CleanFlow Technology for Green and White Liquor Filtration

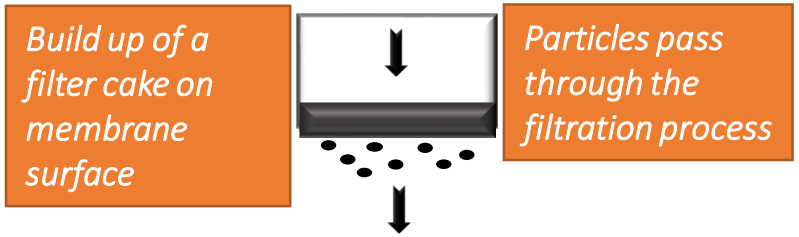
Rohan Bandekar, MSc

rbandekar@noram-eng.com

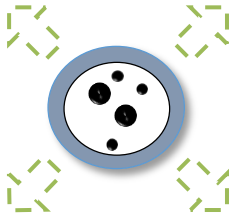
Microfiltration

- Microfiltration is a way of removing contaminants in the size range of 0.1-10µm from fluids or gases, by passing through a microporous medium such as a membrane.
- Microfiltration covers both dead end filtration and crossflow filtration
- In crossflow filtration the fluid stream runs tangential to the membrane, establishing a pressure differential across the membrane causing some of the particles to pass through the membrane while the remaining continue to flow across the membrane, “cleaning it”.
- The use of tangential flow prevents thicker particles from building up a filter cake on the membrane

Traditional Dead End Filtration



Crossflow Filtration

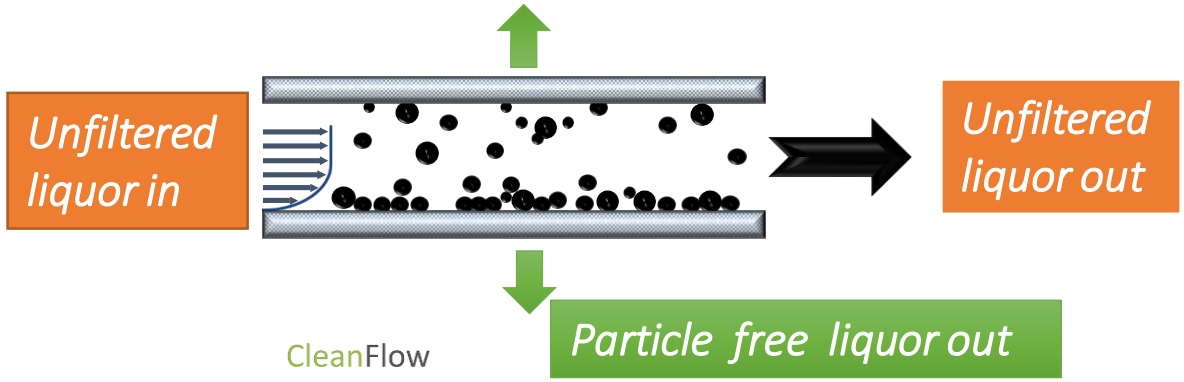


Particle free liquor going out

100% particle separation possible

Clean Flow Technology

- Green/White liquor filtration – to provide additional filtration **capacity** (in parallel)
- Improve white liquor **quality**
- The patented technology is based on **cross-flow filtration** and was developed in collaboration with the university, KTH Royal institute of Technology in Sweden.
- CleanFlow technology is adoptable for all kinds of pulp mills and is already **commercialised**



Before vs. after green liquor filtration with CleanFlow

What’s in it for pulp mills?

Increased capacity

- Effective removal of bottlenecks enabling an increase in pulp production capacity

Lower production costs

- Purer liquor and hence reduced chemical consumption in the digester.
- Reduced filter maintenance, energy consumption and lime purchases

Higher quality

- Near zero metal content pulp
- A purified liquor improves the quality of the end product, e.g. cellulose

Improved profitability

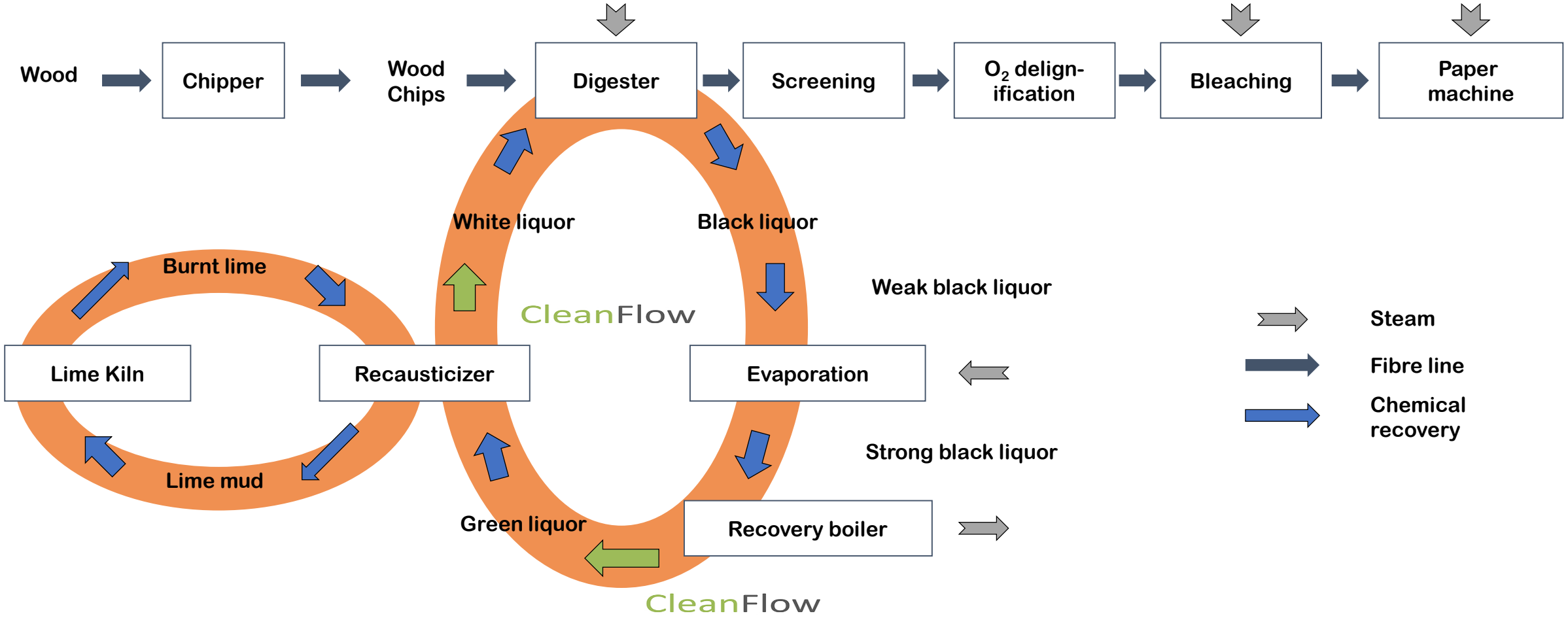
- Boosted mill capacity with higher end product quality

Modularity

- Offering customized solutions, easy to adopt to existing facilities and can easily be expanded in the future

Clean Flow Technology

Schematic description of a kraft pulp mill



Overview of CleanFlow's Modular Construction

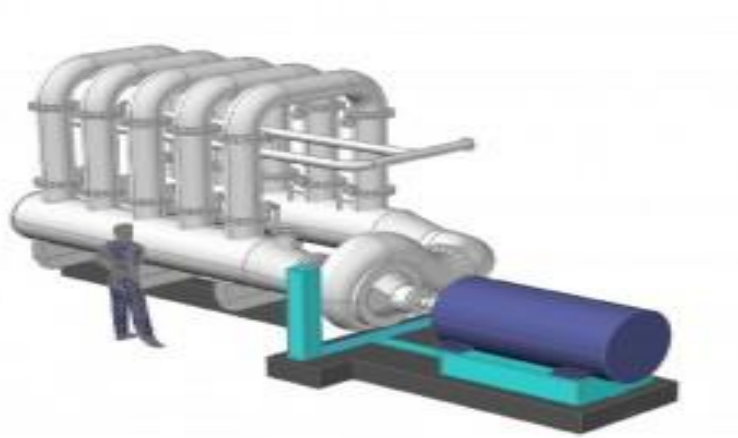
Unfiltered liquor in

- ✓Each ceramic CleanFlow rod is 1.5 meters in length, and has 19 parallel channels
- ✓The ceramic rods have a pore size of 0.1 µm - 1 µm
- ✓The rods have a proven life-time of approx. 3 years

- ✓Each filter holder holds up to 46 CleanFlow rods
- ✓The liquor filters are compact and of highest quality
- ✓Two filter brackets form one filter module

Overview of CleanFlow's Modular Construction

- ✓Filtration capacity range from partial (typically 90 – 350 gpm) up to full liquor flow of ~1760 gpm
- ✓Works in parallel with conventional liquor filters, e.g. Casett filter, Pre-coat filter, Gravimetric separation



- ✓Highly modular products for optimization
- ✓Easy to scale by adding filter modules for increased capacity
- ✓Large capacity at low footprint

Superior Performance

Green liquor filtration

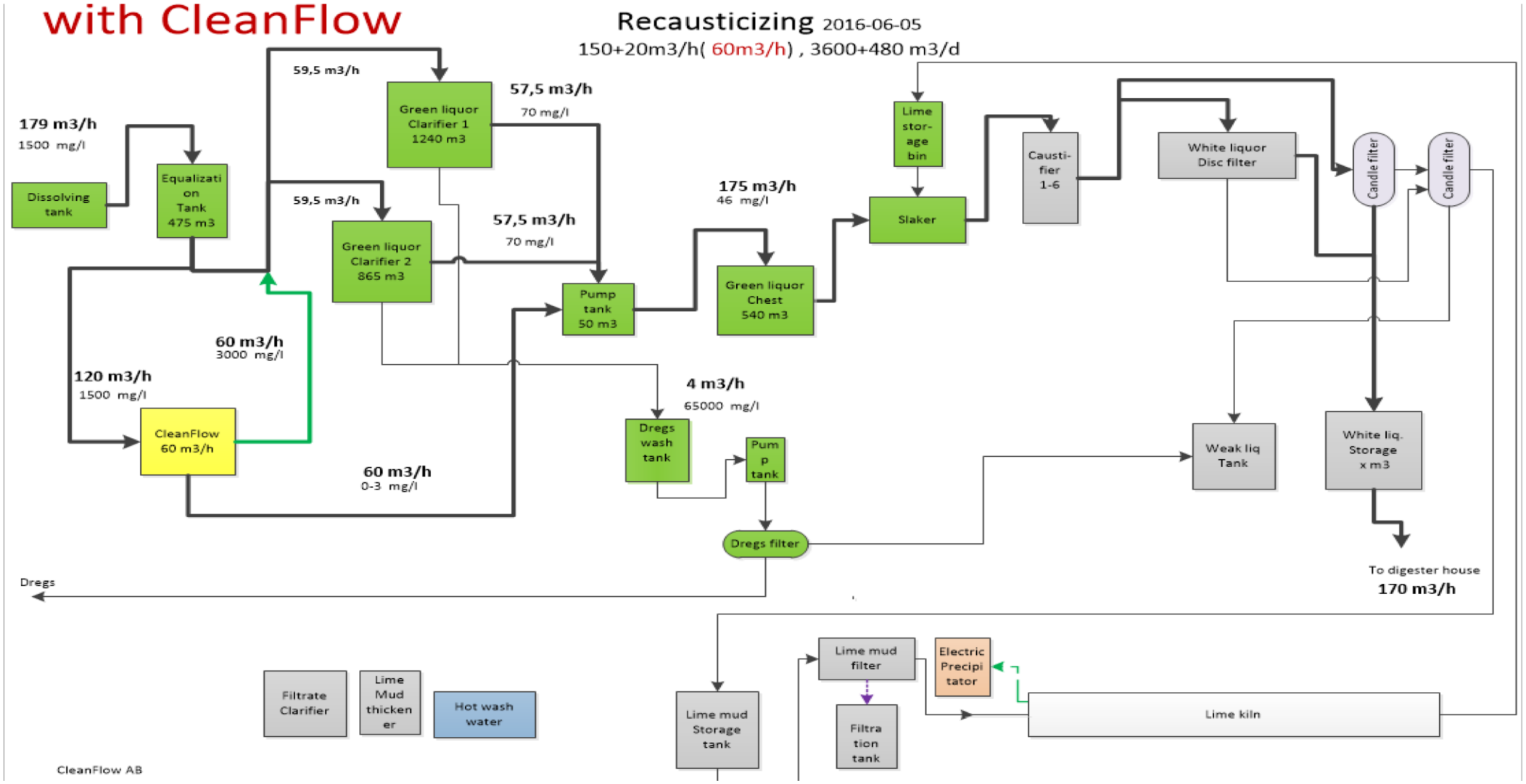
- Outstanding performance removing nearly all unwanted particles of the green liquor, from 3,000 mg/l to <6 mg/l
- Works in parallel with conventional filters
- Key economical gains:
  - ✓increased capacity
  - ✓increased uptime
  - ✓reduced lime need
  - ✓reduced filter wear
  - ✓reduced filter maintenance

White liquor filtration

- Outstanding performance removing nearly all unwanted particles of the white liquor, from 300 mg/l to <2 mg/l
- Works in parallel with conventional filters
- Key economical gains:
  - ✓increased capacity
  - ✓improved pulp quality
  - ✓reduced wear of other equipment

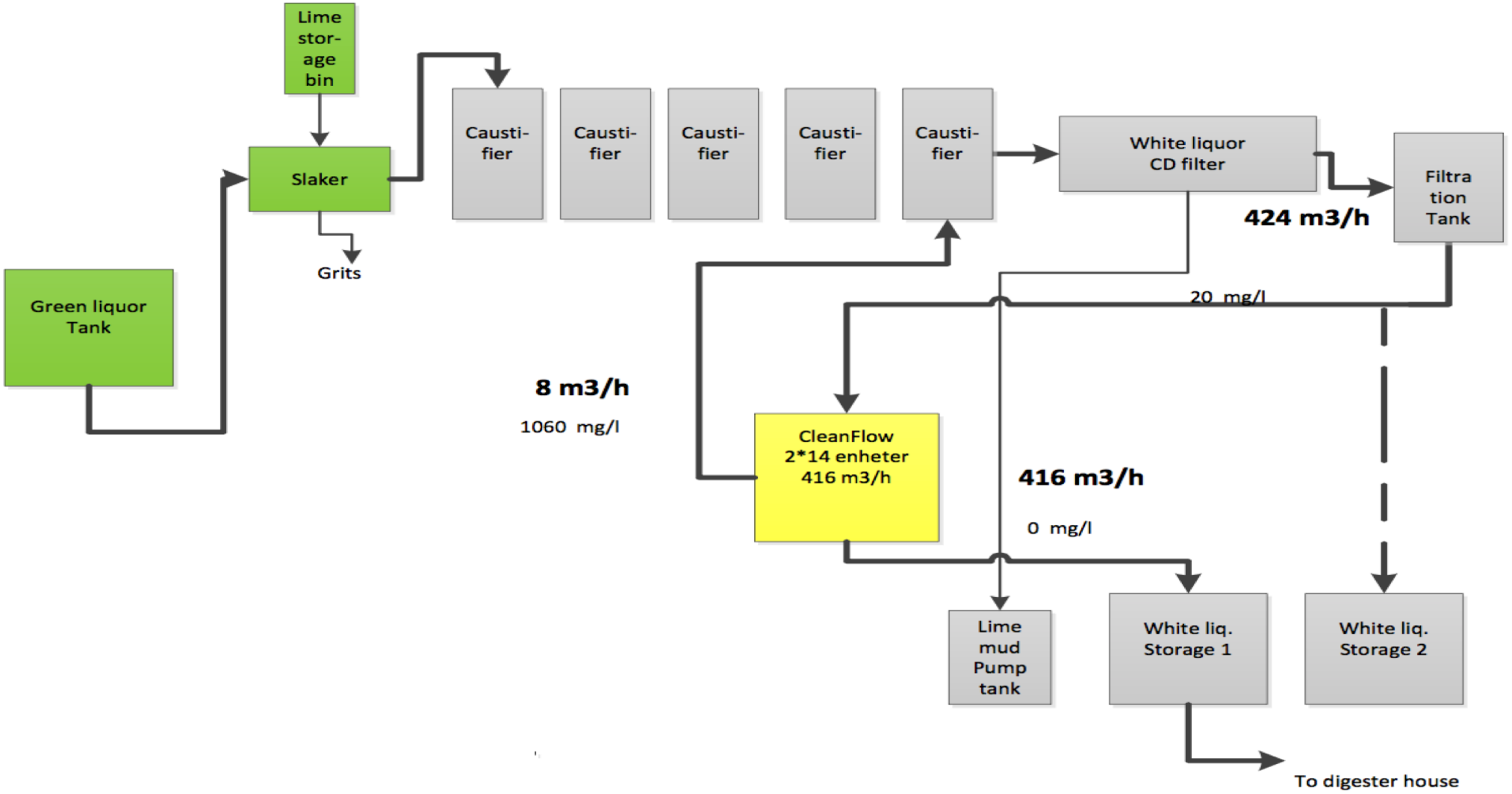
Green Liquor Filtration

Example schematics – Increased capacity



- CleanFlow can be used for green liquor filtration to provide additional filtration capacity at the pulp mill - *boosting*
- The CleanFlow solution takes approx. 30% of the green liquor flow and relieves the ordinary green liquor clarifiers, hence making it possible to increase the filtration capacity at the pulp mill
- Filtration capacity up to a liquor flow of ~400 m^3/h

White Liquor Filtration
Example schematics – Higher Quality



- CleanFlow can also be used for white liquor filtration to increase white liquor quality – *polishing*
- CleanFlow effectively removes all unwanted particles leading to a near zero metal content white liquor
- Filtration capacity up to a liquor flow of ~400 m^3/h

Industrial Proof-of-Concept in Place

- First mill in the world to introduce the CleanFlow filter into its pulping production
- The full-size plant has a filtration capacity of 20 m^3/h
- The plant is fitted with 2 filter modules, each filter holder containing 46 filter elements
- The plant has run at full capacity since May 2013 with a total of more than 50,000 operating hours

Aspa Bruk, pulp mill fully-owned by Ahlstrom-Munksjö, located outside Askersund, Sweden

Industrial Proof-of-Concept in Place

ENCE Pontevedra pulp mill, Spain

- Clean Flow system was started up in Fall 2019
- The plant is fitted with 10 filter modules, each filter holder containing 46 filter elements
- Purpose to improve operation and increase production capacity
- Capacity of the system has been dimensioned to fit the mill's production increase and thanks to the module function it can easily be expanded and adapted to future expansions
- **Filtration capacity** of 100 m^3/h

THANK YOU