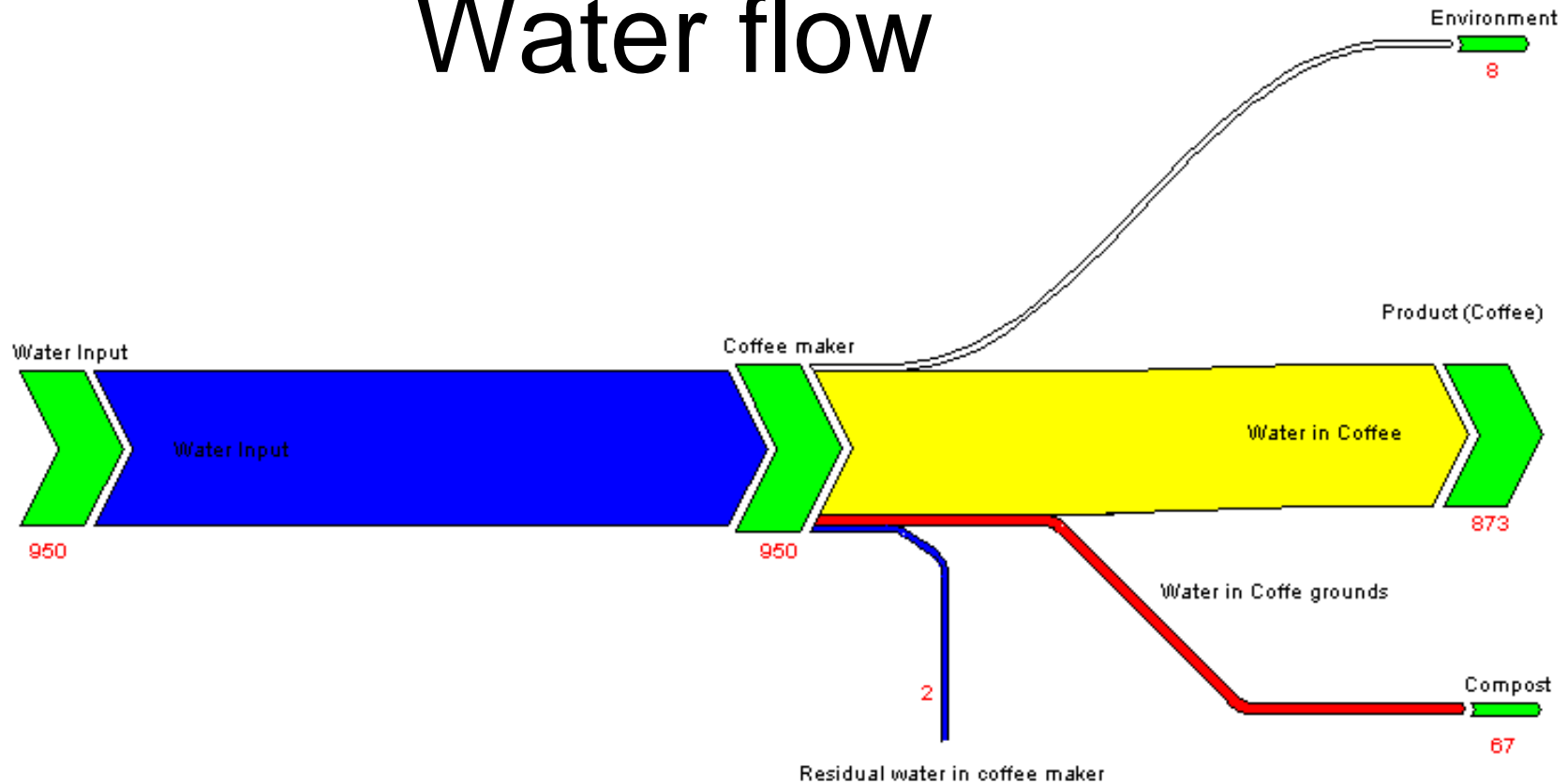
Composition of Coffee



Composition of Coffee grounds



Water flow



Coffee making - options

- **Product change**
 - Use soluble coffee
 - Use caffeine pills
 - Use caffeine containing soda
 - Enjoy the coffee in a cafe
- **Good housekeeping**
 - Grind bigger amounts
 - Define recipe
 - Define indicators
 - Define process instructions
 - Train operators
 - Provide for quality control
- **New raw materials**
 - Buy ground coffee
 - Use larger containers



Coffee making – options 2

- Change in technology
 - Grind finer
 - Use closed machine to reduce evaporation losses
 - Use bigger filter
 - Use a machine without filter
 - Use metal foil filter
- Internal recycling
 - Reuse for another cup of coffee (mix)
- External recycling
 - Sell as 2nd grade product
 - Compostate
 - Reuse as pesticide (against potato beetle)



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Coffee making – options 3

