

About Graintec

Why Energy Efficiency?

Energy Consumption

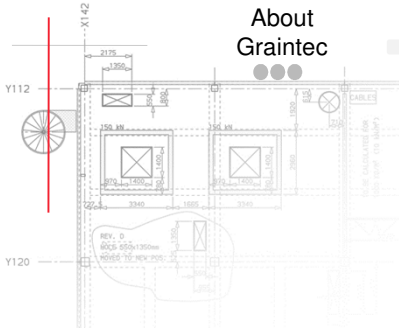
Energy Recovery Solutions

The Smart Solution

Product Quality Aspects / Summary

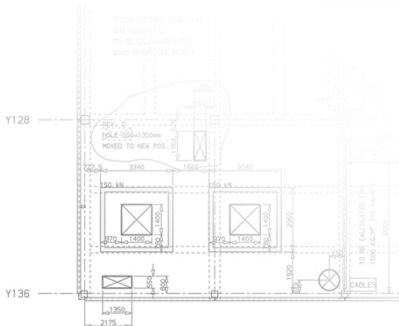


GRAINTEC A/S



# ENERGY EFFICIENCY IN PRODUCTION OF EXTRUDED FEED

## GRAINTEC A/S



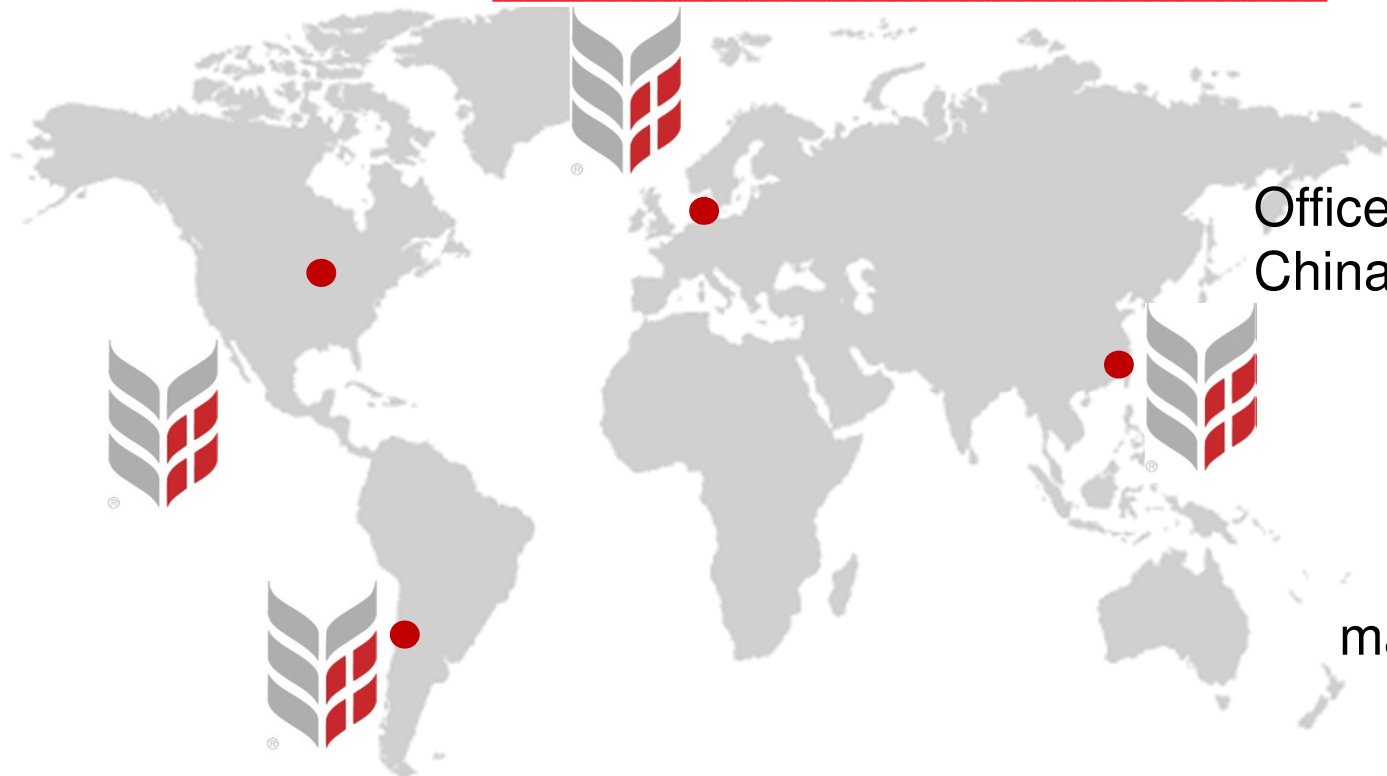
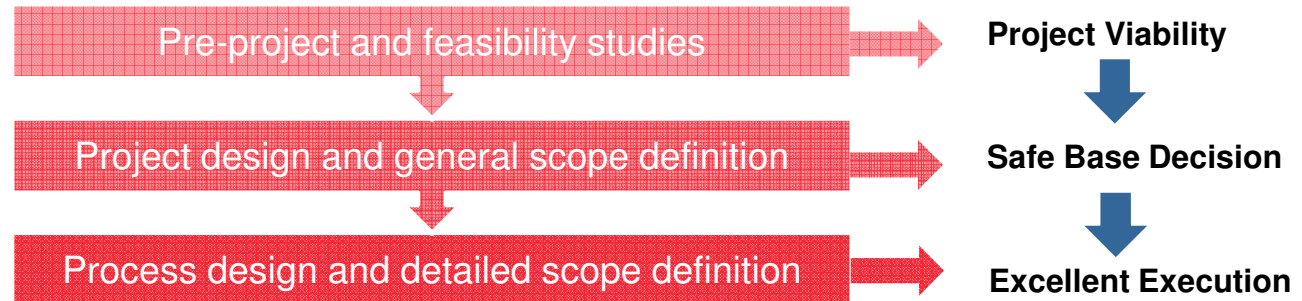
**Speaker: Anders F. Haubjerg**  
**M.Sc., Process Engineer**  
**Industrial PhD Student**

DESIGN EXECUTE INSTALL MAINTAIN



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TURN-KEY SUPPLIER OF PROCESS PLANTS FOR THE FEED INDUSTRY, SINCE 1985



Offices in Denmark, Chile,  
China and USA

Graintec A/S  
40 Enghavevej  
DK-7100 Vejle

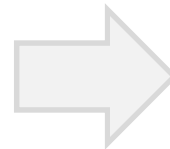
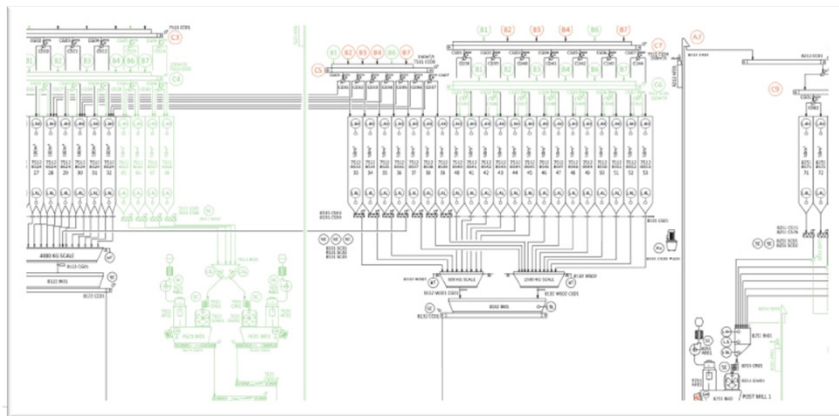
[mail@graintec.com](mailto:mail@graintec.com)

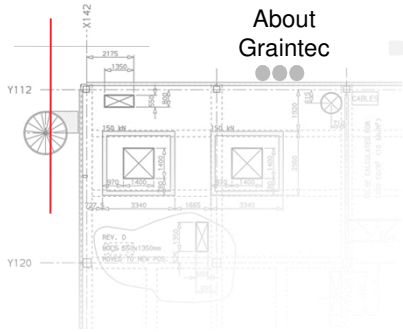


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YOUR ULTIMATE CHOICE OF A GLOBAL BUSINESS PARTNER

- Engineering, contracting and project management
- Energy recovery
- Environmental improvements





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Why Energy  
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●●●

Energy  
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●●●

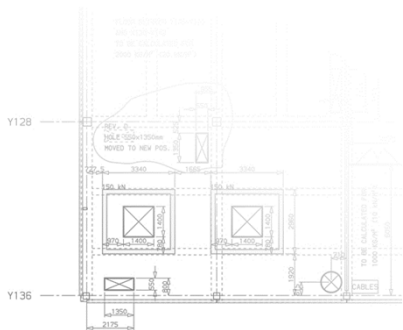
Energy Recovery  
Solutions  
●●●

The Smart  
Solution  
●●●

Product Quality  
Aspects / Summary  
●●●

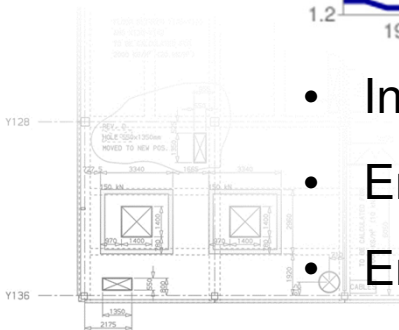
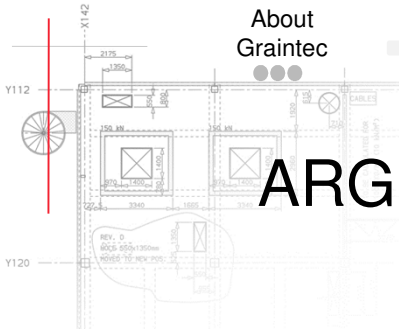


# WHY ENERGY EFFICIENCY?

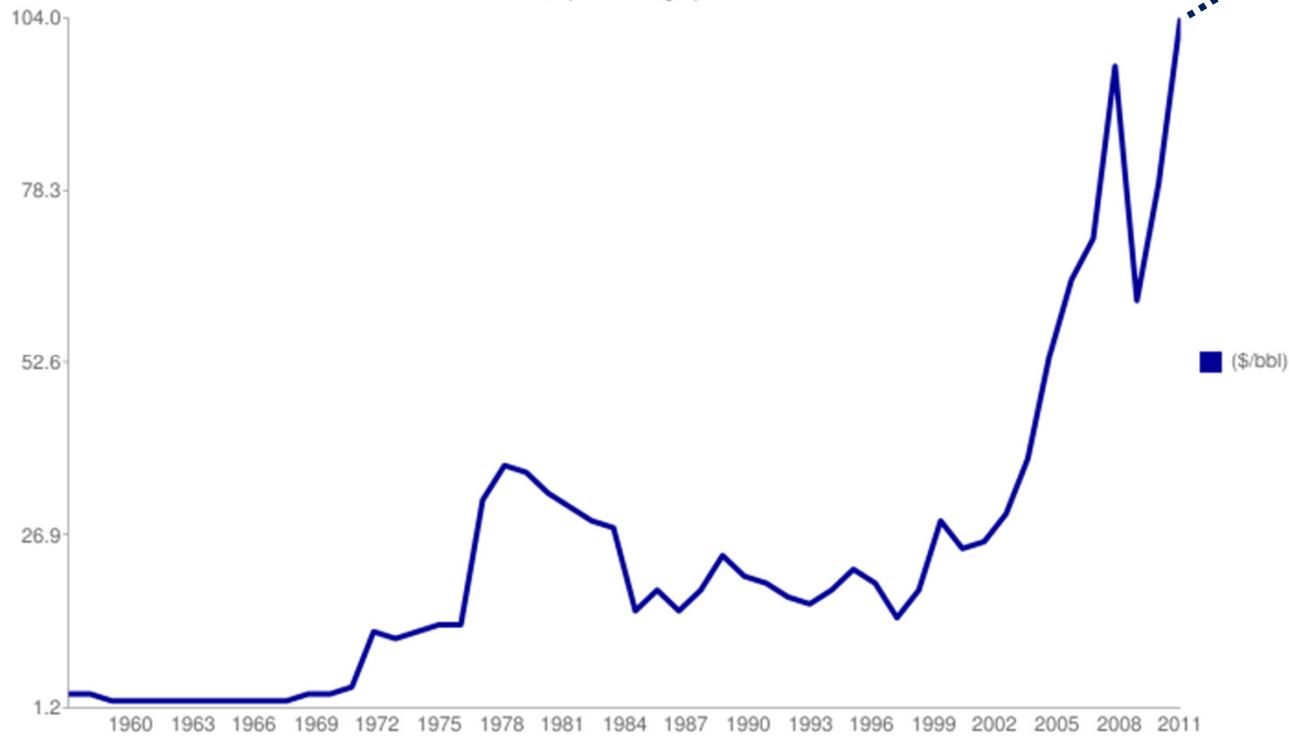




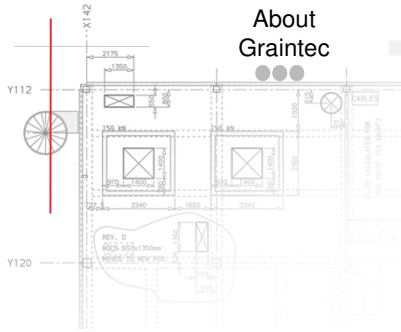
# ARGUMENTS FOR ENERGY EFFICIENCY



Crude oil, Spot Average price chart



- Increasing energy prices
- Emmision taxes
- Environmental friendly company profiles



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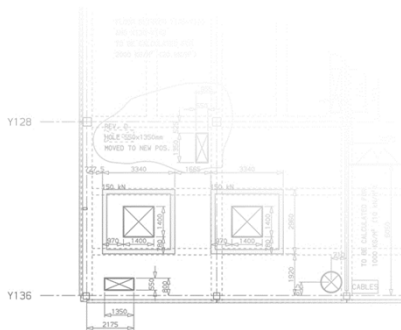
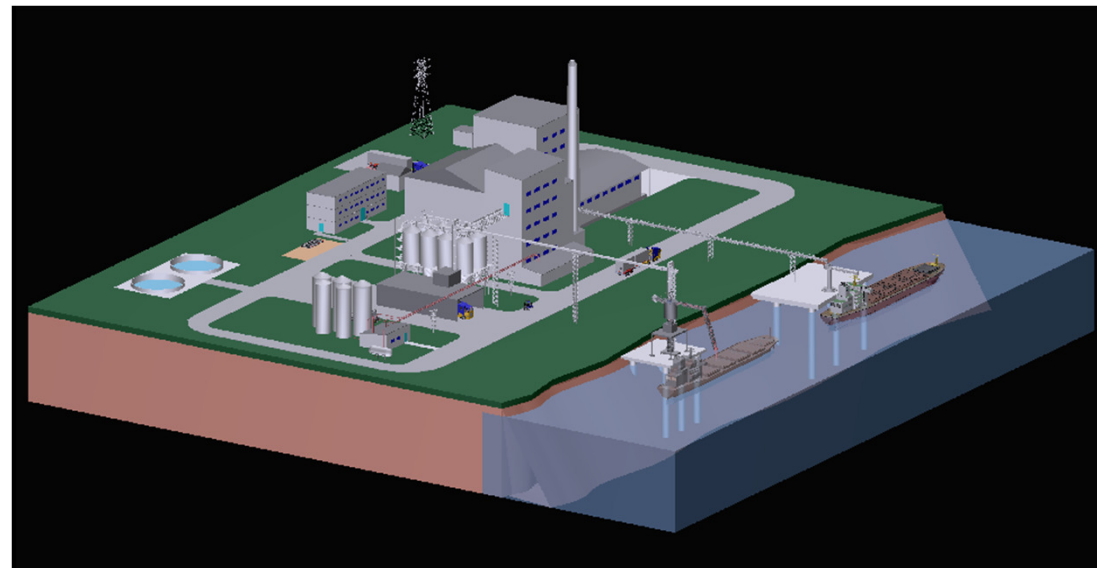
Energy Recovery  
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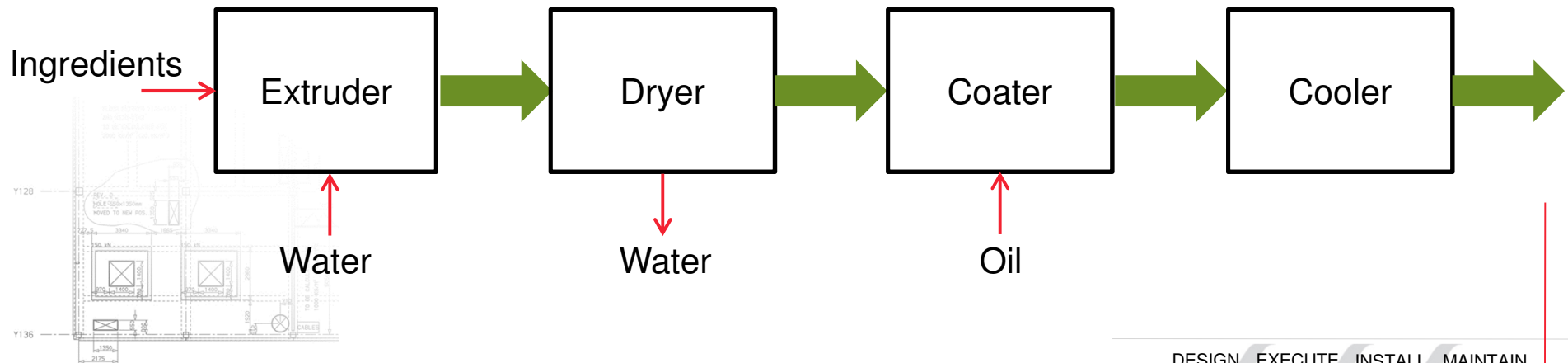
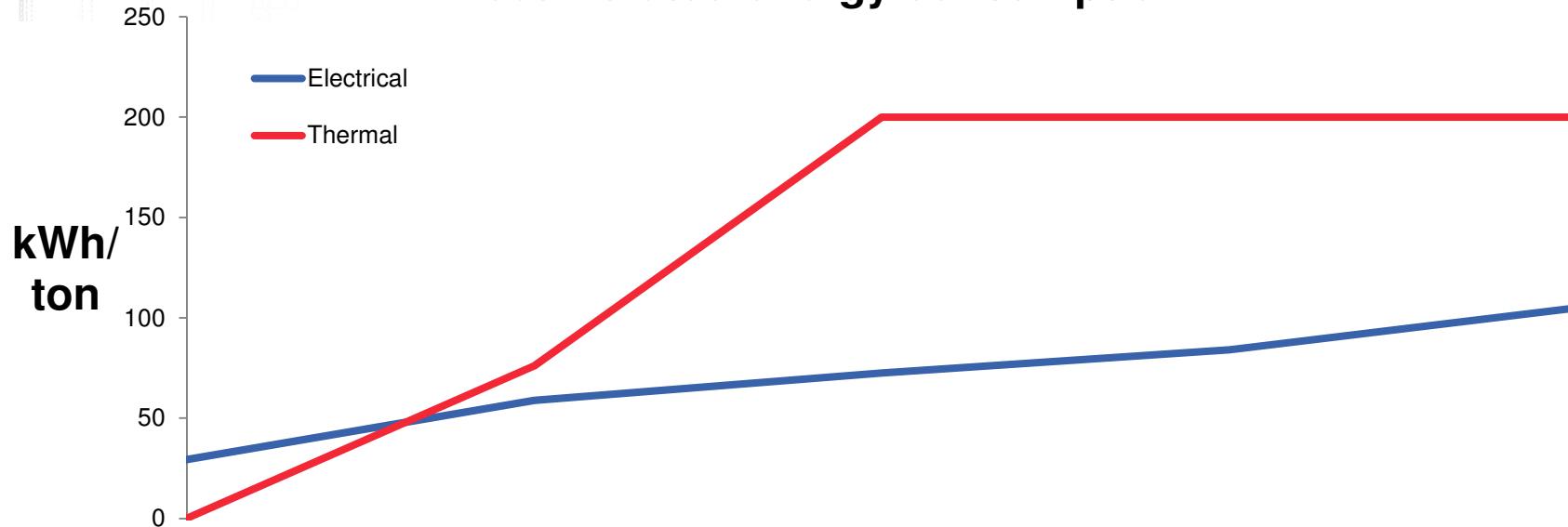


# ENERGY CONSUMPTION IN EXTRUDED FISH FEED PRODUCTION



# ENERGY CONSUMPTION IN EXTRUDED FISH FEED PRODUCTION

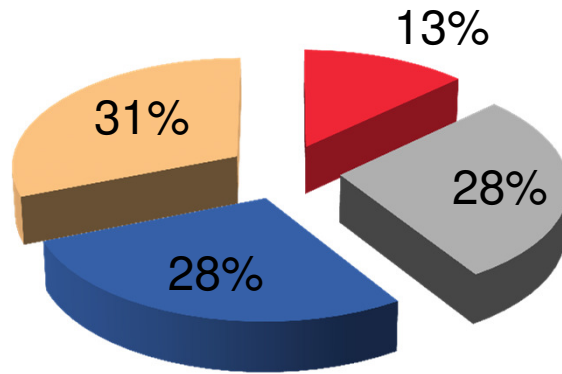
## Accumulated energy consumption





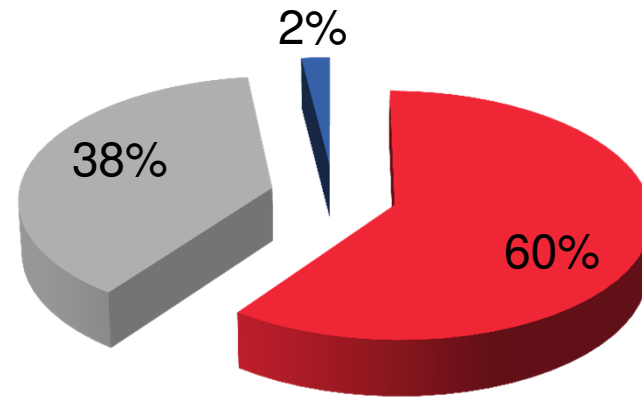
# ENERGY CONSUMPTION IN EXTRUDED FISH FEED PRODUCTION

## ELECTRICAL ENERGY CONSUMPTION



- Drying
- Extrusion
- Grinding
- Others

## THERMAL ENERGY CONSUMPTION



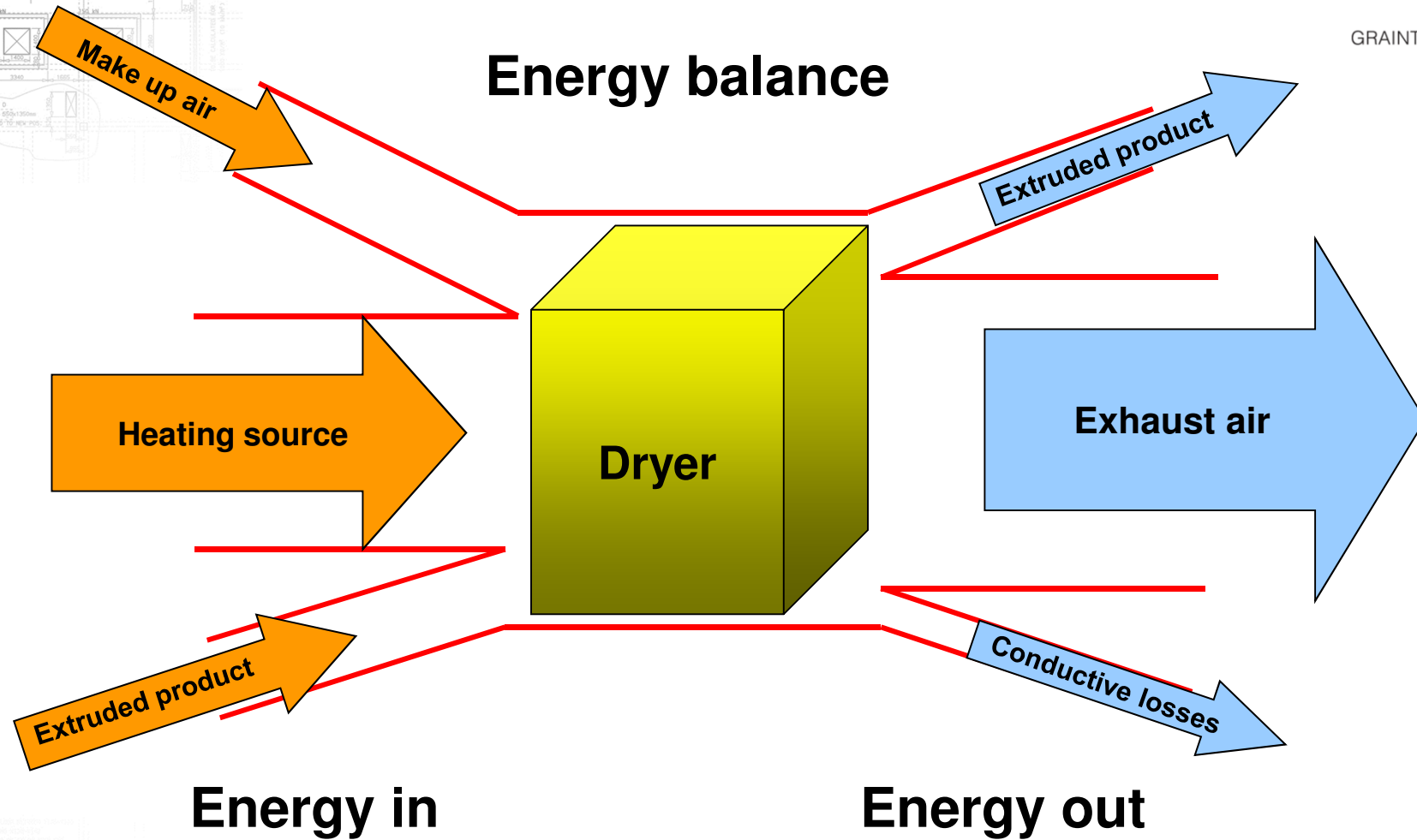
- Dryer
- Extruder
- Others

The largest savings potential is in the drying process!





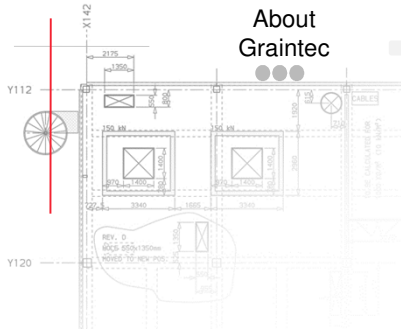
# Energy balance



**Energy in**

**Energy out**

**Note: Up to 95% of energy in dryer exhaust**



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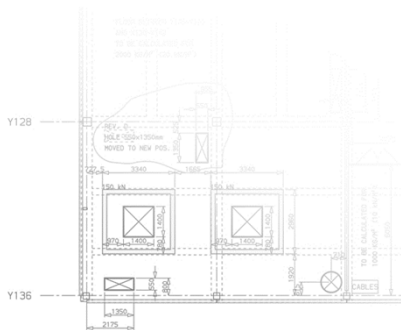
The Smart  
Solution

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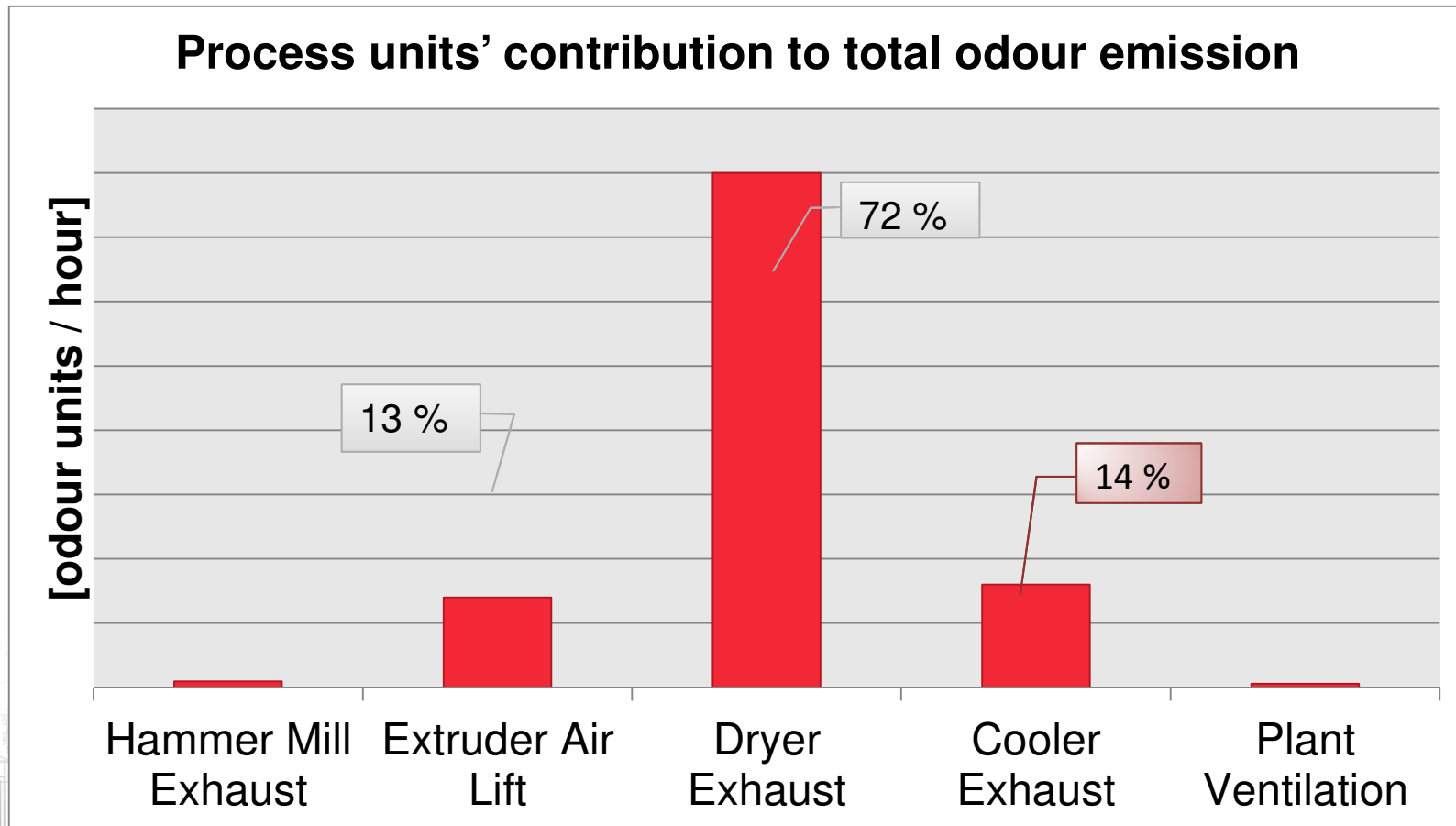
Product Quality  
Aspects / Summary



# ODOUR EMISSION & THE SMART SOLUTION



# ODOUR EMISSION FROM FISH FEED FACTORY



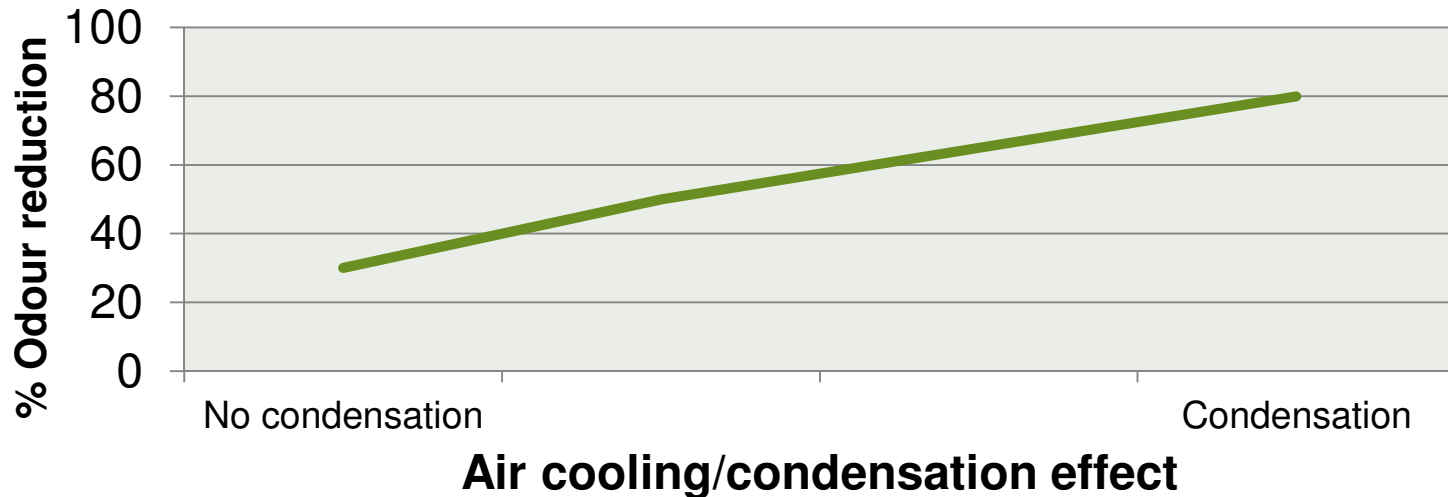


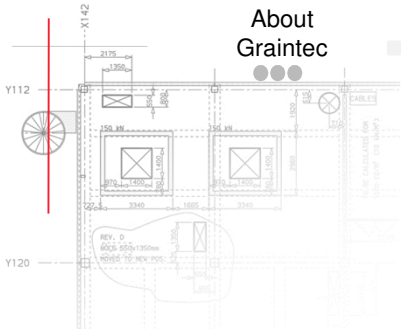
# THE SMART SOLUTION

**CONDENSATION**

**=**

**ODOUR  
REDUCTION**





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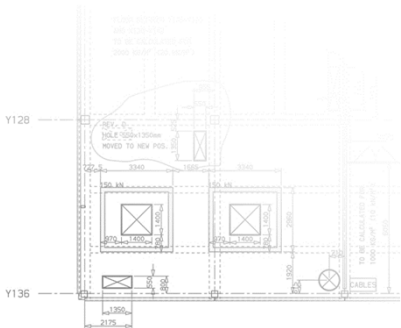
The Smart  
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# ENERGY RECOVERY SOLUTIONS

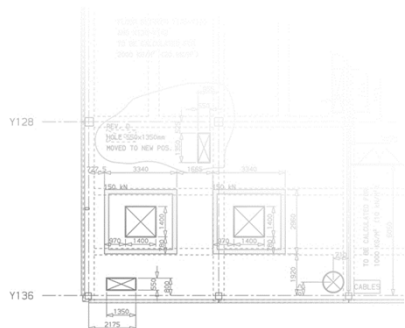
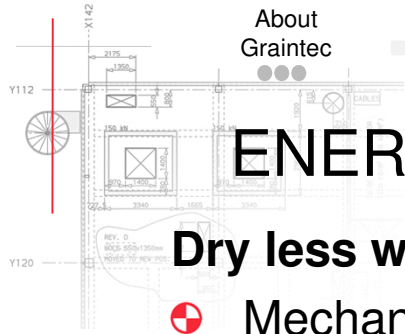




# ENERGY RECOVERY SOLUTIONS

**Dry less water, little capital expense**

- Mechanical dewatering
- Avoid overdrying





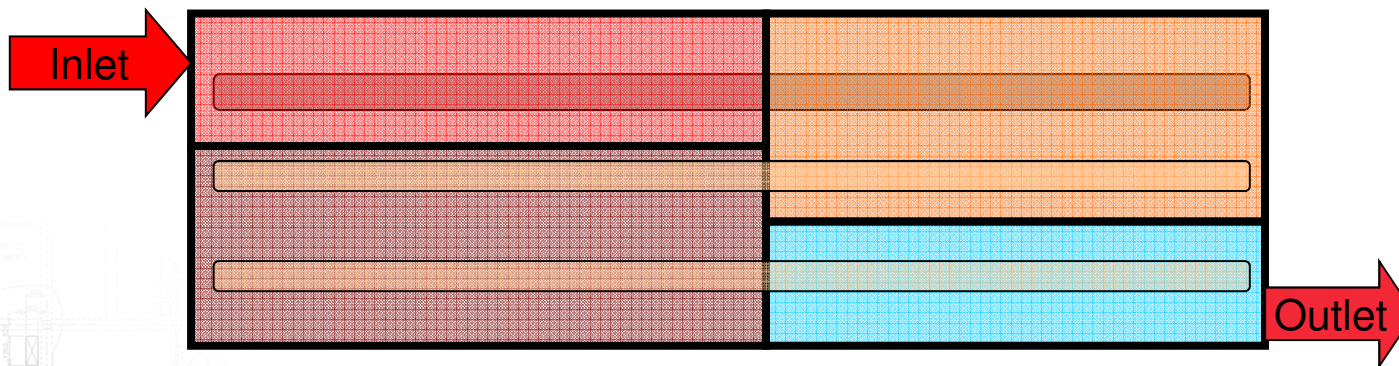
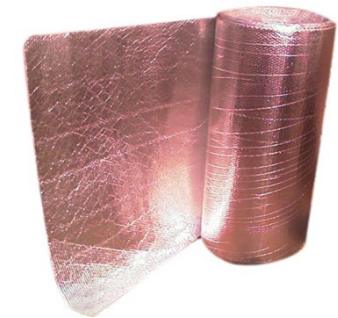
# ENERGY RECOVERY SOLUTIONS

## Dry less water, little capital expense

- Mechanical dewatering
- Avoid overdrying

## Increase efficiency of drying air, little capital expense

- Reduction of air leaks, improve insulation, etc.
- Increase moisture content in exhaust air
- Use hot air from cooler
- Zone-wise temperature control





# ENERGY RECOVERY SOLUTIONS

## Simple solutions, little capital expense

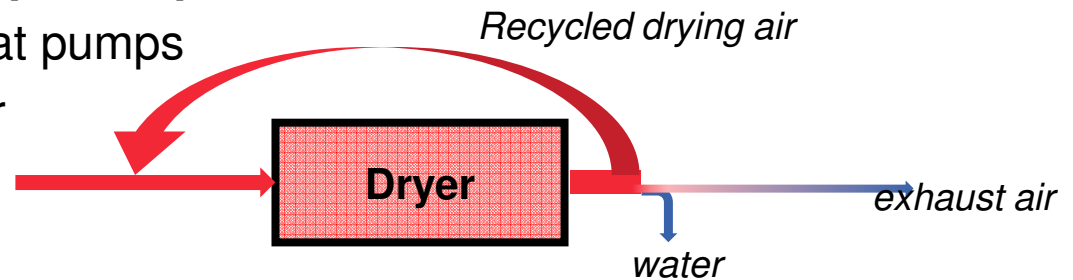
- Mechanical dewatering
- Avoid overdrying

## Increase efficiency of drying air, little capital expense

- Reduction of air leaks, improve insulation, etc.
- Increase moisture content in exhaust air
- Use hot air from cooler
- Zone-wise temperature control

## Energy recovery, higher capital expense

- Heat exchangers and heat pumps
- Recirculation of drying air

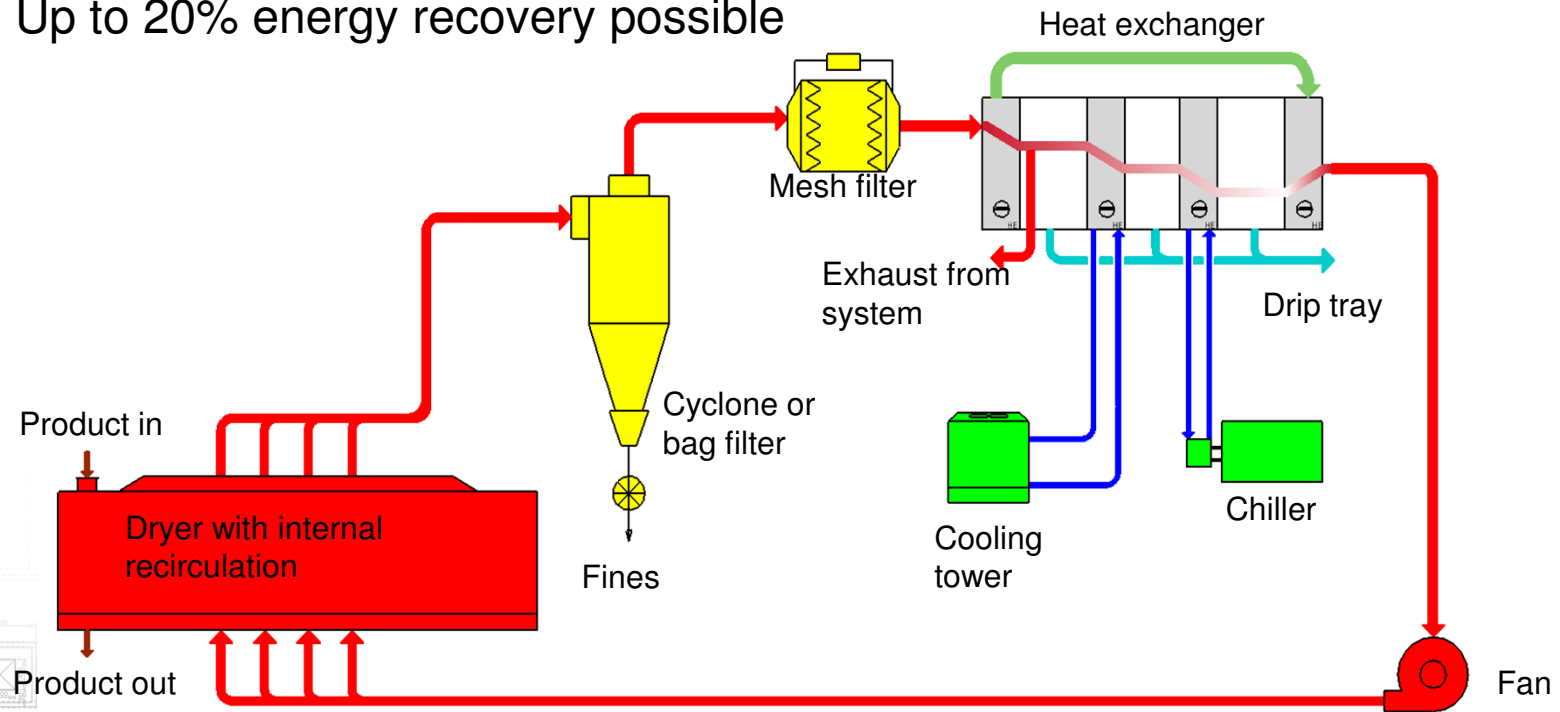






# THE SMART SOLUTION = GRAINTEC RECONDENSING SYSTEM

- Air to water exchangers, cooling tower and chiller
- Recirculation of dryer air
- Condensation of water
- Odour reduction effect above 85%
- Up to 20% energy recovery possible



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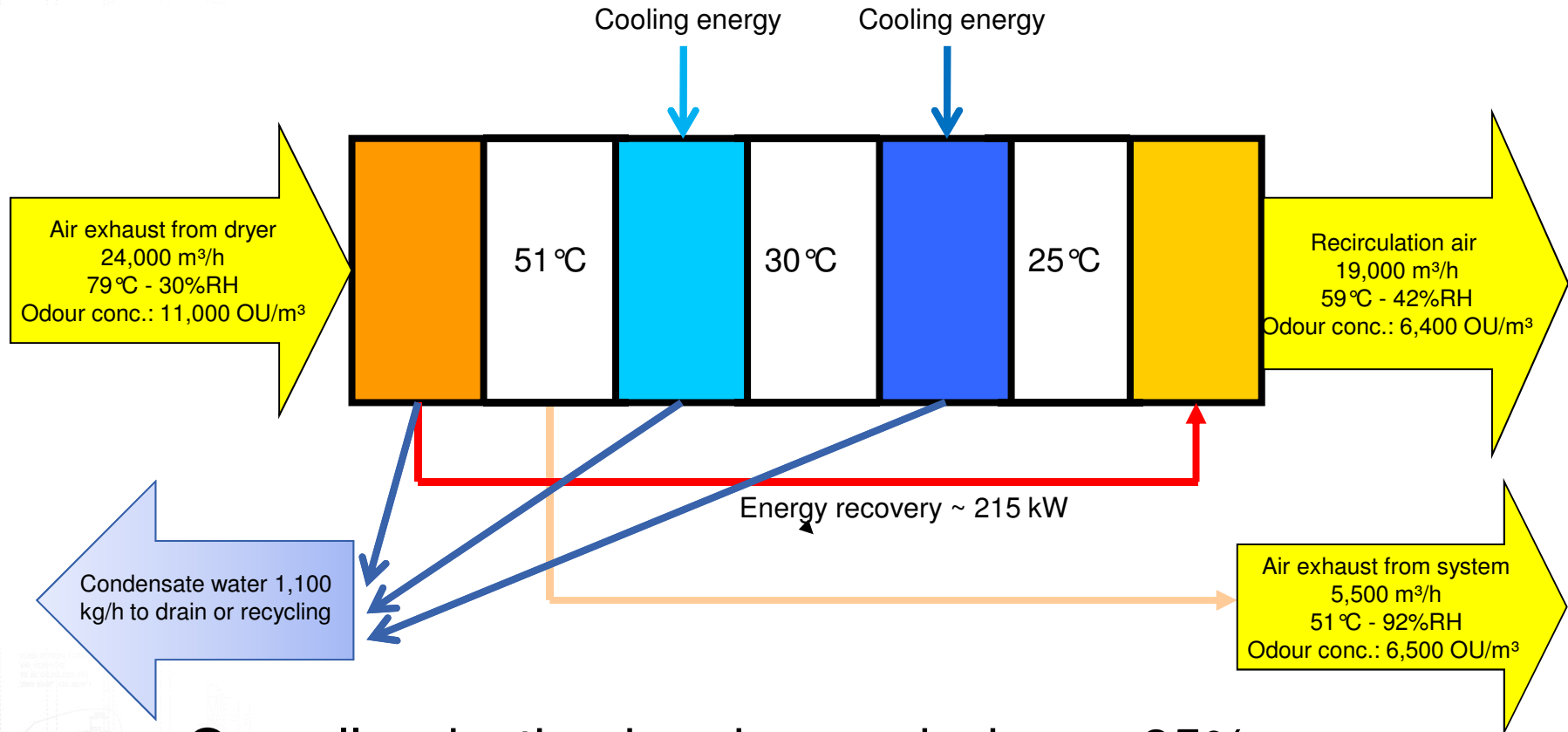
# BAG FILTER AND RE-CONDENSING BATTERY



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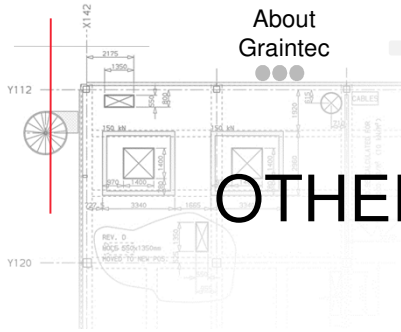


# MEASUREMENTS FROM ACTUAL PLANT USING GRAINTEC RECONDENSING SYSTEM



Overall reduction in odour emission: > 85%

Thermal energy recovery: ~ 215 kW



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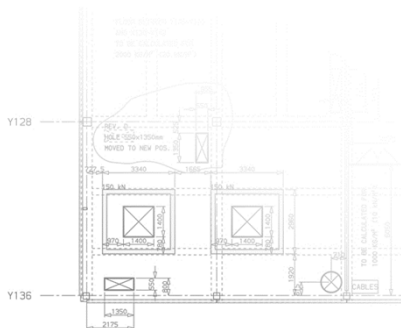
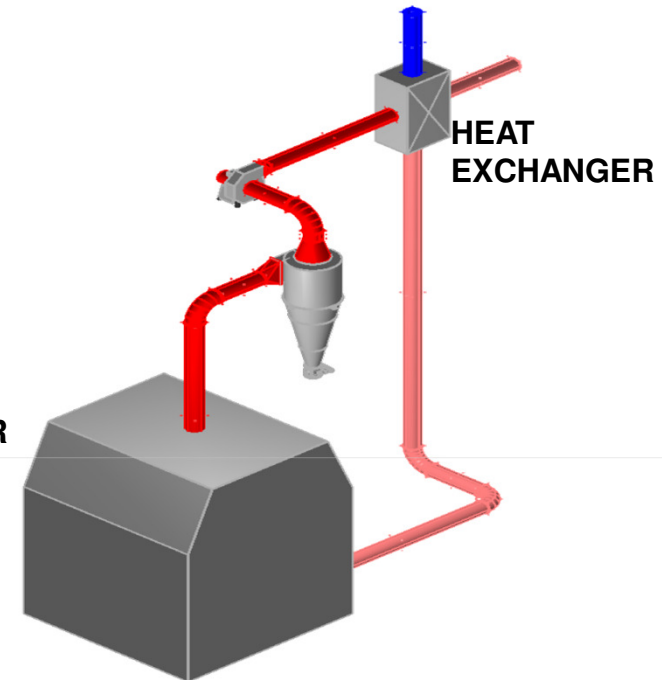
GRAINTEC A/S

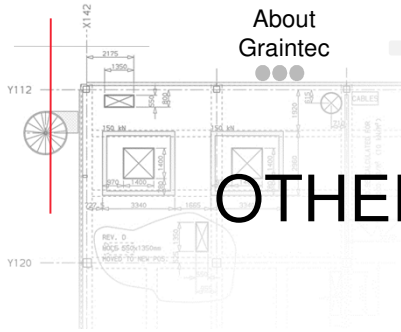
# OTHER SOLUTIONS:

## Air/Air Heat exchanger

- ➊ No recirculation of dryer air
- ➋ Some water condensation
- ➌ Odour reduction effect below 50%
- ➍ Up to 50% energy recovery possible

DRYER





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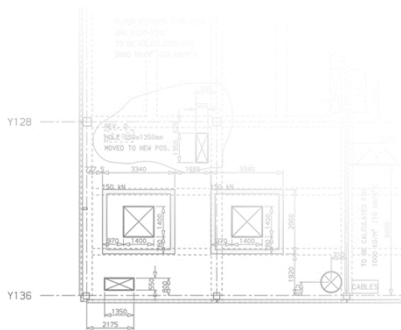


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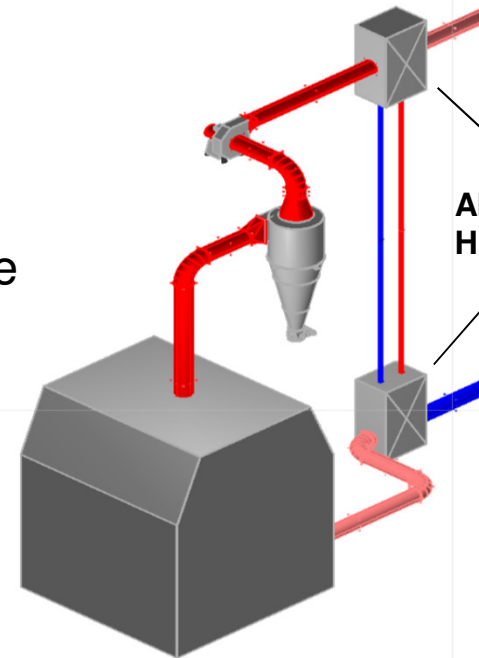
# OTHER SOLUTIONS:

## Air/water heat exchangers

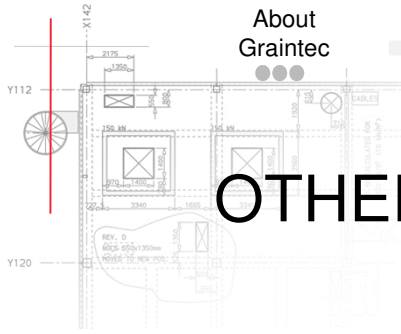
- ⊕ No recirculation of dryer air
- ⊕ Some water condensation
- ⊕ Odour reduction effect below 50%
- ⊕ Up to 40% energy recovery possible



DRYER



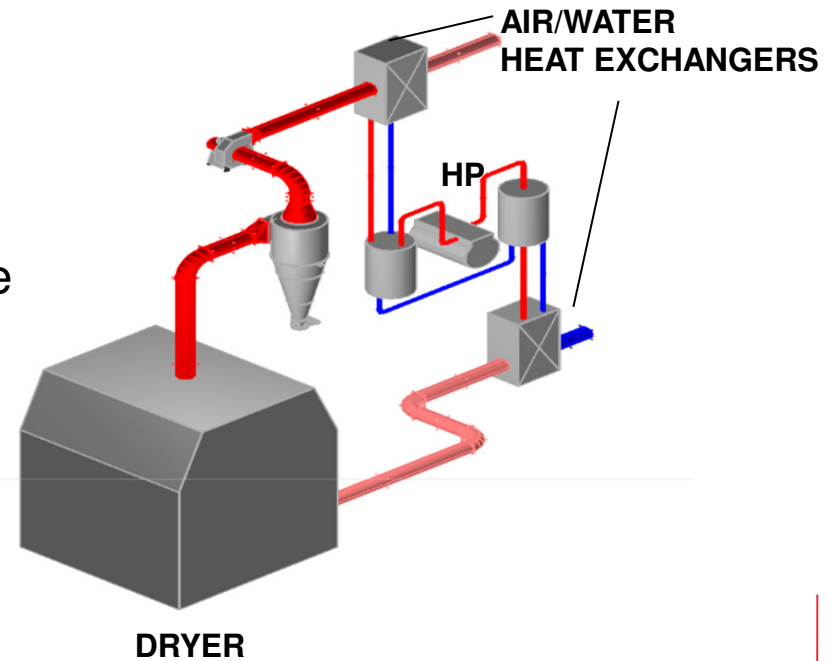
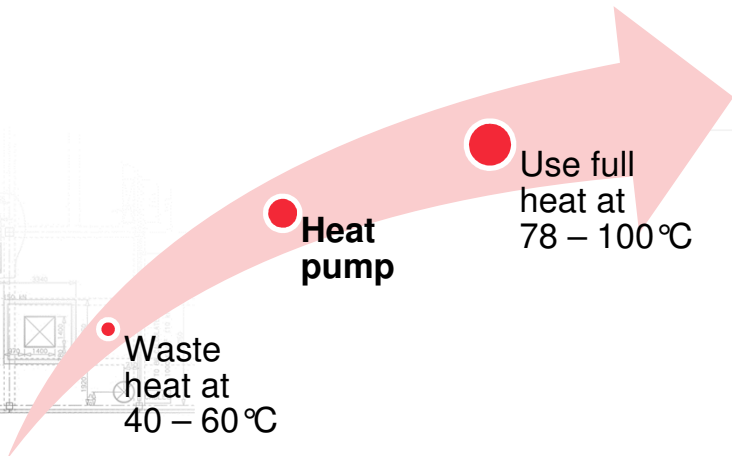
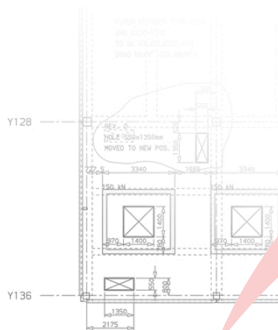
AIR/WATER  
HEAT EXCHANGERS



# OTHER SOLUTIONS:

## Air/water heat exchangers + heat pump

- ➊ No recirculation of dryer air
- ➋ Some water condensation
- ➌ Odour reduction effect above 50%
- ➍ Up to 60% energy recovery possible





# FOULING IN HEAT EXCHANGERS



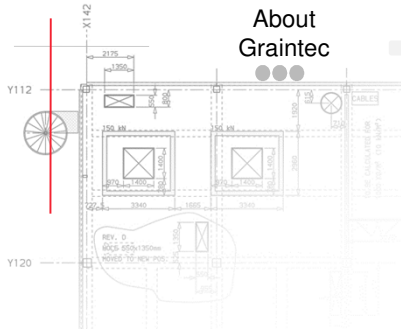
➤ Moist and dirty exhaust air

➤ Microbial growth

➤ Avoid by:

- High efficiency cyclones
- bag and mesh filters
- CIP





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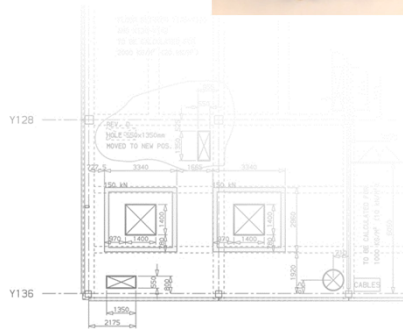
Energy Recovery  
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# PRODUCT QUALITY ASPECTS AND SUMMARY







# PRODUCT QUALITY ASPECTS



**Quality**

***Drying  
process***



**Energy efficiency**



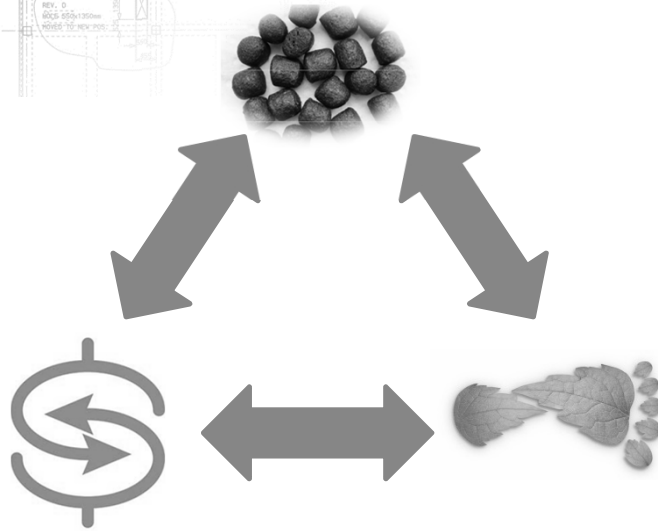
**Environmental  
performance**

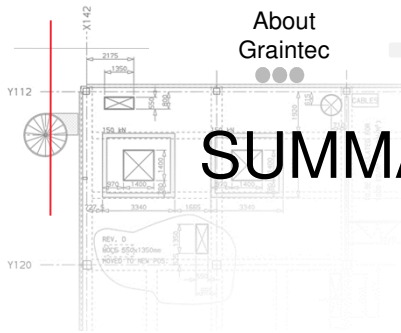


# PRODUCT QUALITY ASPECTS

## 3-year industrial PhD

*Ensuring Technical Product Quality in Energy Efficient Hot Air Drying of Extruded Fish Feed*





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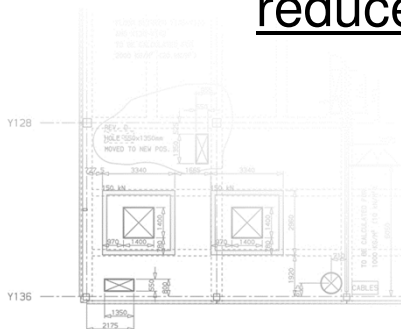
Product Quality Aspects / Summary

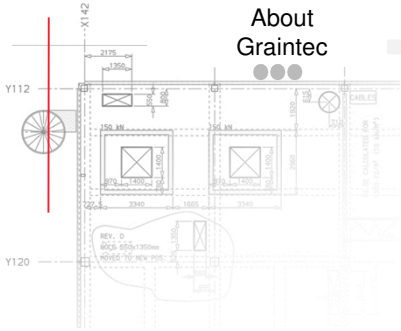


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# SUMMARY

- Energy recovery of dryer exhaust air → 20 – 100 kWh/ton
- Integration of energy and odour reducing technologies are in most cases a very cost effective solution
- Energy efficiency must not compromise product quality
- New technology inventions of heat exchangers and heat pumps will bring further possibilities to recover energy and reduce emissions from the feed production industry





About Graintec ●●●

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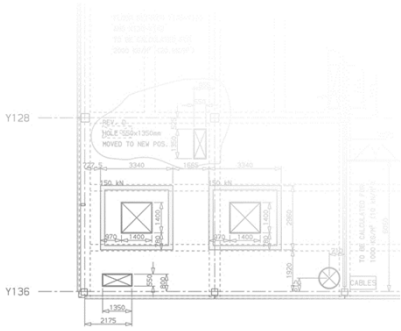
Energy Recovery Solutions ●●●

Product Quality Aspects / Summary ●●●



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THANK YOU!  
QUESTIONS?



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