

A man with a goatee and glasses, wearing a purple jacket, is looking upwards and to the right against a cloudy sky. The text 'AFRY for students' is overlaid on the left side of the image.

# AFRY for students

MY CAREER DEVELOPMENT

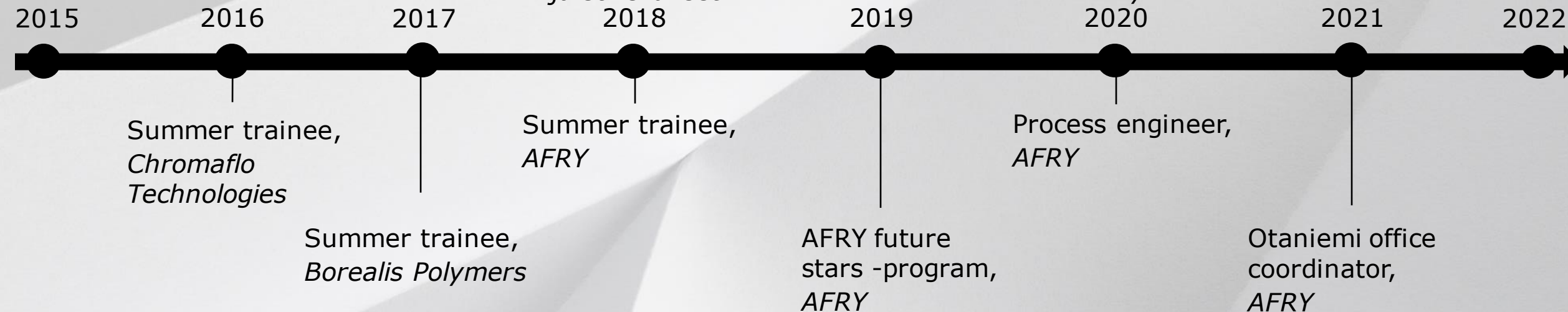
Lassi Laumola, Process engineer



Started studies  
at Aalto,  
*Prosessiteekkarit*

B.Sc. Thesis  
*Neste-nesteuutto  
hiilidioksidin  
avulla,  
toimintaperiaate  
ja sovellukset*

M.Sc. Thesis  
*Characterization  
and treatment of  
waste gas  
emissions from  
process  
industry*



# AFRY is an international engineering, design and advisory company

We are

**17,000**

employees

We speak  
more than

**50**

languages

Offices in  
more than

**40**

countries

Projects in

**100**

countries

Annual revenue

**~2**

billion EUR

# AFRY helps clients all around Finland

About

2,800

employees

Offices in

~30

locations

From Hanko  
to Kittilä



A woman with long, dark, wavy hair is looking slightly to her right. She is wearing a black turtleneck sweater under a dark, heavy coat with a silver belt buckle. The background is a wall made of light-colored wooden planks arranged in a herringbone pattern. The lighting is bright, suggesting an outdoor setting during the day.

OUR MISSION

We accelerate the  
transition towards a  
sustainable society

# Our offerings in six divisions

## Infrastructure



Real estate  
Rail & Road  
Architecture  
Environment  
Water

## Industrial & Digital Solutions



Food & Life Science  
Product and Software Design  
Automation  
Defense

## Process Industries



Pulp & paper  
Mining & Metals  
Steel Industry  
Oil & Gas

## Energy



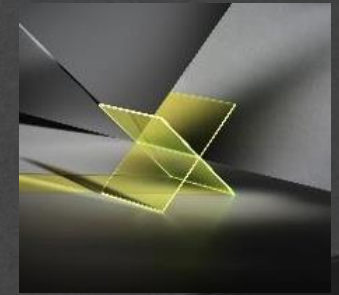
Hydro  
Renewables  
Nuclear  
Transmission & Distribution

## Management Consulting



Bioindustry  
Energy  
Capital  
Industry

## AFRY X



Digital services  
and products

A photograph of two young women with long blonde hair, wearing winter clothing and berets, riding bicycles on a city street. They are smiling and looking at each other. The background shows a blurred city scene with trees and buildings. The image is overlaid with a semi-transparent dark grey filter.

We offer students...

Intern-  
ships

Summer  
jobs

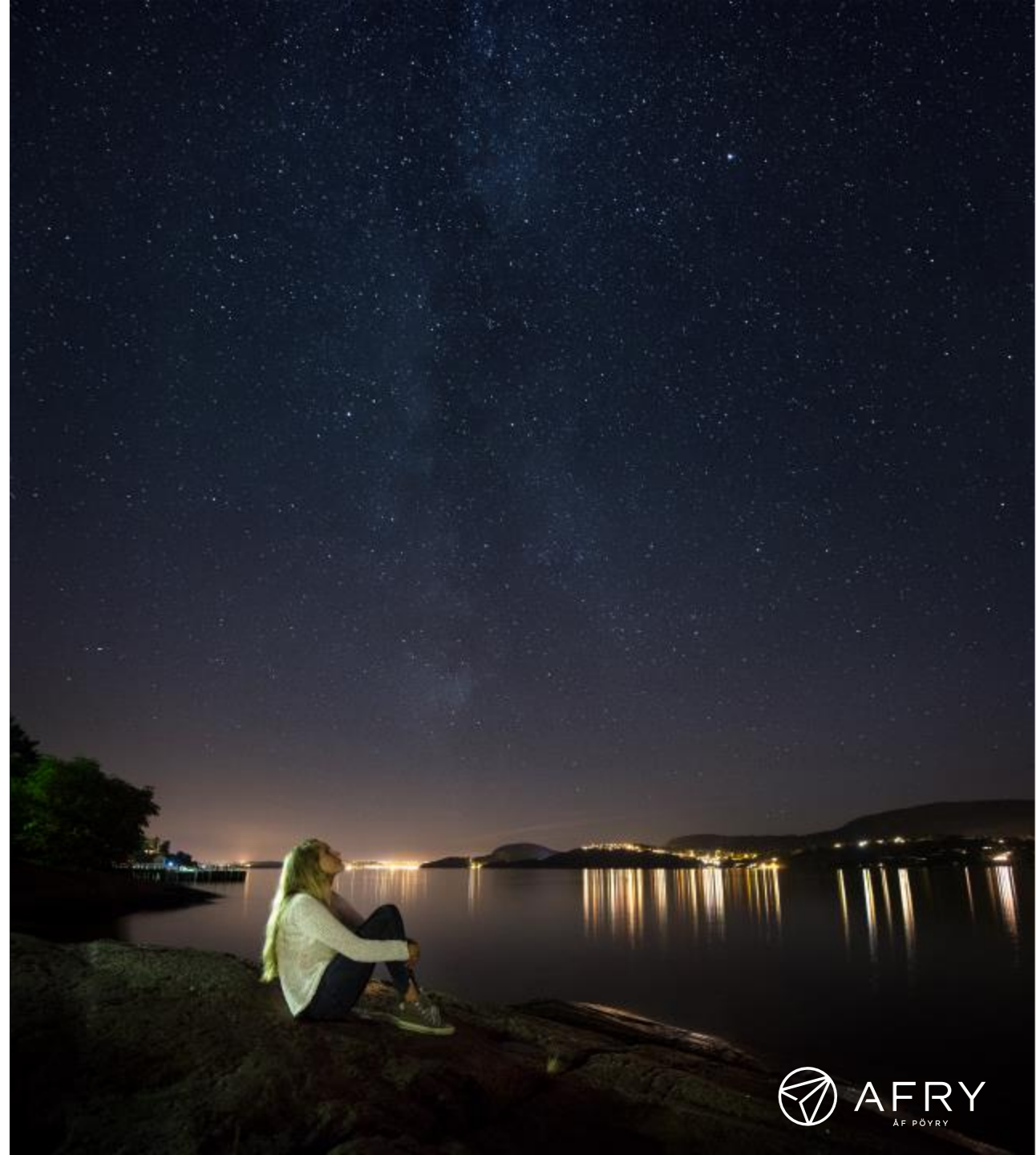
Part time  
jobs

Theses and  
master's theses

and AFRY Future Stars programme

# AFRY Future Stars programme

- Duration: 1 year (May-April)
- Summer work and part-time job during semesters
- 4 Training Days
- Own mentor, guiding in everyday work and career planning
- AFRY Future Stars community
- Next application round: November 2022



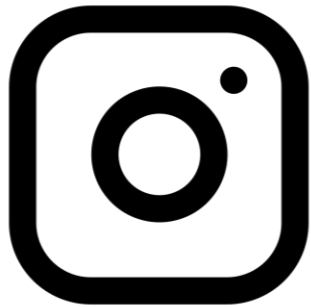


# Apply to AFRY

- In case you cannot find a suitable job from our open positions, it is possible that we could still offer something interesting to you
- Send us an open application and tell us about your background, skills, preferred duration & timing of the job, and how much you can work per week
- We constantly follow the incoming open applications and will contact you in case we have something to offer
- Send us an open application at [afry.fi](https://afry.fi)



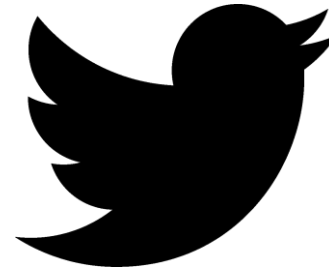
# Follow us on social media to keep updated



@afry.official  
@afry.suomi



AFRY



@AFRY\_global  
@AFRYSuomi



AFRY Suomi



# Making Future



Aalto University  
School of Chemical  
Engineering

# CHEM-E0115 Planning and Execution of a biorefinery Investment Project (5 cr)

*Lecture 1*  
*September 8, 2022*  
*Lassi Laumola*

# Lecture 1 contents

## 1. Introductions

## 2. Course overview

- *Learning outcome objectives*
- *Program/lectures*
- *Advice*
- *Evaluation*
- *Course Material*

## 3. Project management fundamentals

- *Forest BioFacts*

## 4. Course Assignment

- *RFQ material overview*

# Course objectives

- After the course, the students are familiar with systematic **planning**, **implementation** and **management** of a biomass-based process industry **investment project**.
- The students will acquire experience in **engineer's work** in a consultancy company, as well as working with real-life **tools** for **project planning**.
- Moreover, the students have experience in project work in **teams**, as well as on report **writing** and giving oral **presentations**.

# Course program

## See detail in MyCourses...

- Lectures on Thursdays 08:15-12:15 in Puu1, L2
- 3 workshops
  - 13.10. in AFRY Otaniemi
  - 3.11. in AFRY Otaniemi
  - 10.11. in AFRY Vantaa

# Course completion

## To complete the course

- Assignment (presentation 17.11.2022)
- Exam (17.11.2020 or 05.12.2022)
- Peer and self assessment (with presentation 17.11.2022)

**5 cr = 5 x 27 h = 135 h**

- Lectures + examination: 50 h
- Assignment (Project work): 85 h



# Course evaluation

## Course Evaluation criteria (Mandatory to participate in each three)

- Examination 50 % (25 points)
- Assignment 30% (15 points)
- Assignment Self and Peer assessment 20% (10 points)

Based on the final peer and self-assessment, coefficient will be used to calculate individual share for each student based on the overall score of the team's achievement.

For example:

You get 22/25 points in exam.

Your team gets 20/25 for the assignment  $(3/5)*20=12$

You get co-efficient 1.1 from the peer- assessment.  $((2/5) *1.1*20)=8.8$ .

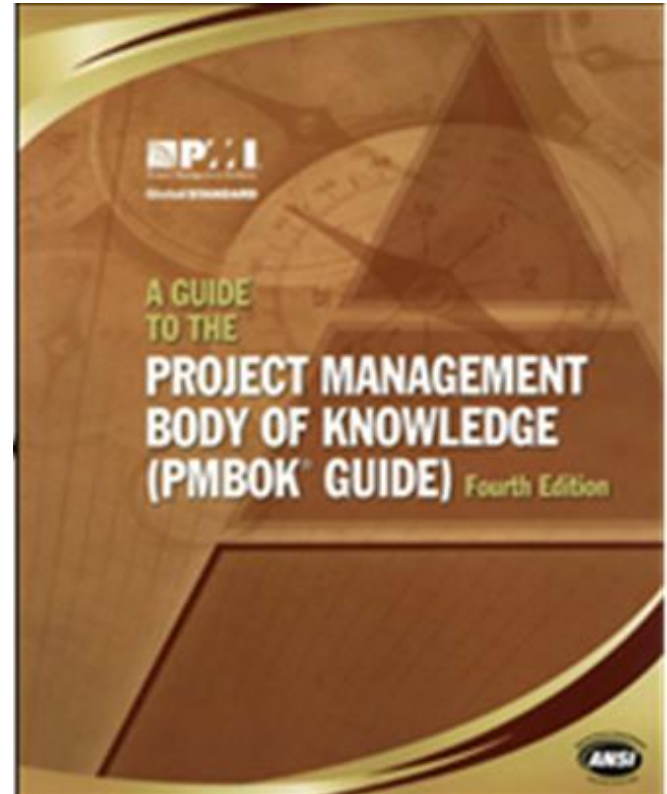
Your total points are 42.8 => Your grade is 4

Grades basis (subject to adjustment based on overall scoring)

15.5-19.5 = 1, 9.5-28 = 2, 28-35= 3, 35-43 = 4, 43- = 5

# Course Material

- Project Management Institute: A guide to the Project Management Body of Knowledge (PMBOK®Guide)
- Lecture slides (Materials in My Courses)
- Supporting material available at:



# Course Advice

- Discussion ahead of lecturing – EVERYONE PARTICIPATES! → Talking is important!
- Join the lectures
- Lectures at AFRY require registration in advance, please also respect the time required for checking in at the reception
- Practical exercise is the key effort of the course for you
- Attitude matters 😊
- Lecture material available afterwards in "MyCourses"

# Questions?

# ForestBiofacts

You should be able to use it  
with Aalto credentials

⇒ **Section: Business and  
investment planning**

Digital learning environment



[info@puunjalostusinsinorit.fi](mailto:info@puunjalostusinsinorit.fi)

+358 40 132 6688



**ForestBioFacts**

Paperi ja Puu Oy



**PUUNJALOSTUS-  
INSINÖÖRIT**

Forest Products Engineers

© 2020 ForestBioFacts

# Business and Investment Planning

The screenshot shows a web interface for 'Business and investment planning'. At the top left is the 'forest bio facts' logo. The main title 'Business and investment planning' is centered at the top, with a search bar to its right containing the text 'Search...' and a magnifying glass icon. Below the title, the editors are listed as 'Editors: Dr. Tom Lind and Dr. Antti Lindqvist'. The main content area features a large video player with a forest scene and a white play button. A 'Collapse sidebar' button is located at the bottom left of the sidebar area.

forest bio facts

Business and investment planning

My account - Logout

Search...

**Business and investment planning**

Investment project fundamentals >

**Business and investment planning in the forest industry >**

Conceptual phase >

Pre-feasibility phase >

Feasibility phase >

Organisational learning in investment projects >

Editors: Dr. Tom Lind and Dr. Antti Lindqvist

**Business and investment planning**

Collapse sidebar <

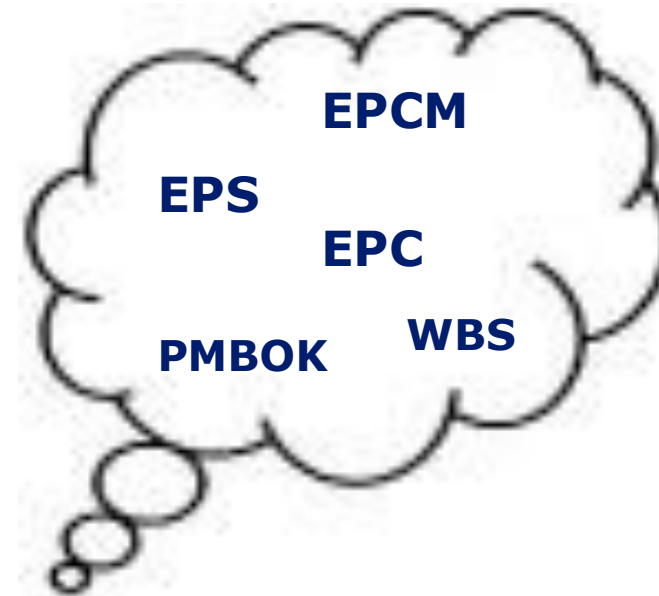
# How to access:

**Register as Aalto team user here:**

<https://forestbiofacts.com/my-account/join-team/bb3627d8fd3c6150fad3dfb6e9d29f35>

# PROJECT MANAGEMENT TRAINING

- After this training all team members know the project management basics and recognize terms used in project execution phase





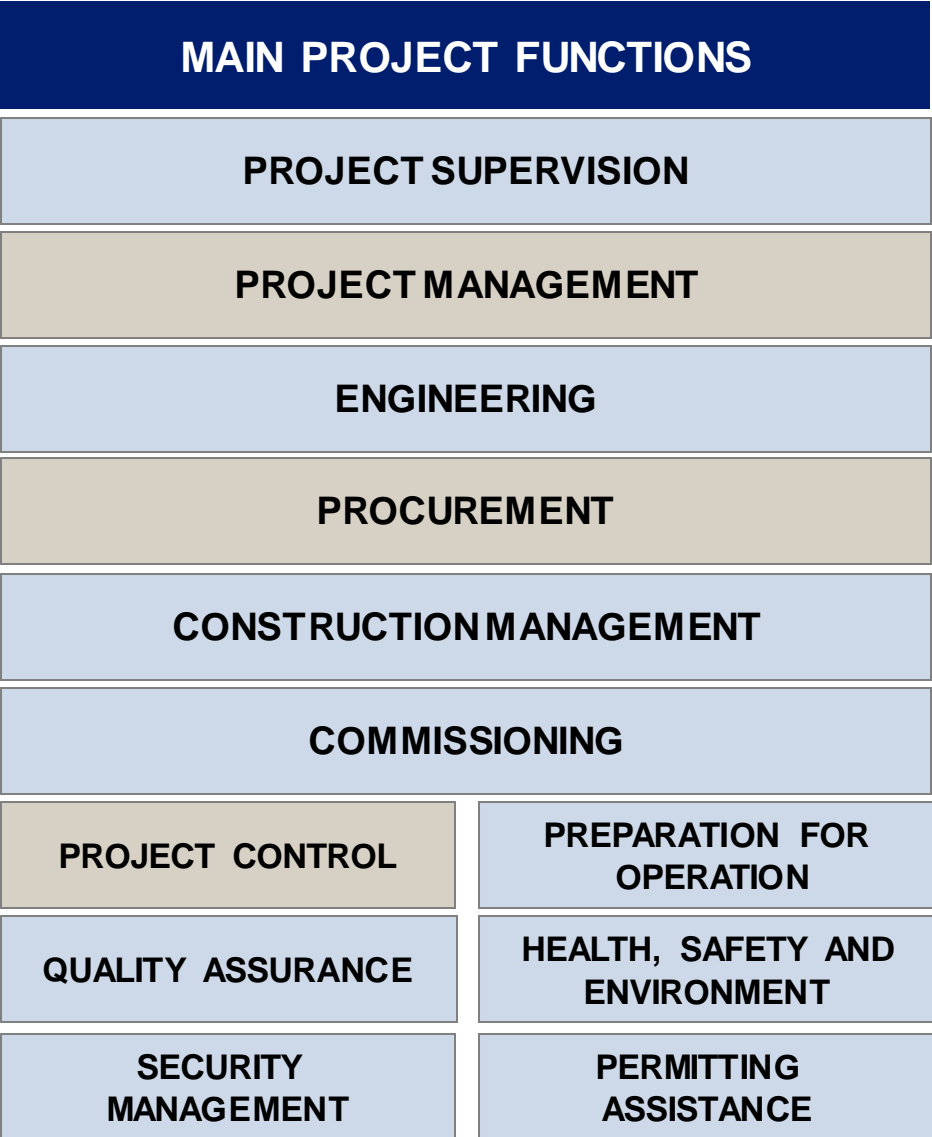
# PROJECT MANAGEMENT FUNDAMENTALS

– What is a project?

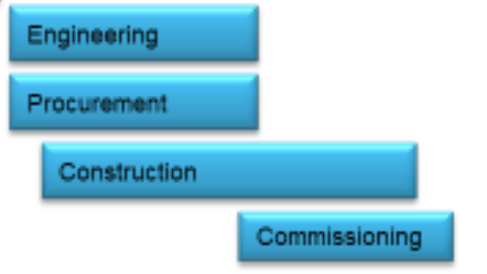


# PROJECT MANAGEMENT FUNDAMENTALS

— MAIN PROJECT FUNCTIONS



# PROJECT LIFECYCLE



# PROJECT IMPLEMENTATION METHODS

## Terms

- EPCM = Engineering -Procurement -Construction Management
- EPS = Engineering/Equipment-Procurement -Supply/Services
- EPC = Engineering -Procurement -Construction
- OB = Open Book
- ESS = Extended Scope of Supply
- BOO = Build-Own-Operate
- BOOT = Build-Own-Operate-Transfer
- BOT = Build-Own-Transfer
- DB = Design-Build
- DBO = Design-Build-Operate
- DBFO = Design-Build-Finance-Operate
- FBO = Finance-Build-Operate
- FBOM = Finance-Build-Operate-Maintain

# PROJECT MANAGEMENT GUIDELINES

## Focus on Project Controls

SCOPE

COST

TIME

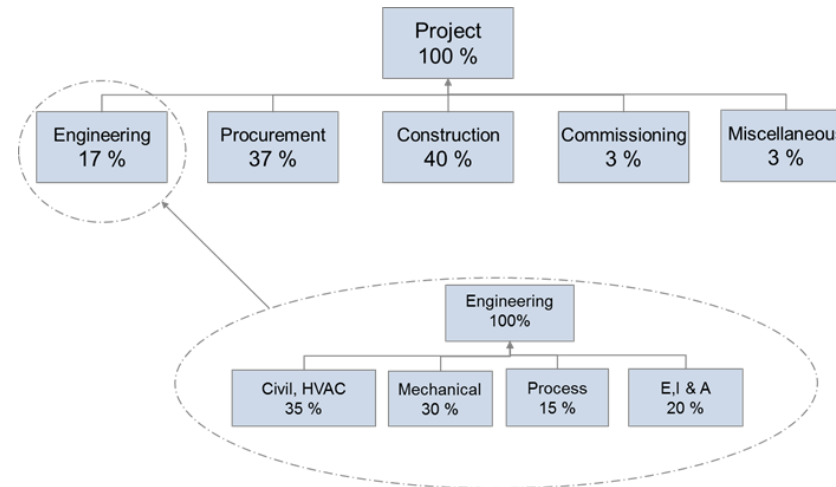
QUALITY

- Contract Management
- Integration and Control Management
- **Scope Management**
- **Time Management**
- **Financial Performance Management**
- Quality Management
- Project Human Resources Management
- Project Communication and Reporting Management
- Project Risk and Opportunity Management
- Project Closure Management
- Engineering Management
- **Procurement Management**
- Construction Management
- Commissioning Management
- Test and Acceptance Management
- HSEQ & Security Management
- Training Management
- Warranty Management
- IT Management

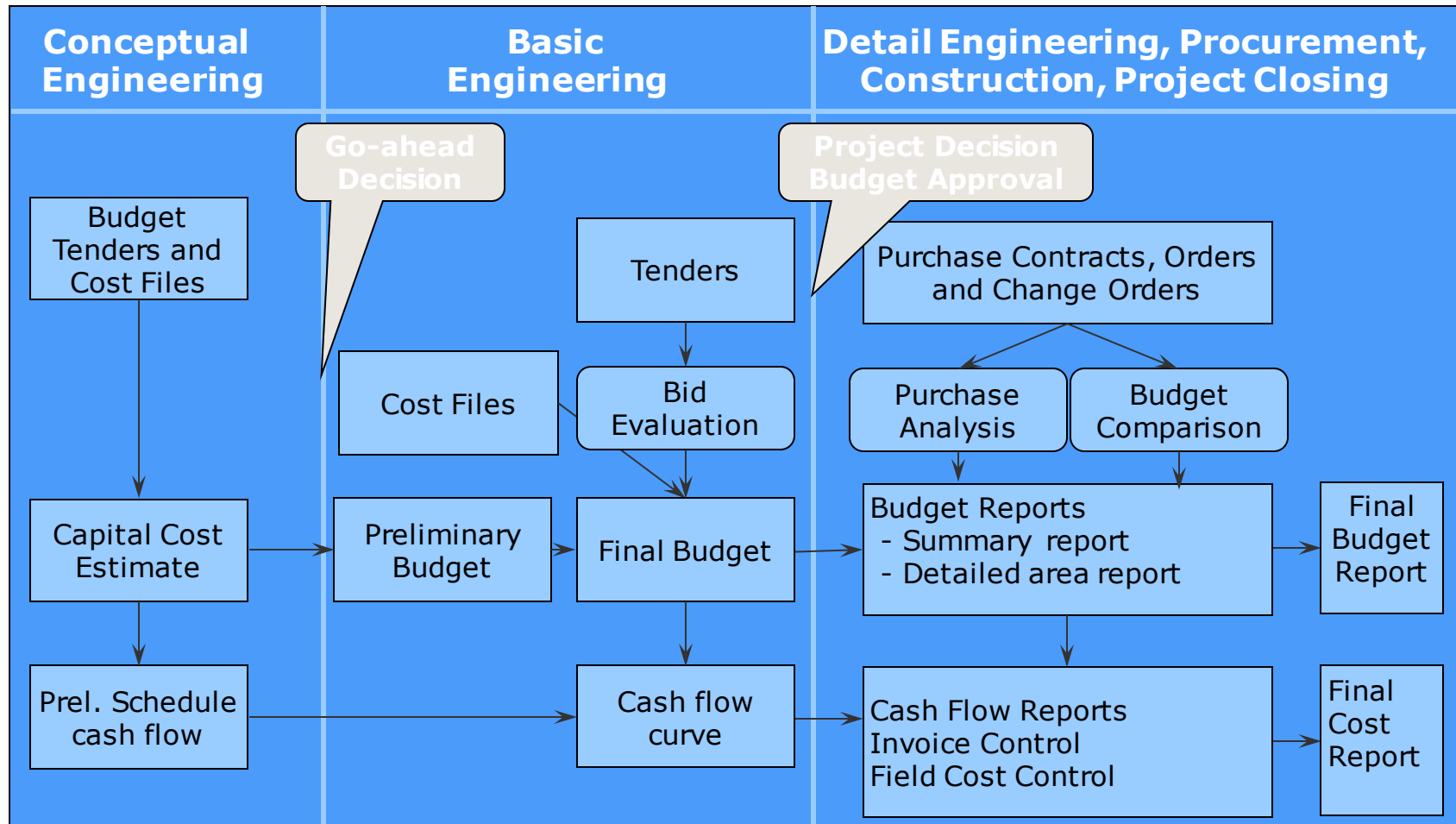
# Scope management

- Collect requirements
- Define Scope
- Create Work Breakdown Structure (WBS)
  - “Create WBS is the process of subdividing project deliverables and project work into smaller, more manageable components.” – PMI
- Define activities
  - “Define Activities is the process of identifying the specific actions to be performed to produce the project deliverables.” – PMI
- Control Scope
- Verify Scope

## Example of WBS



# Cost Management- Process Flow



# Project Control – Time Management

Work Processes

Tasks

Deliverables

Time Management



Preparation of time management instructions

- Planning, scheduling, and follow up instructions

Time schedule development

- Time schedules and schedule basis memorandums
  - Target time schedule
  - Coordinating time schedules
  - Master time schedules
  - Detailed time schedules
  - Contract control schedules
  - Document delivery schedules

Progress monitoring

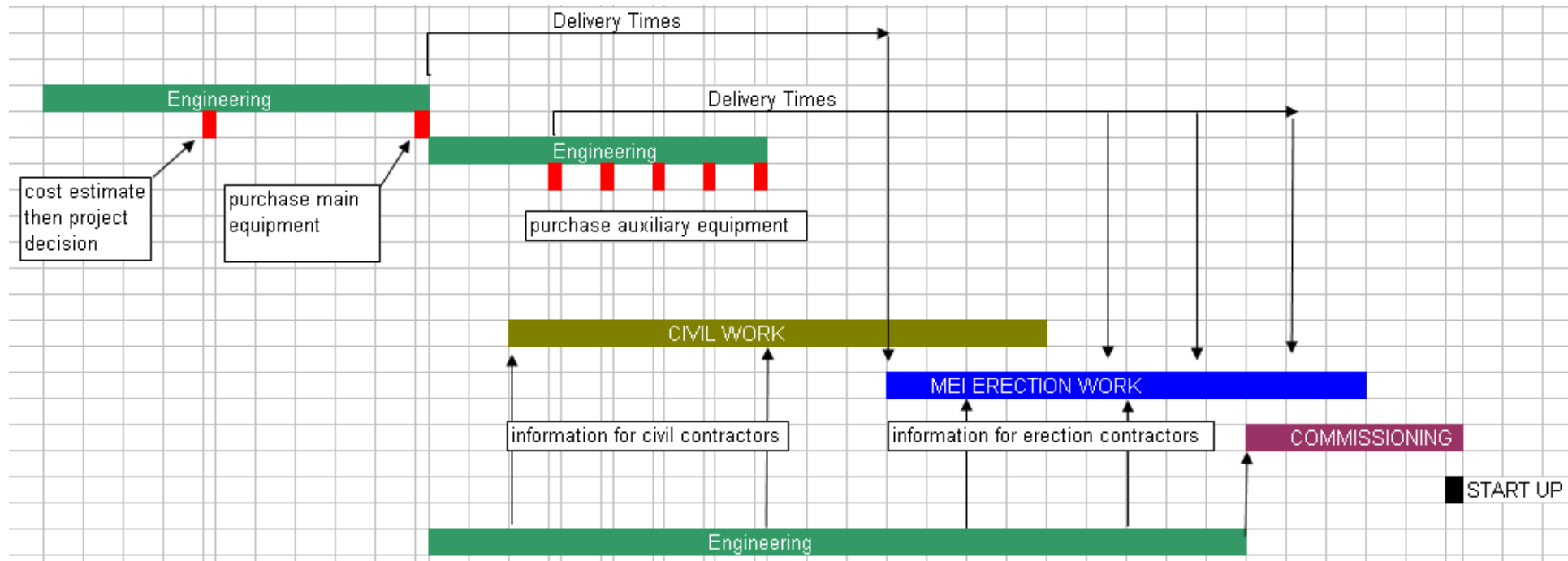
- Progress Reports
  - Time schedule status
  - Histograms and charts
  - Numerical progress tables

Delay Mitigation

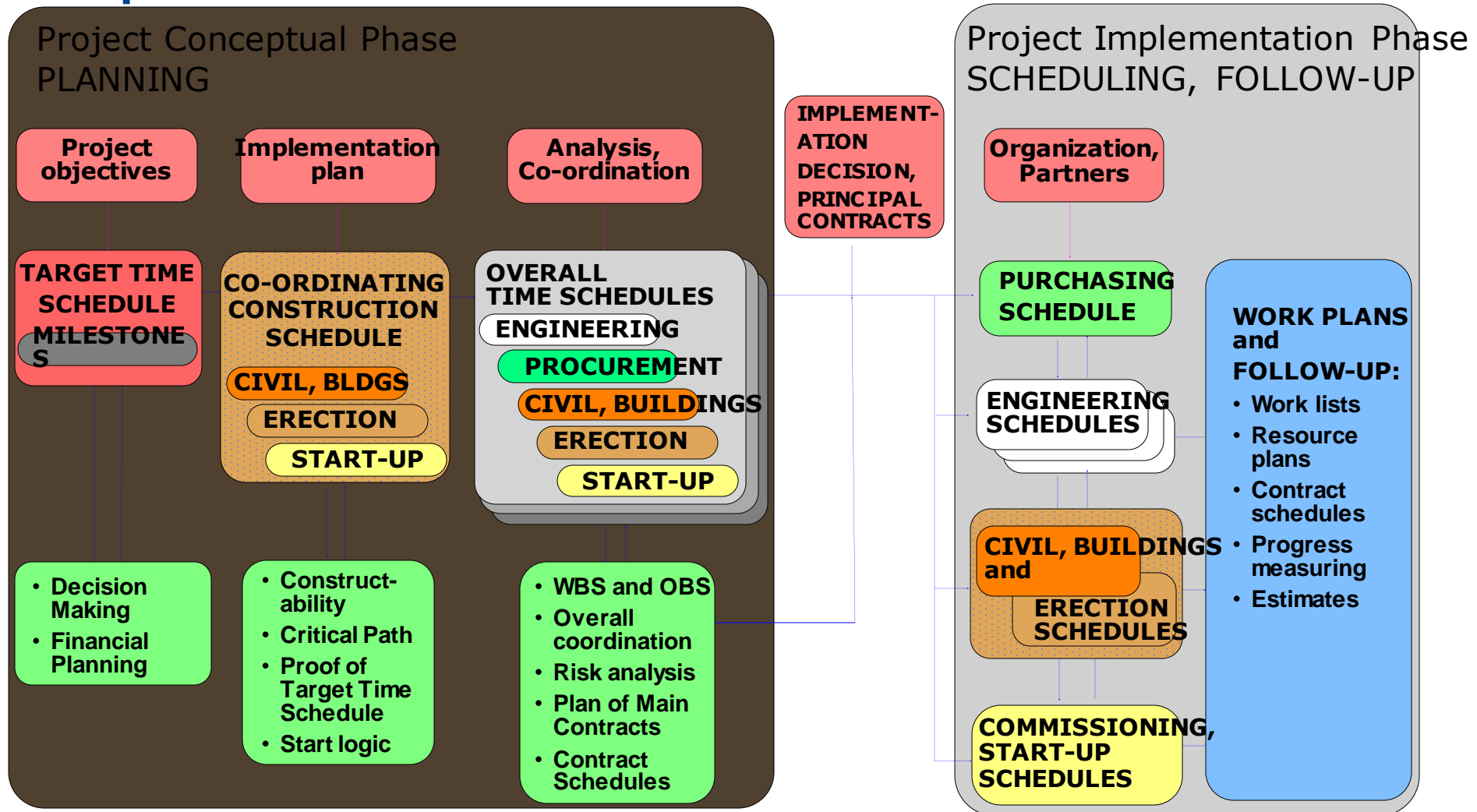
- Corrective action plans
- Revised time schedules



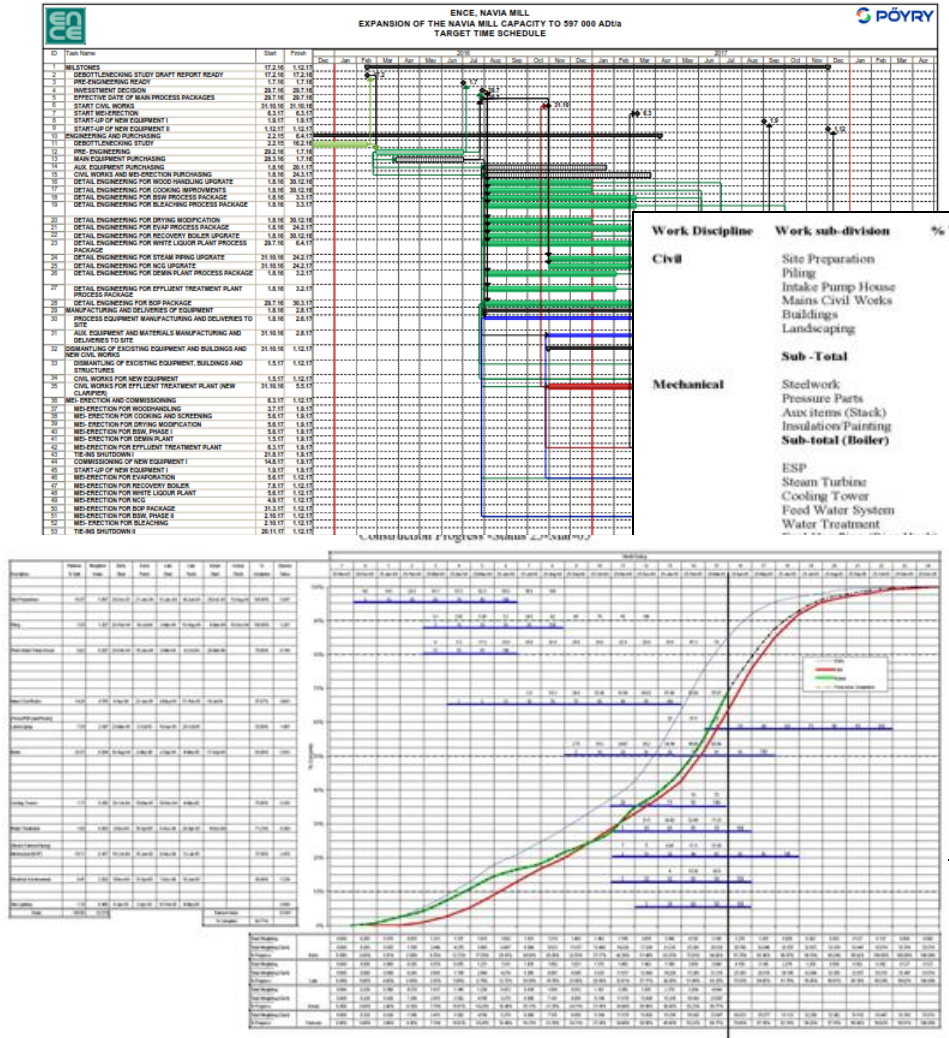
# Time Management - Simplified Project Logic



# Time Management- Time schedule development



# Structured progress assessment



**Overall weightings:**

Phase	weighting %
Engineering	9.58
Procurement	46.88
Construction	33.57
Commissioning	9.97
<b>Total</b>	<b>100.00%</b>

Work Discipline	Work sub-division	% Weighting	% Split	
<b>Civil</b>	Site Preparation	5.697	16.97%	
	Piling	1.207	3.50%	
	Intake Pump House	0.207	0.62%	
	Mains Civil Works	3.296	9.82%	
	Buildings	1.499	4.86%	
	Landscaping	2.547	7.50%	
	<b>Sub - Total</b>	<b>14.453</b>	<b>43.05%</b>	
	<b>Mechanical</b>	Steelwork	1.877	5.50%
		Pressure Parts	4.790	14.27%
		Aux items (Stack)	1.607	4.79%
Insulation/Painting		0.310	0.92%	
<b>Sub-total (Boiler)</b>		<b>8.584</b>	<b>25.57%</b>	
ESP		1.124	3.35%	
Steam Turbine		0.927	2.76%	
Cooling Tower		0.393	1.17%	
Feed Water System		0.187	0.56%	
Water Treatment		0.505	1.50%	
	1.770	5.27%		
	0.361	1.08%		
	0.626	1.86%		
	1.422	4.23%		
	<b>7.315</b>	<b>21.79%</b>		
	<b>15.899</b>	<b>47.36%</b>		
	0.806	2.80%		
	1.432	4.27%		
	0.584	1.74%		
	<b>2.822</b>	<b>8.41%</b>		
	0.299			
	0.101			
	<b>0.400</b>			
	<b>33.574</b>			

Work Discipline	Work Sub- Division	Weighting %	Complete	Earned Value
<b>Civil</b>	Site Preparation	5.697	→ 97.5%	→ 5.554%
	Piling	1.207	→ 72.5%	→ 0.875%
	Intake Pump House	0.207	→ 51.3%	→ 0.106%
	Main Civil Works	3.296	→ 10.7%	→ 0.353%
	Buildings	1.499	→ 5.6%	→ 0.084%
	Landscaping	2.547	→ 0.0%	→ 0.000%
	<b>Totals</b>	<b>14.453</b>		<b>48.24%</b> ←

**Calculation of Construction Overall Progress**

Construction Overall Progress is calculated as follows:

Discipline	Weighting	% Complete	Earned Value
Civil	14.453	→ 48.24%	→ 6.972%
Mechanical	13.899	→ 9.82%	→ 1.561%
Electrical	2.822	→ 1.01%	→ 0.028%
C & I	0.400	→ 0.00%	→ 0.000%
<b>Totals</b>	<b>33.574</b>	<b>25.50%</b> ←	<b>8.561%</b>

# Procurement Management Procurement Is Not Only Purchasing...

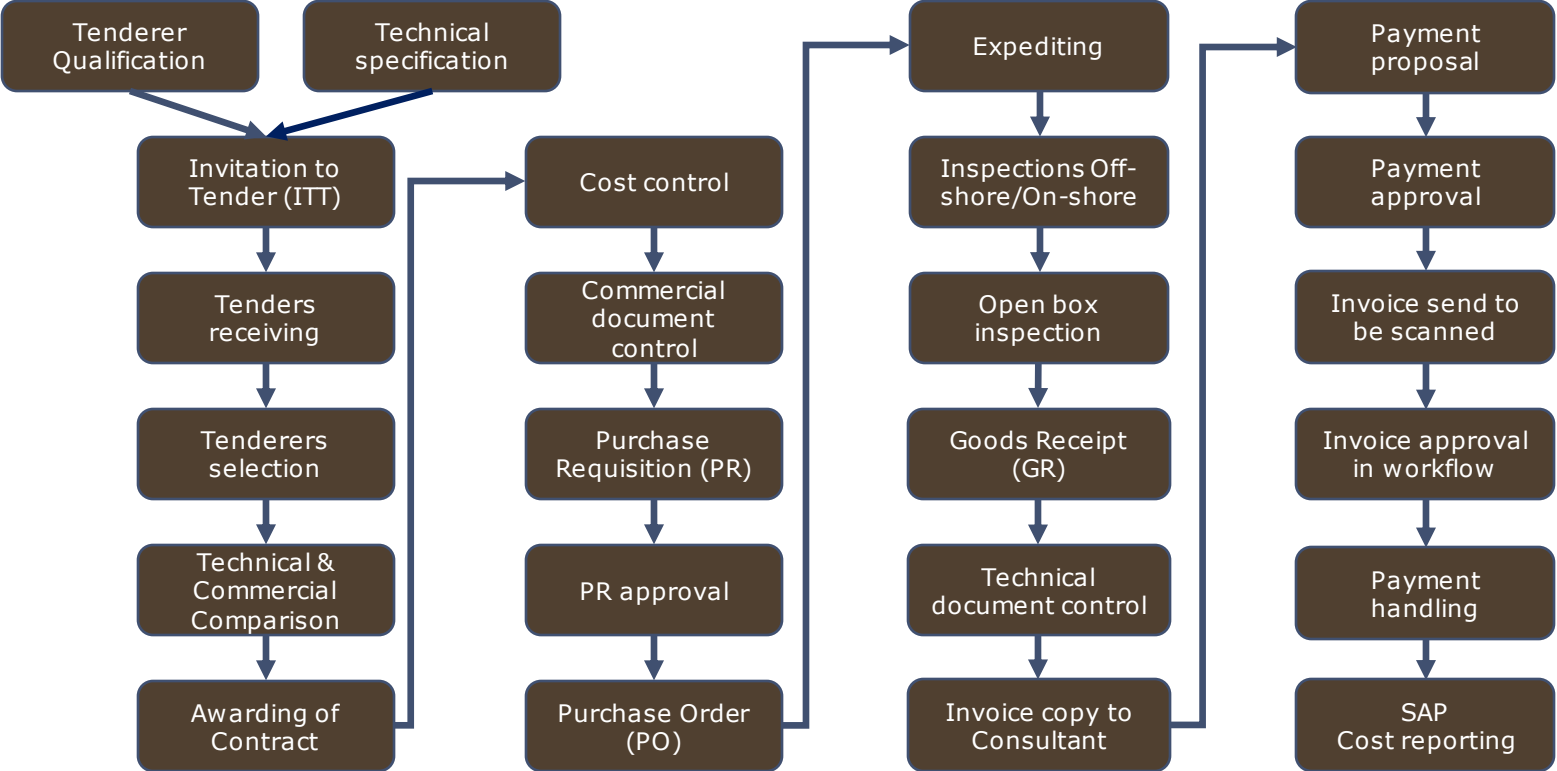


...it is a wide range of activities to ensure that materials and services are available at site in the **right time**

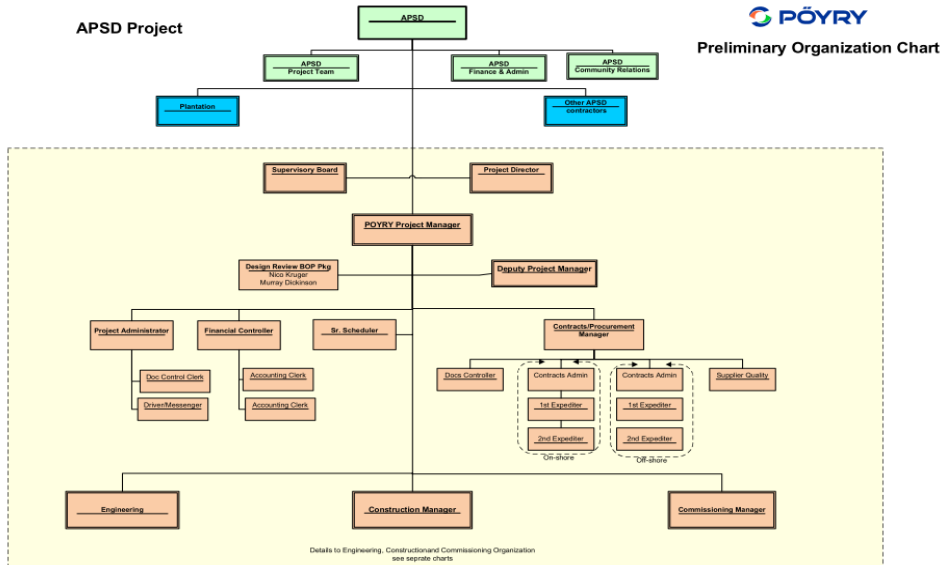
- **Purchasing Planning and Control**
  - identifying and controlling what is to be purchased and when
- **Requirements Documentation**
  - compiling commercial conditions and technical requirements
- **Supplier Evaluation**
  - evaluating and determining which suppliers and contractors should be invited to supply products and services => Request for Information (RFI)
- **Awarding of Contracts**
  - issuing Request for Tender (RFT) documents, technical & commercial tender evaluations, technical & commercial purchase negotiations, preparation and awarding of the contracts, purchase orders, variation orders
- **Contract Control => Expediting & Inspection**
  - ensuring that suppliers' and contractors' performance meets contractual requirements
- **Contract Closure**
  - Hand-over & Final Settlement
  - Feedback to capital cost estimating and engineering

# Procurement MANAGEMENT

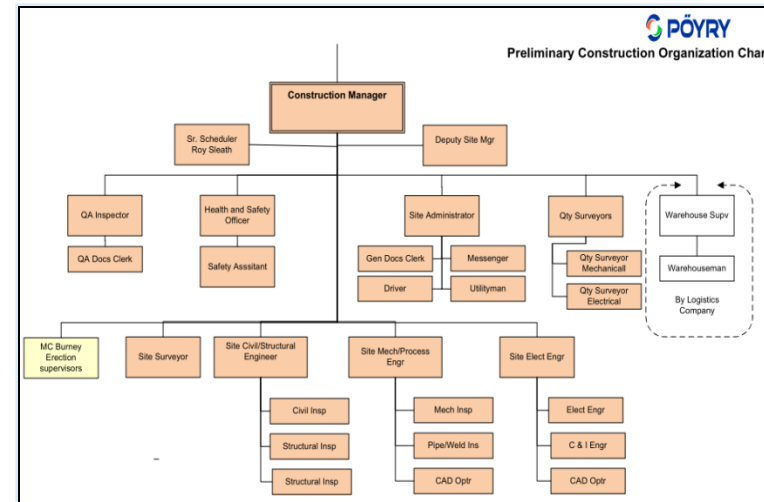
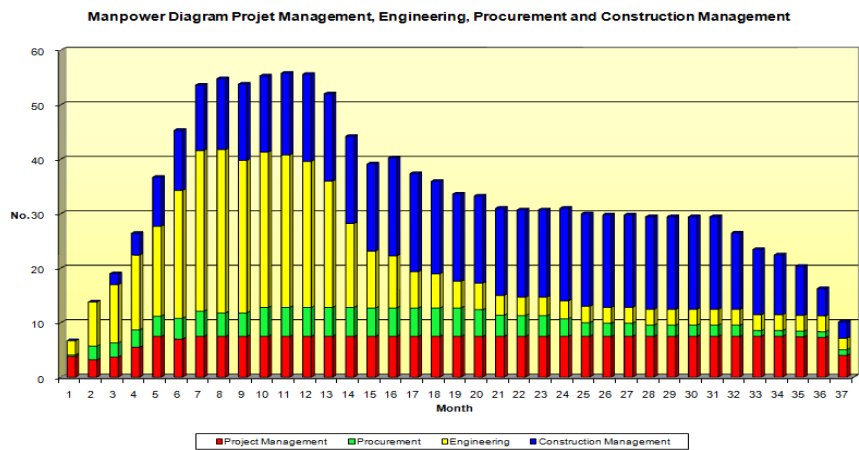
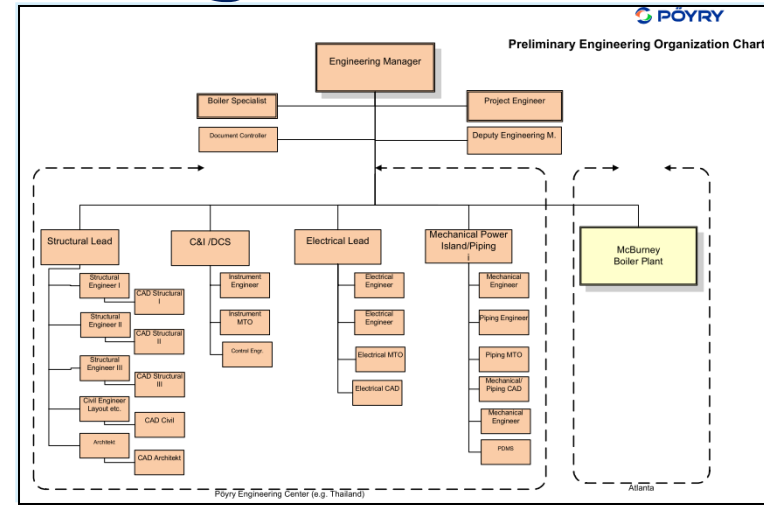
## Procurement process



# Typical project organisation histograms



# histograms

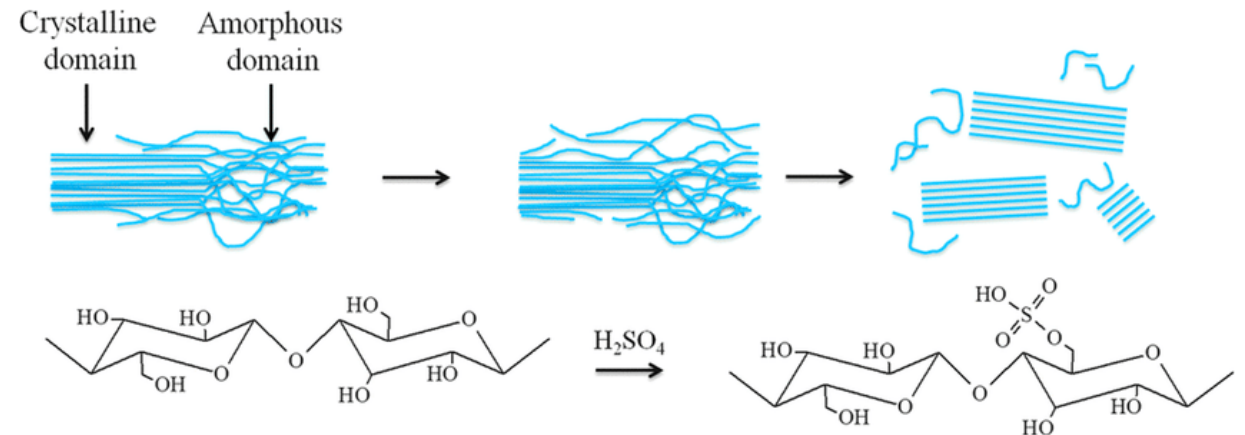
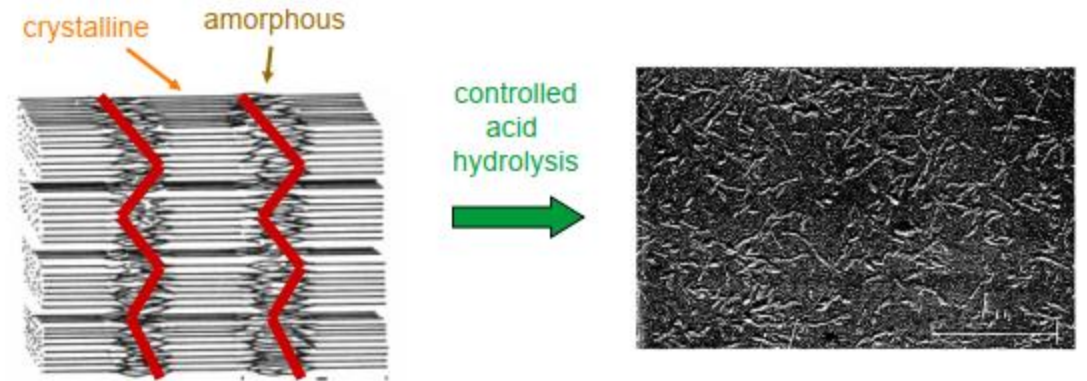


# MCC production line

SEPTEMBER 8, 2022

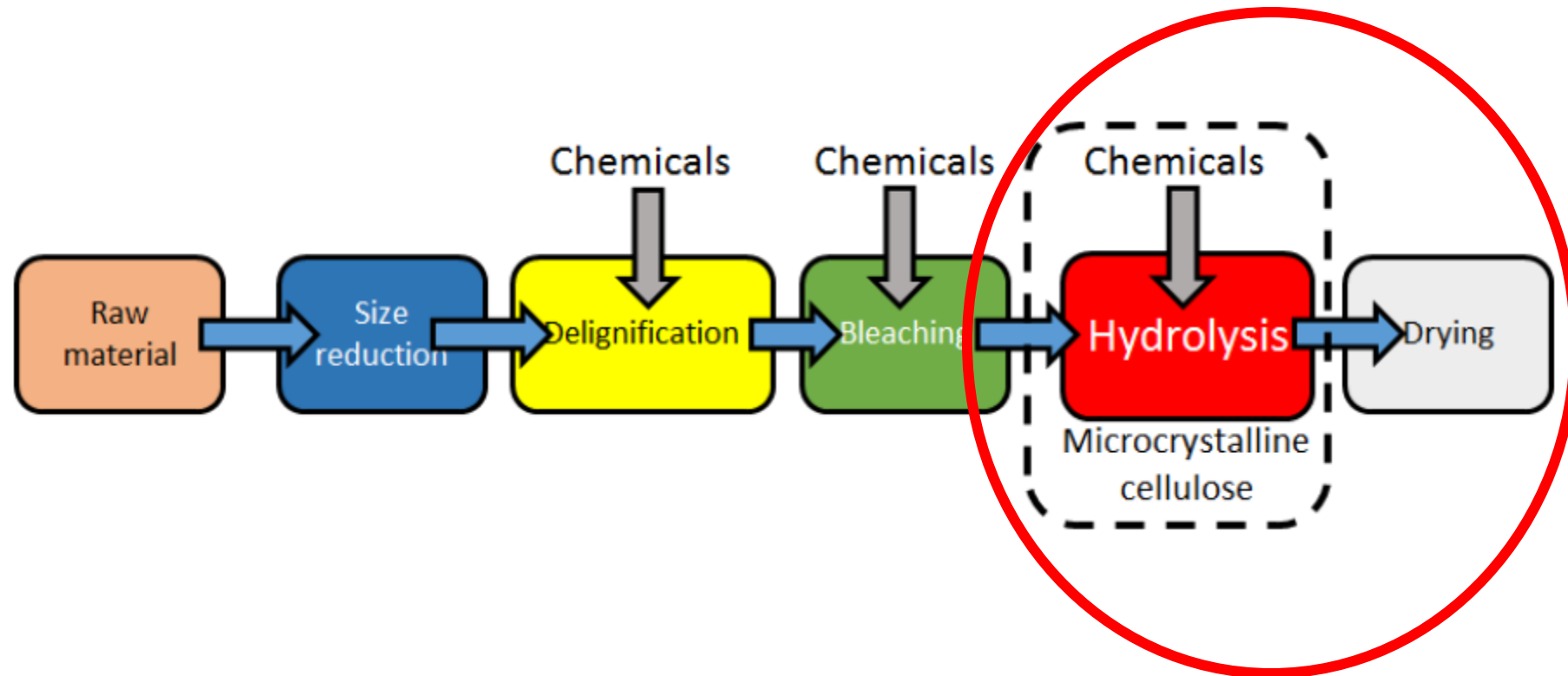
# Introduction

- Microcrystalline cellulose is cellulose where amorphous parts of the microfibril are hydrolyzed, and crystalline parts remain
- MCC is used in the food and pharma sectors
  - Used to stabilize foams, give mouthfeel
  - Medical tablet bulk filler, binder and compression aid additive
- Medical use requires the product to meet certain standards in terms of residual chemicals

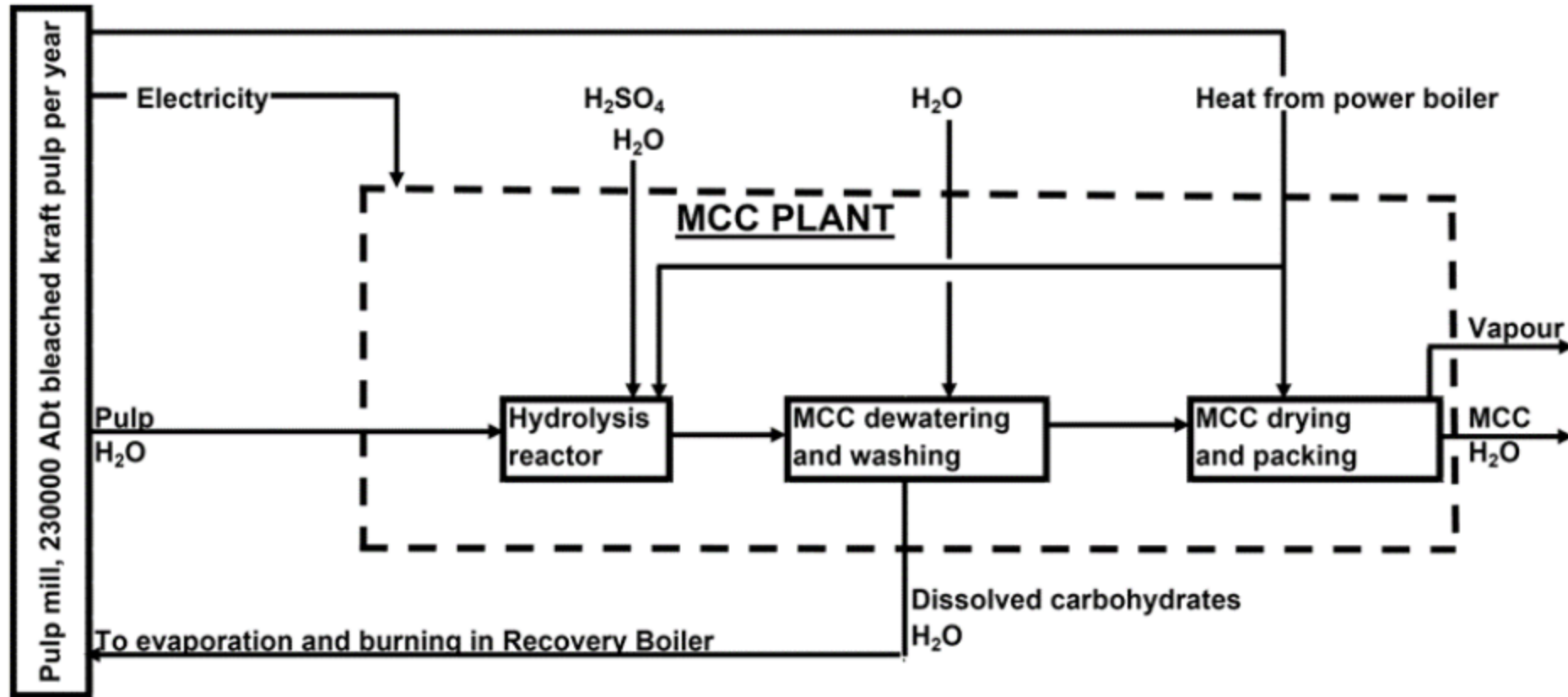




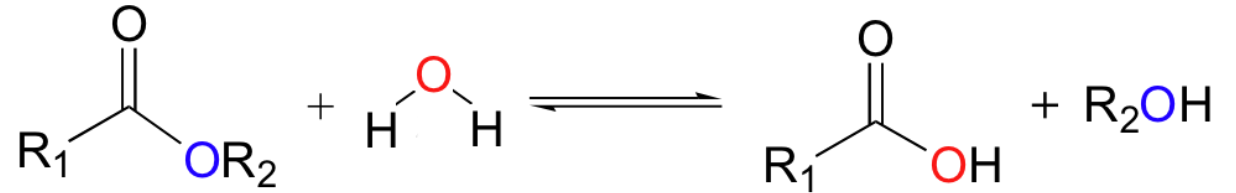
# Schematic drawing



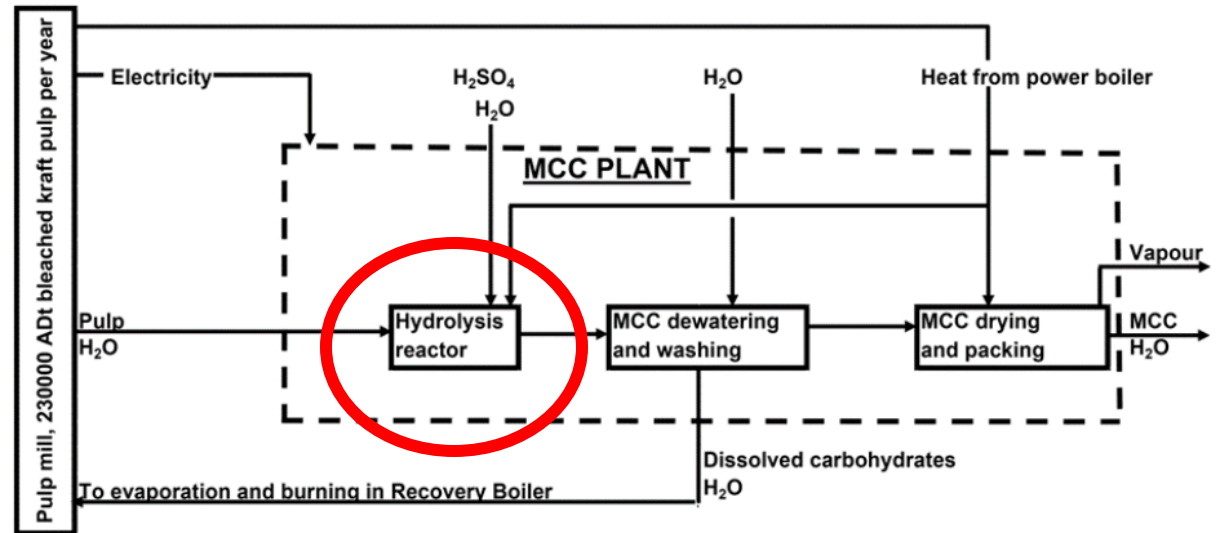
# Subprocesses



# 1. Hydrolysis reactor

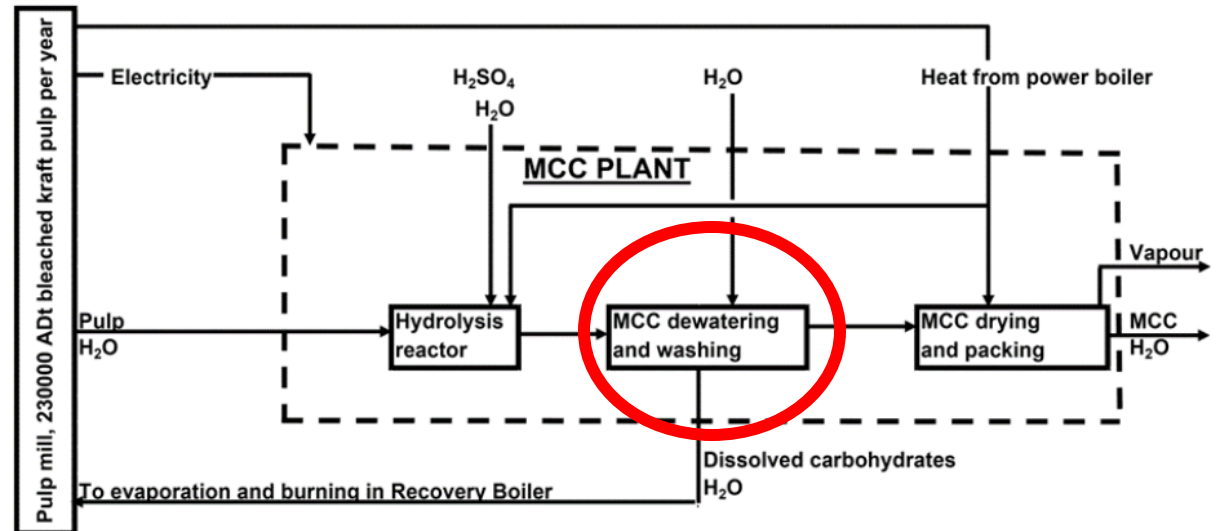


- Acid hydrolysis reaction with yield of 90 % breaks the amorphous regions of the cellulose by using sulfuric acid
- Heat is required to have a sufficient reaction
- Cellulose crystals resulting from hydrolysis are moved to the next process stage



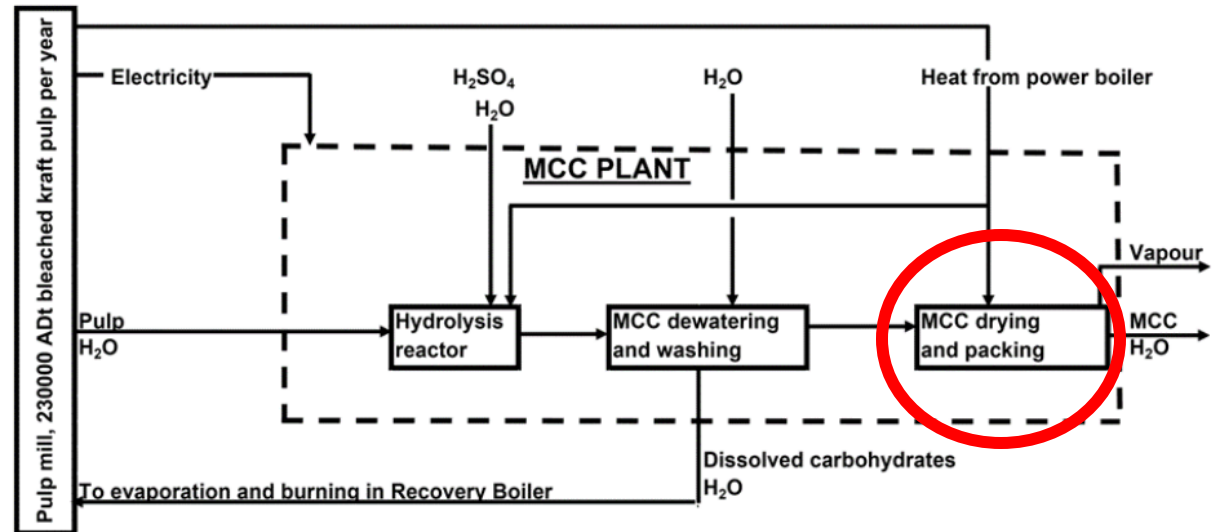
# 2. Dewatering and washing

- MCC crystals are dewatered and washed to prevent dissolved carbohydrate or sulfuric acid accumulation in the end product
- Resulting solution can be directed to the evaporation unit and used as fuel in the recovery boiler similar to black liquor



# 3. Drying and storage

- MCC is dried to consistency of 90 % or over
  - Drying requires heat
- Storage of MCC is done in silos
- Silos are used to load the dry MCC to powder into trucks

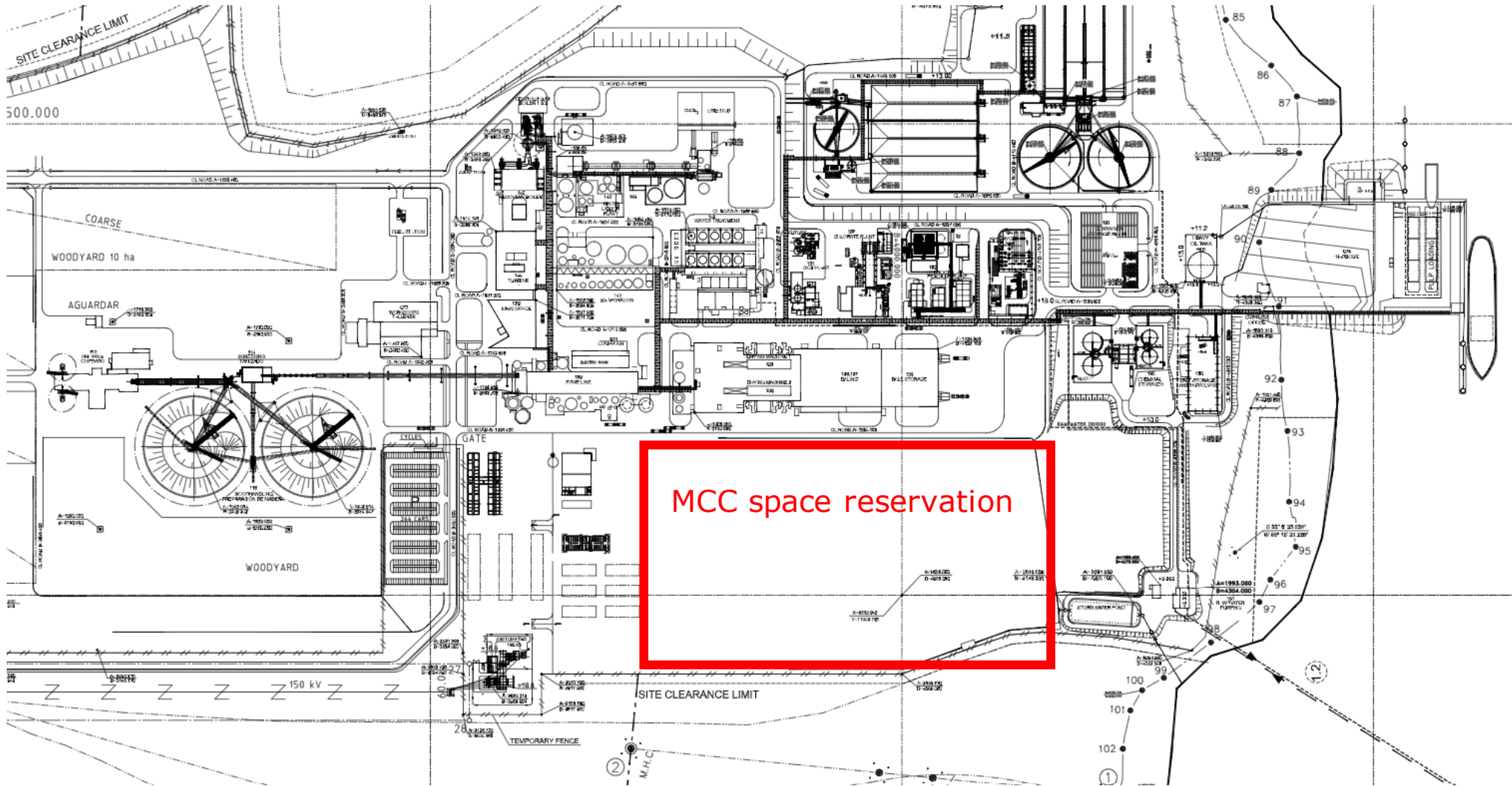


# Safety

## **HAZOP**

- Plant HAZOP must be done during project implementation.

# Layout for the existing pulp mill with space reservation for MCC production line



# Making Future



# Planning and Execution of a Biorefinery Project, 5 cr

PROJECT ASSIGNMENT  
AUTUMN 2022

# Contents

1. Learning objectives
2. Background
3. Assignment Schedule
4. Evaluation
5. Team formation and task distribution
6. First tasks for the team
7. Group
8. Hints and advice

# Learning objectives

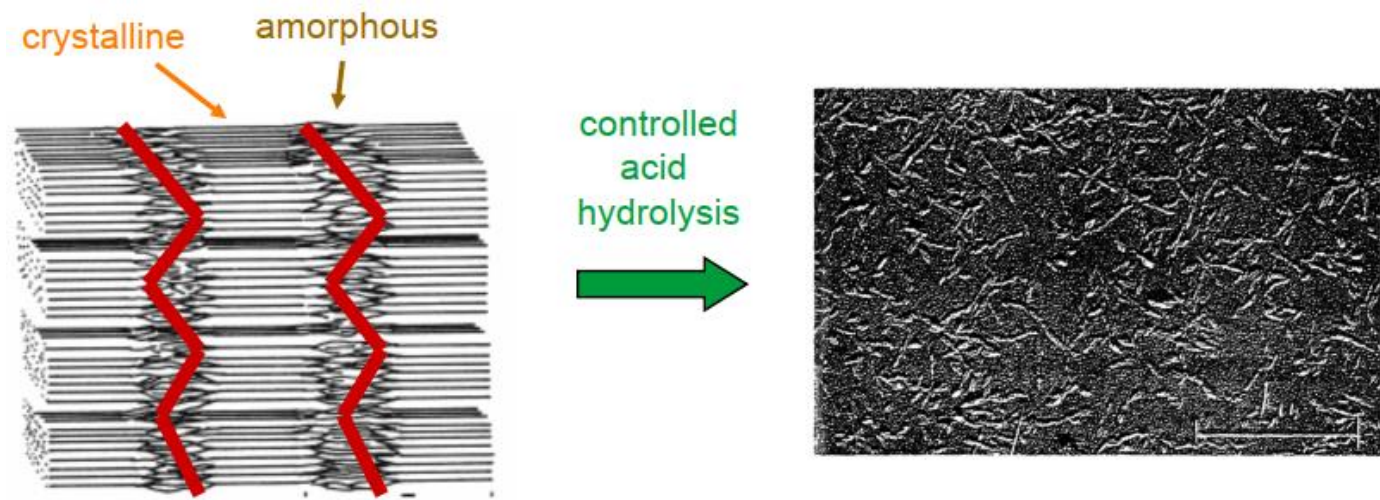
How to  
prepare a  
Project  
Proposal

Deliverables  
in Biorefinery  
Investment  
Project

Cost  
estimating,  
time  
scheduling

Project Team  
Work

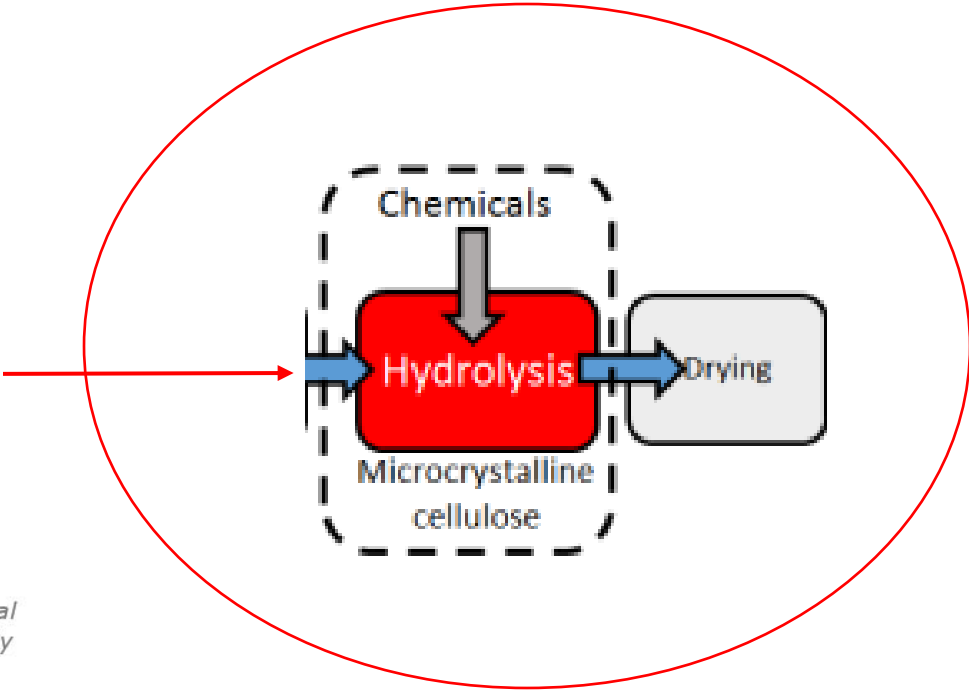
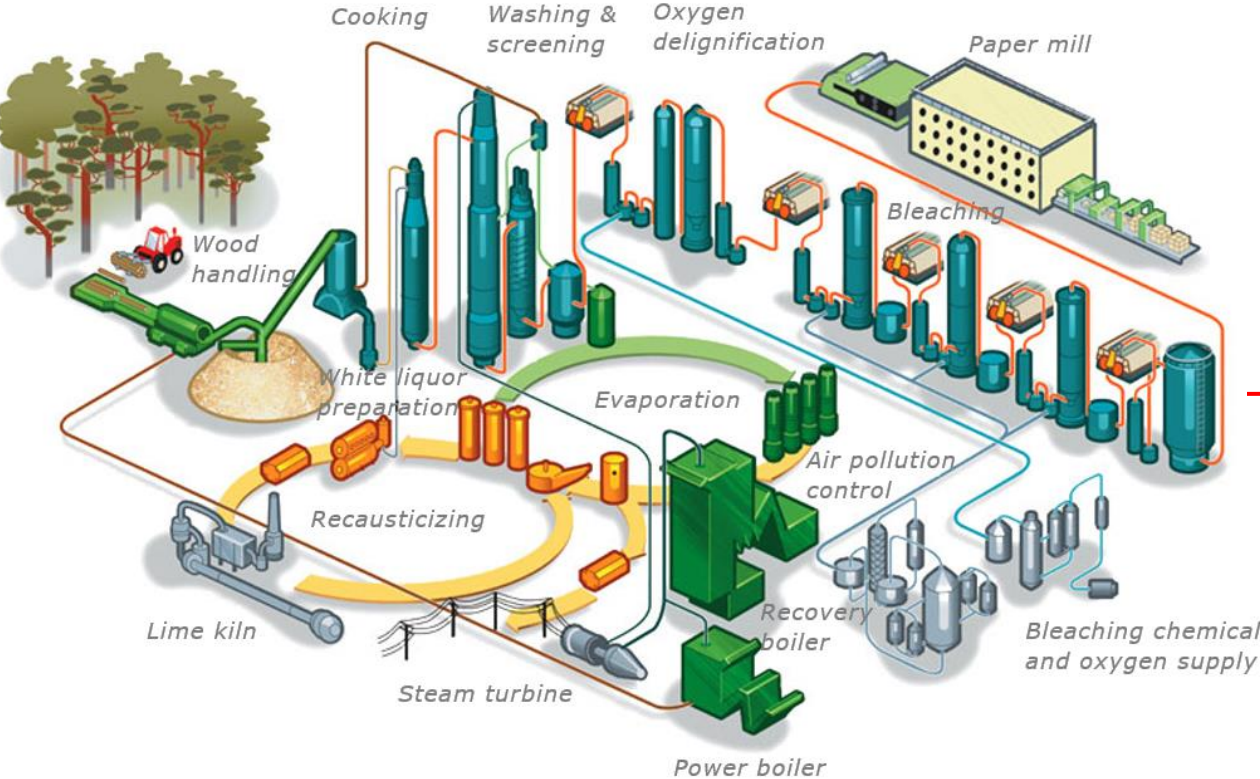
# MCC



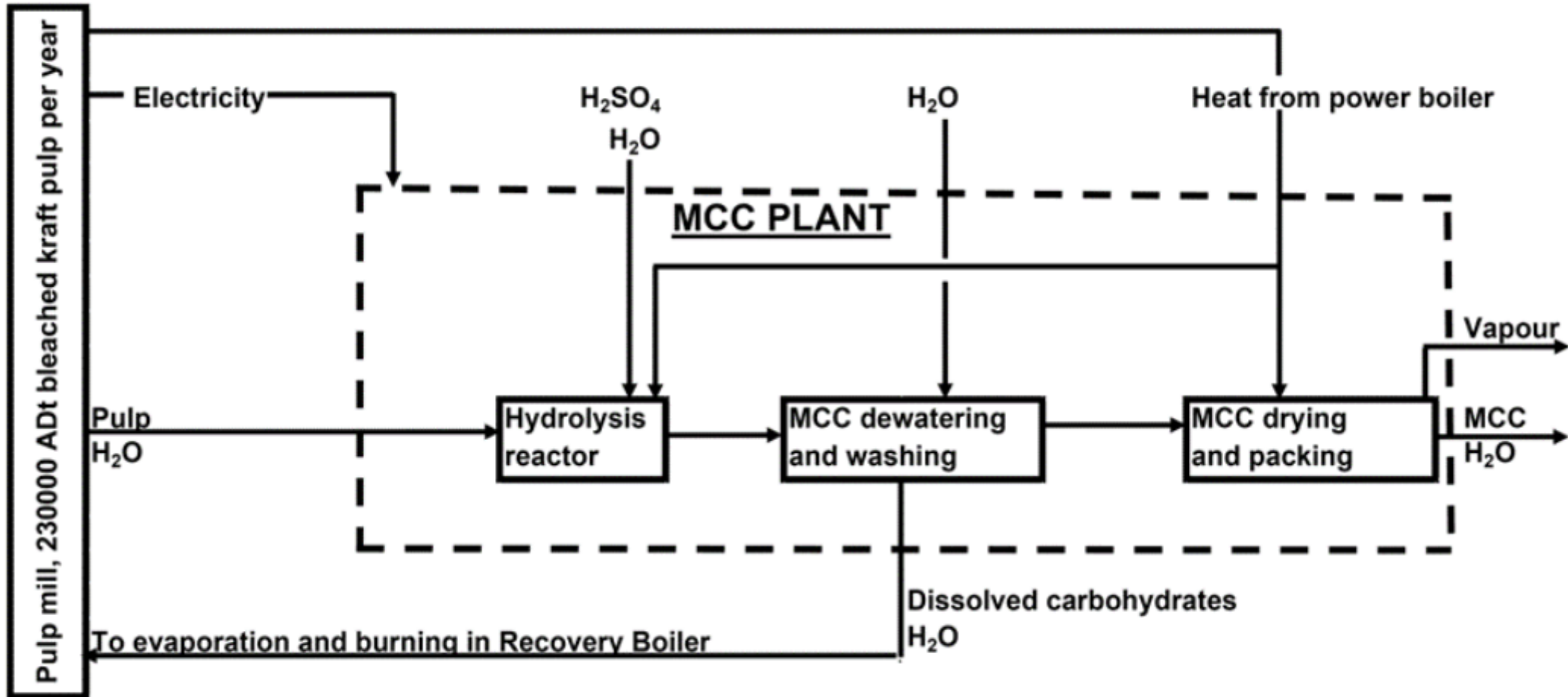
- Microcrystalline cellulose (MCC) production will be integrated to an existing chemical pulp mill
- MCC is cellulose nanocrystals with the amorphous domain cut off
- In this project, the isolation of crystalline cellulose is done with acid hydrolysis
- The produced MCC is used in the pharmaceutical industry as bulk material for tablets



# EPC Proposal for an MCC production line



# Process steps



Vanhatalo, K. M *et al.* (2014) Techno-Economic Analysis of Simplified Microcrystalline Cellulose Process

# Main design data

— Required MCC production	20 000 BDt/a (bone dry tonnes per year)
— Feed pulp consistency	30 % solids
— MCC yield in process	90 %
— Hydrolysis chemical	H <sub>2</sub> SO <sub>4</sub>
— H <sub>2</sub> SO <sub>4</sub> dosing (in 100% concentration)	1.5 % of the bone dry raw material used
— Hydrolysis process temperature	160 °C
— Reactor residence time	10-15 min
— Consistency after dewatering	50 %
— Consistency of the final product after drying	≥90 %

# Assignment:

1. You will form 2-3 Project Teams (Company X and Y for example)
2. Each Company will act as a an "EPC Contractor" preparing a turnkey quotation for the Client
3. Assignment is to prepare "EPC Quotation for an integrated MCC production line"
4. Client (AFRY lecturers) will evaluate the Quotations



# Assignment Schedule

- Work planning can be started now
- Designated sessions for guidance and mandatory progress reporting are organised during October-November 2022
  - *Workshop #1: October 13, 2022 (@AFRY Otaniemi)*
    - *Subject: How to prepare a good proposal?*
  - *Workshop #2: November 3, 2022 (@AFRY Otaniemi)*
    - *Subject: HSE in proposals, review of time schedules and cost estimates*
  - *Workshop #3: November 10, 2022 (@AFRY Vantaa)*
    - *Preparation for presentations, draft presentations, final questions and answers*
  - Each team reports the progress of Quotation preparation status during the workshops
- Final presentation of the prepared Quotation in the “executive summary presentation” format on November 17, 2022



# Where to start?

## First tasks for the team

- Proposal organisation, choose Project Manager
- Choose your company's name
- Task and role definitions
- Time schedule for preparing the proposal
- Prepare task list. Who will do what deliverables
- Agree regular meetings with the team
- Study the material! (i.e. read the RFQ =Request for Quotation package)



# Teams Formation & Tasks Distribution Principle

## – Each team shall execute following task

- Management
  - assignment planning and tasks
  - project organization chart
  - implementation plan
  - manpower planning
  - risks, document handling, presentation and team leading
  - Putting the quotation together, checking everything is in order
- Project controls team
  - cost data & scheduling
  - life cycle cost analysis
- Engineering
  - Equipment list, process description and operating values
  - Layouts & line diagrams
  - HSE

## – Team roles (examples)

- Project Management
  - Project or Proposal Manager
  - Coordinator /Document Manager /Procurement Manager
  - Risk /Contract Manager
- Project Controls
  - Time Scheduler
  - Cost Controller
- Engineering
  - Engineering Manager
  - Health, Safety and Environment Manager

# Target outcome

- Target is to have competitive EPC Quotation
  - Client can not make the selection only based on low cost, but that is a major factor, cost estimate should be detailed
  - Focus on preparing cost estimate
  - You also must have credible package of project information
  - Scope, time schedule and cost in balance

The assignment output should include:

- Executive summary presentation (max 20 min, and 10 min for discussion)
- Delivery of Quotation package (all the appendices listed in the RFQ)

# Groups

- Groups of approx. 5-7 persons
- Groups will be random
- Groups to be announced when the course registration ends (12.9.)

# Hints and Advice

- Carefully review RFQ documentation first!
  - What should we deliver? Prepare a list of deliverables
  - Put yourself in the Client's shoes: what is the Client asking for / expecting us to do?
  - Separate main items from details
  - Don't get stuck in the details!
  - Search for facts, ask for guidance!
- Do not focus too much on the technology solution, make simplifications, the process is given, you can use that as the basis. The main thing is to put together the material and plan the project.
- Remember progress reporting for the workshops
- Utilize the knowledge gained during lectures, but be prepared to search for advice
- Strive for team cohesion, assign leaders to the objectives, not to the team, and co-operate
- You are supposed to put together a "real" EPC Quotation
- Keep it short and to the point!

# Questions?

Contact:

[lassi.laumola@afry.com](mailto:lassi.laumola@afry.com)