



# RENEWABLE HEATING & HOT WATER WITH WOOD PELLETS

## Webinar 3

# Practical implementation of pellet boilers in commercial buildings

Marcus Baker

[www.ecohotwater.co.nz](http://www.ecohotwater.co.nz)



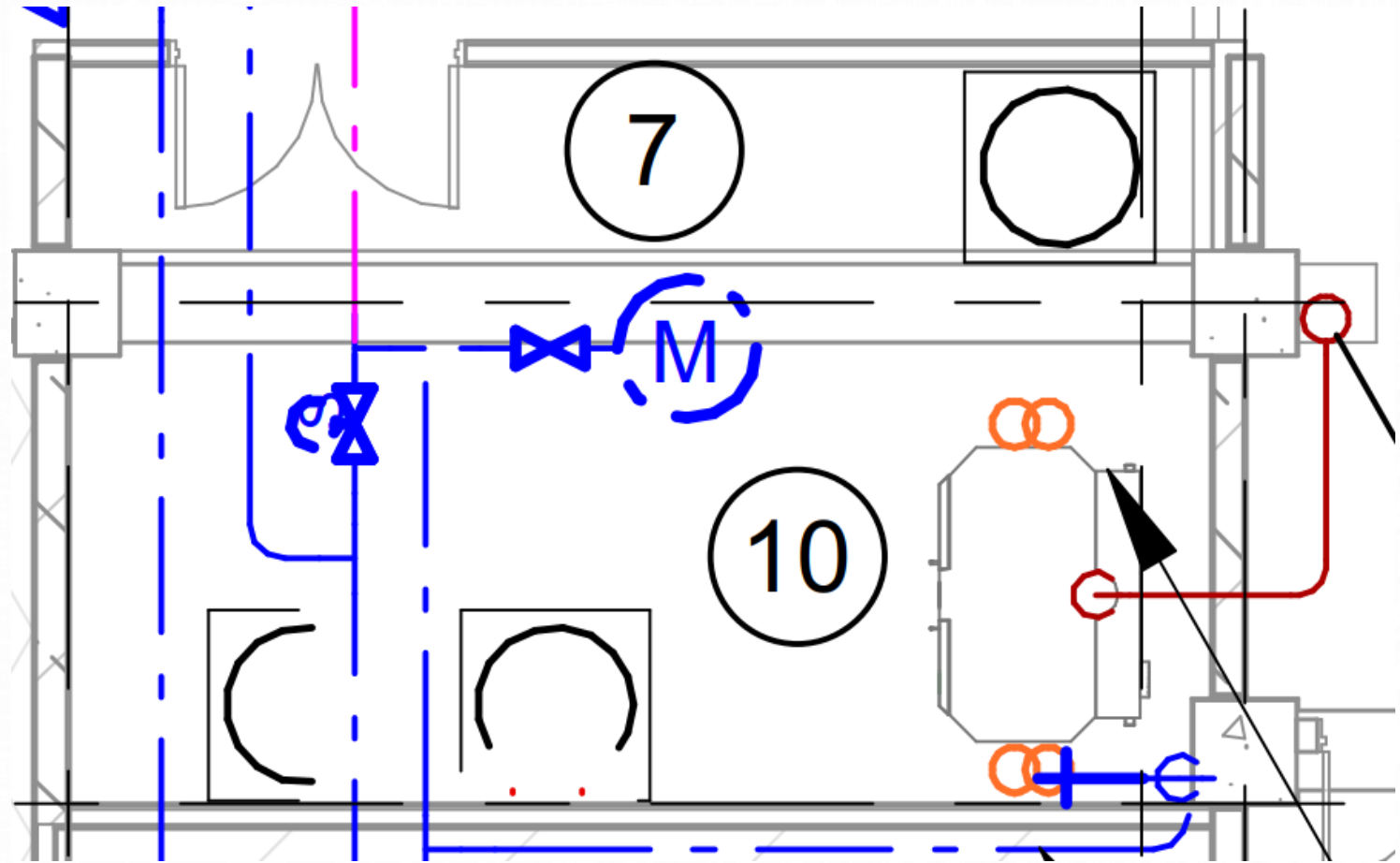
## Aspects to consider for including pellet boilers in commercial buildings

1. Plant space
2. Pellet fuel storage space
3. Fuel delivery – bulk and transfer to boiler
4. System heat load and design
5. Flue

# INTEGRATION WITH BUILDING DESIGN

## Boiler room space

- Will it be single boiler or multiple in cascade?
- Is there enough room to have pellet store & boilers in same space?
- Distance to pellet delivery connection point (assuming blower truck)?



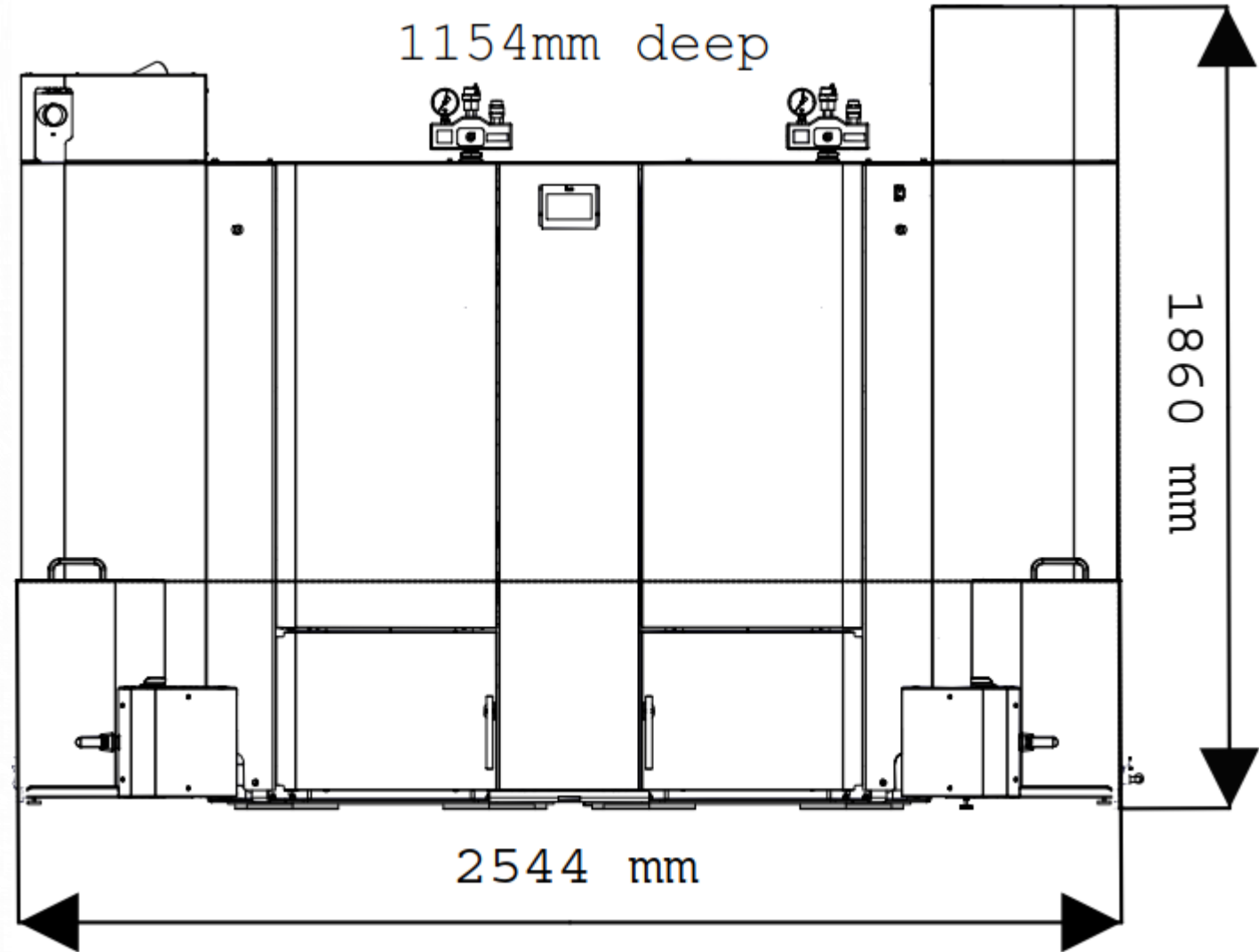
# BOILER ROOM SPACE

## 128kW ÖkoFEN boiler

2.54m wide

1.86m tall

1.15m deep



RECLAIM  
ENERGY



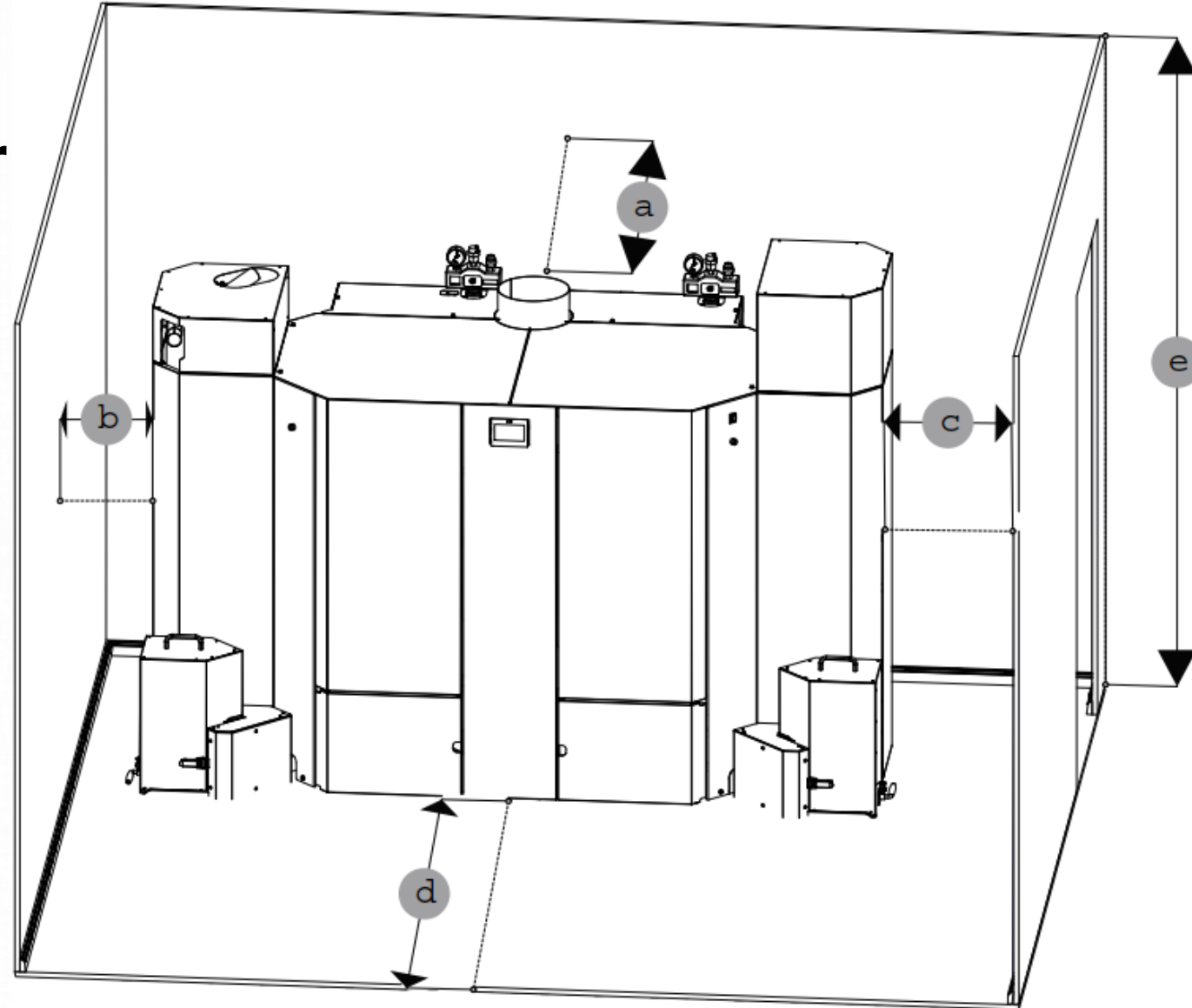
ÖkoFEN

EASYPELL  
CENTRAL HEATING PELLET BOILER

# BOILER ROOM SPACE

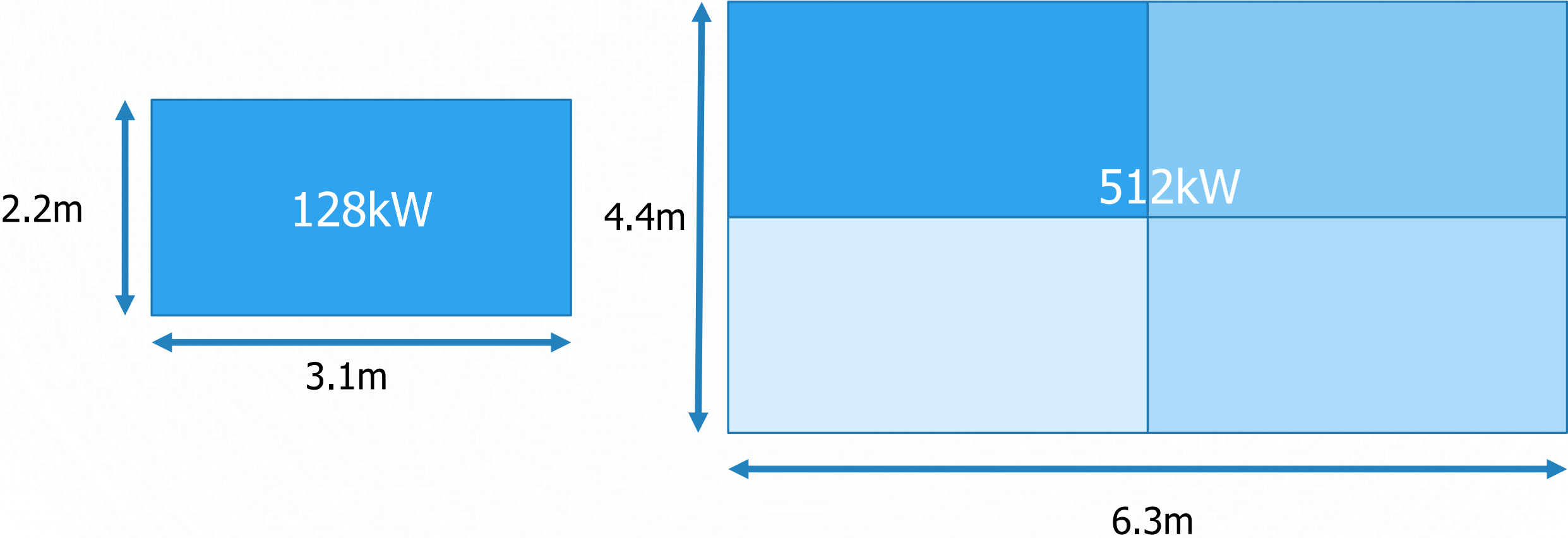
## 128kW ÖkoFEN boiler clearances

- a: 200mm
- b: 300mm
- c: 300mm
- d: 700mm
- e: 2100mm



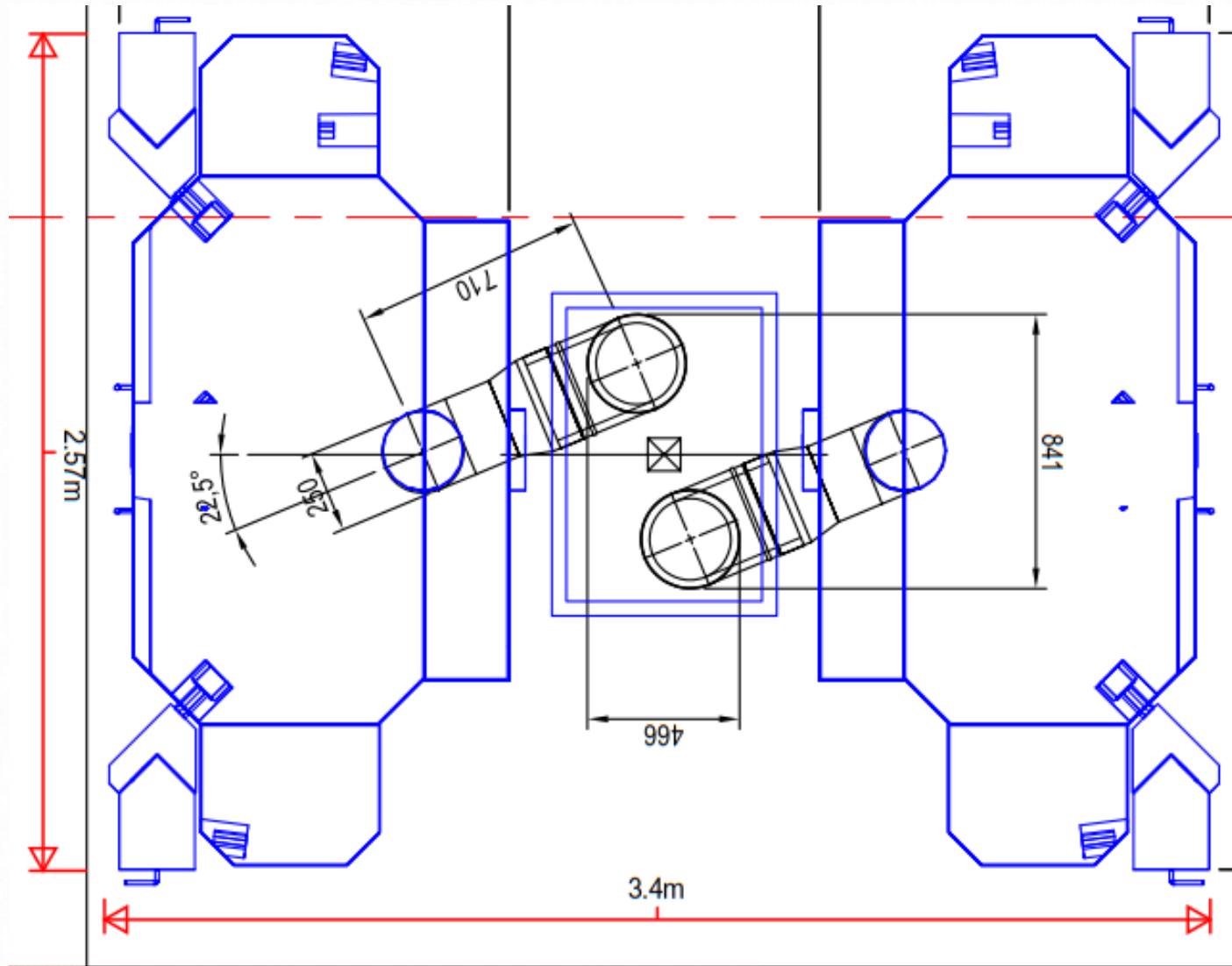
# BOILER ROOM SPACE

## ÖkoFEN boiler space required, including clearances

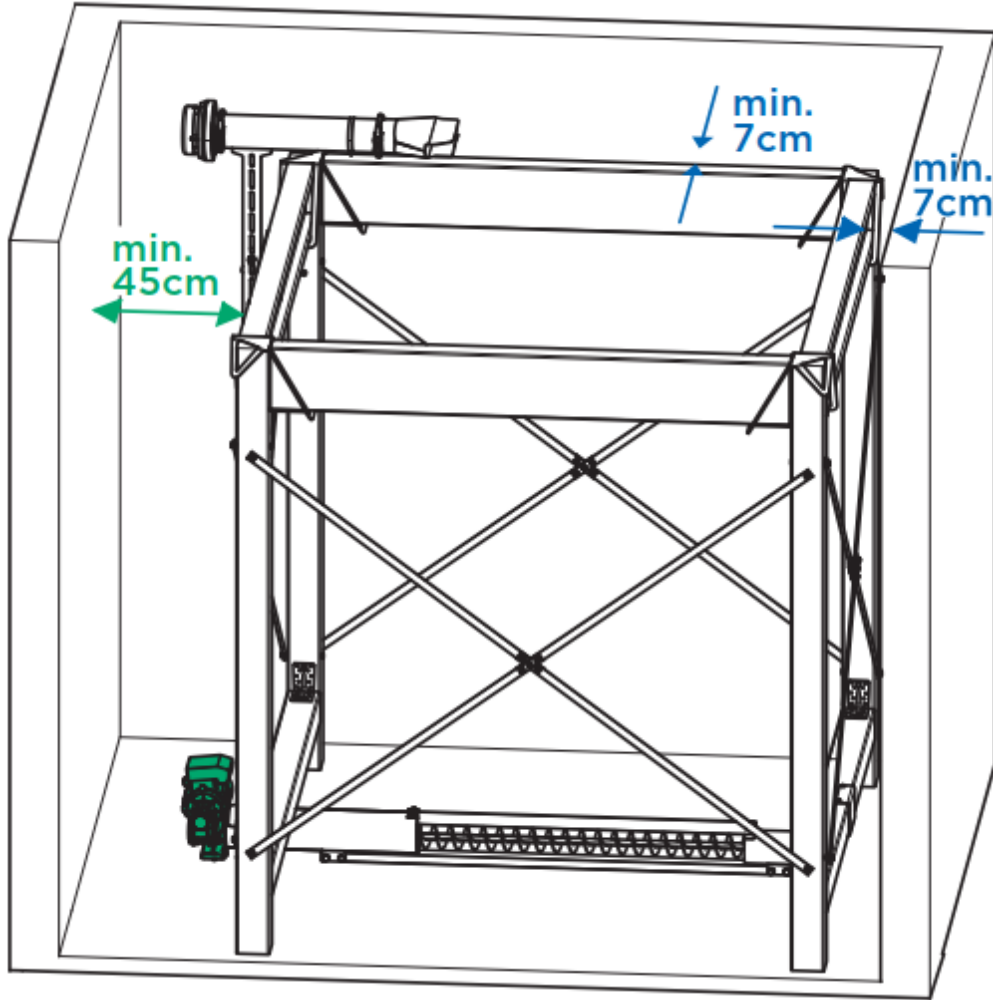


# BOILER ROOM SPACE

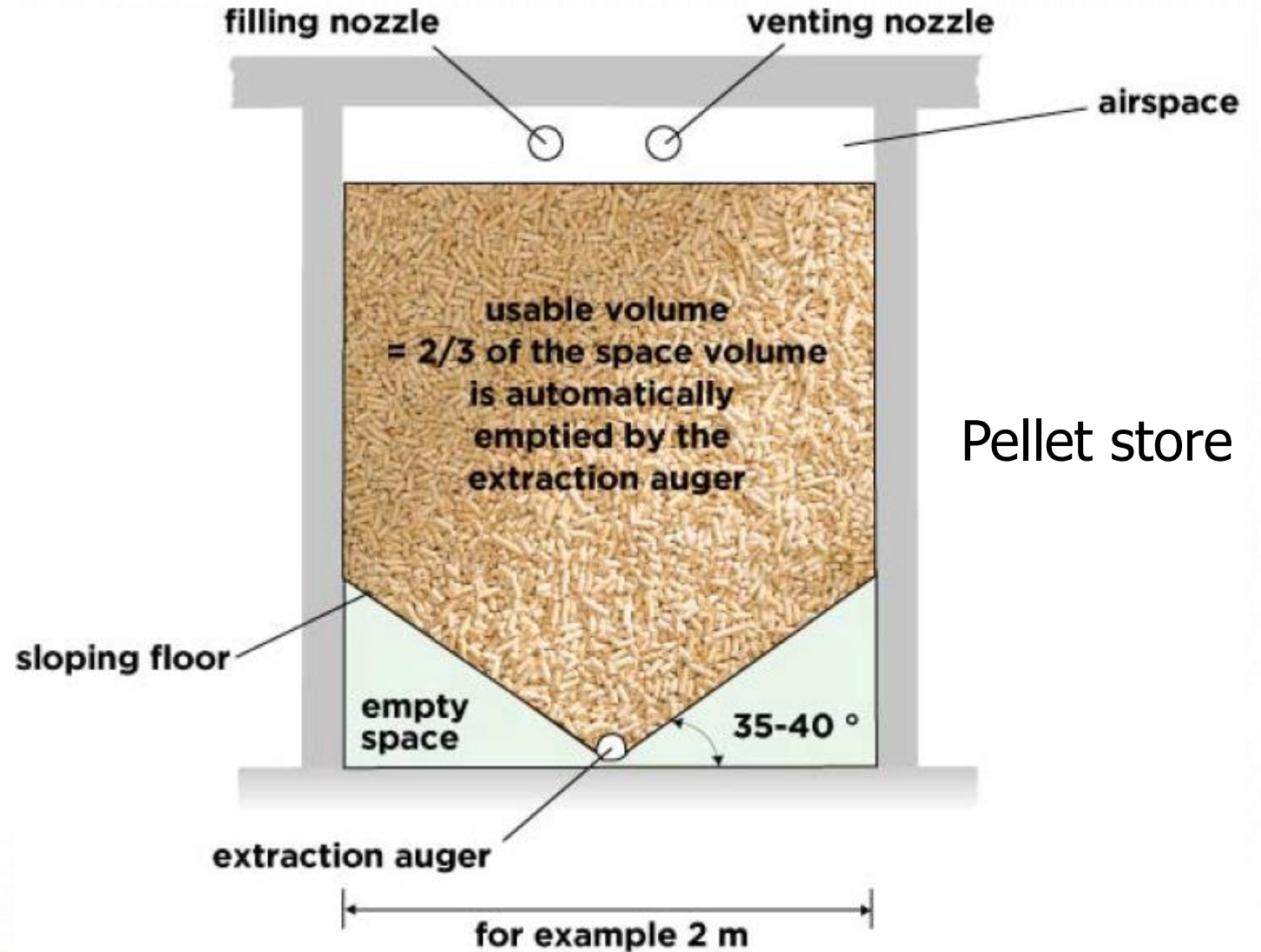
256kW ÖkoFEN boiler  
2 x 128kW back to back



# PELLET STORAGE OPTIONS

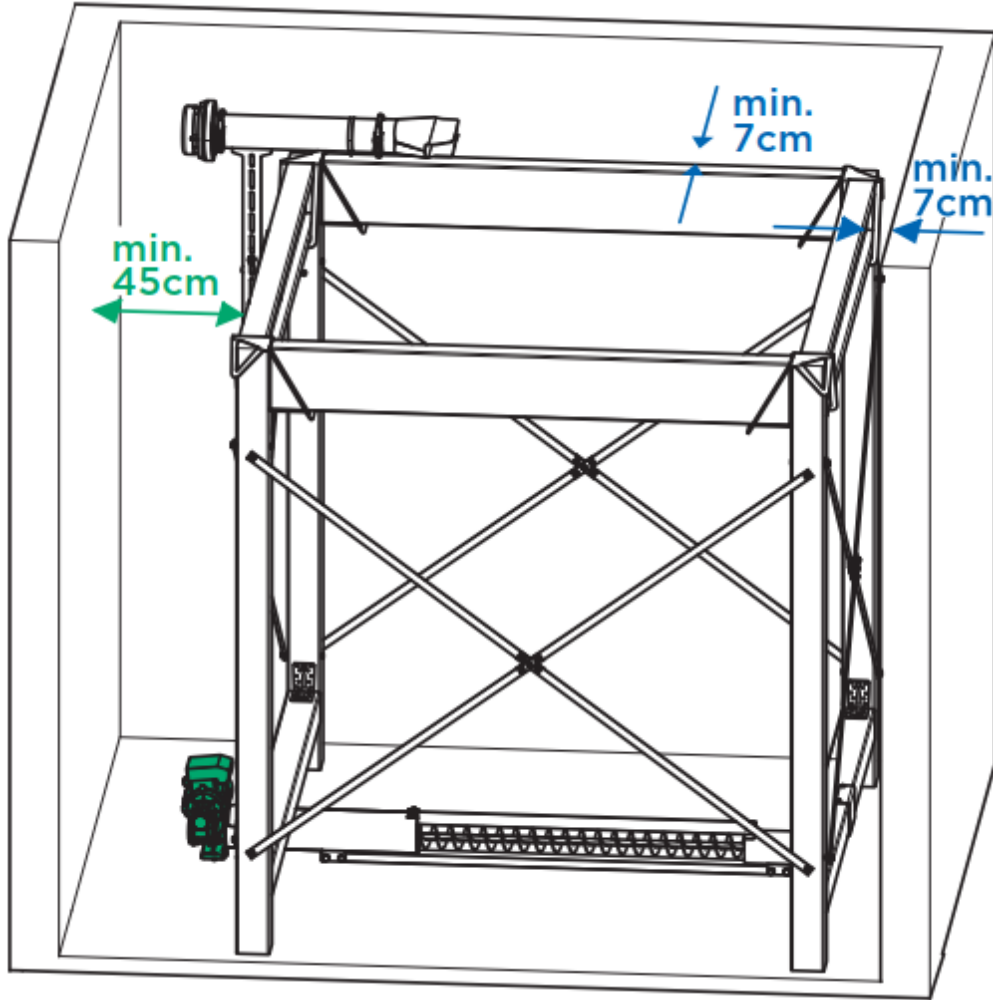


ÖkoFEN Flexilo

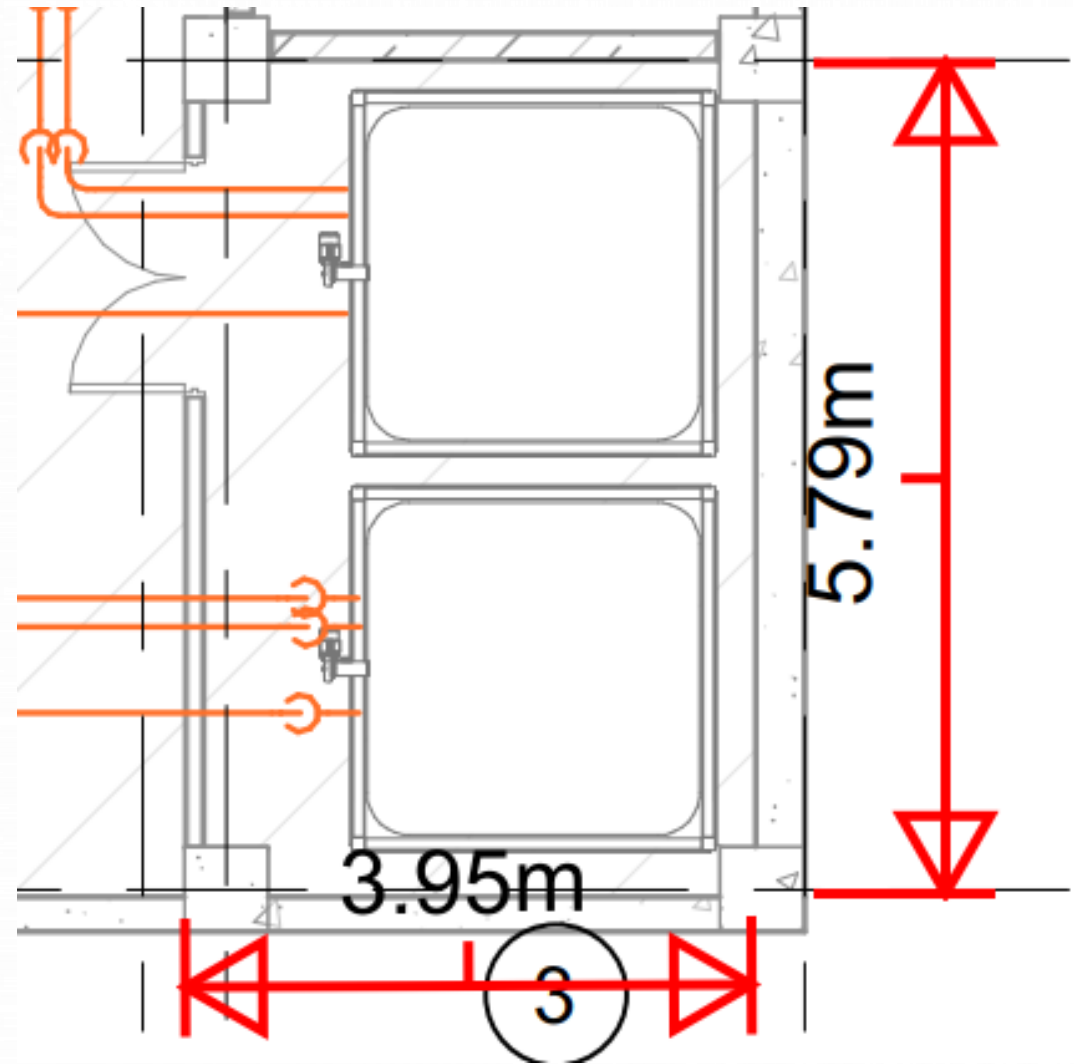




# PELLET STORAGE OPTIONS



2 x 8 tonne ÖkoFEN Flexilo



# PELLET STORAGE

## Pellet storage space & placement

1 tonne pellets = 1.55m<sup>3</sup> = 5.1MWh

Store size dependent on:

- Space available
- Heat load & daily pellet consumption
- Delivery truck capacity & frequency of deliveries

Vacuum truck = 15 tonnes = 23m<sup>3</sup>

Vacuum truck & trailer = 30 tonnes = 46m<sup>3</sup>

- Must retain some residual pellets before delivery otherwise heating stops!

# PELLET TRANSFER TO BOILERS

## Vacuum pellet transfer

- Internationally preferred method for transfer from bulk store to boiler
- Reduced risk of damage to pellets & plant breakdowns
- Greatest flexibility for managing distance and obstacles
  
- 25m between pellet store & boilers
- Through walls, around obstructions
- Bridge fire cells with fire protection collars

Boiler flue termination at roof

Eight storey building including two basement levels

20 metres

Pellet fuel deliveries by blower truck connects to fitting in service bay wall  
Fills bulk pellet fuel bags in sub basement

20 metres

Ground floor

128kW pellet boiler with automatic vacuum fuel delivery from bulk fuel bags

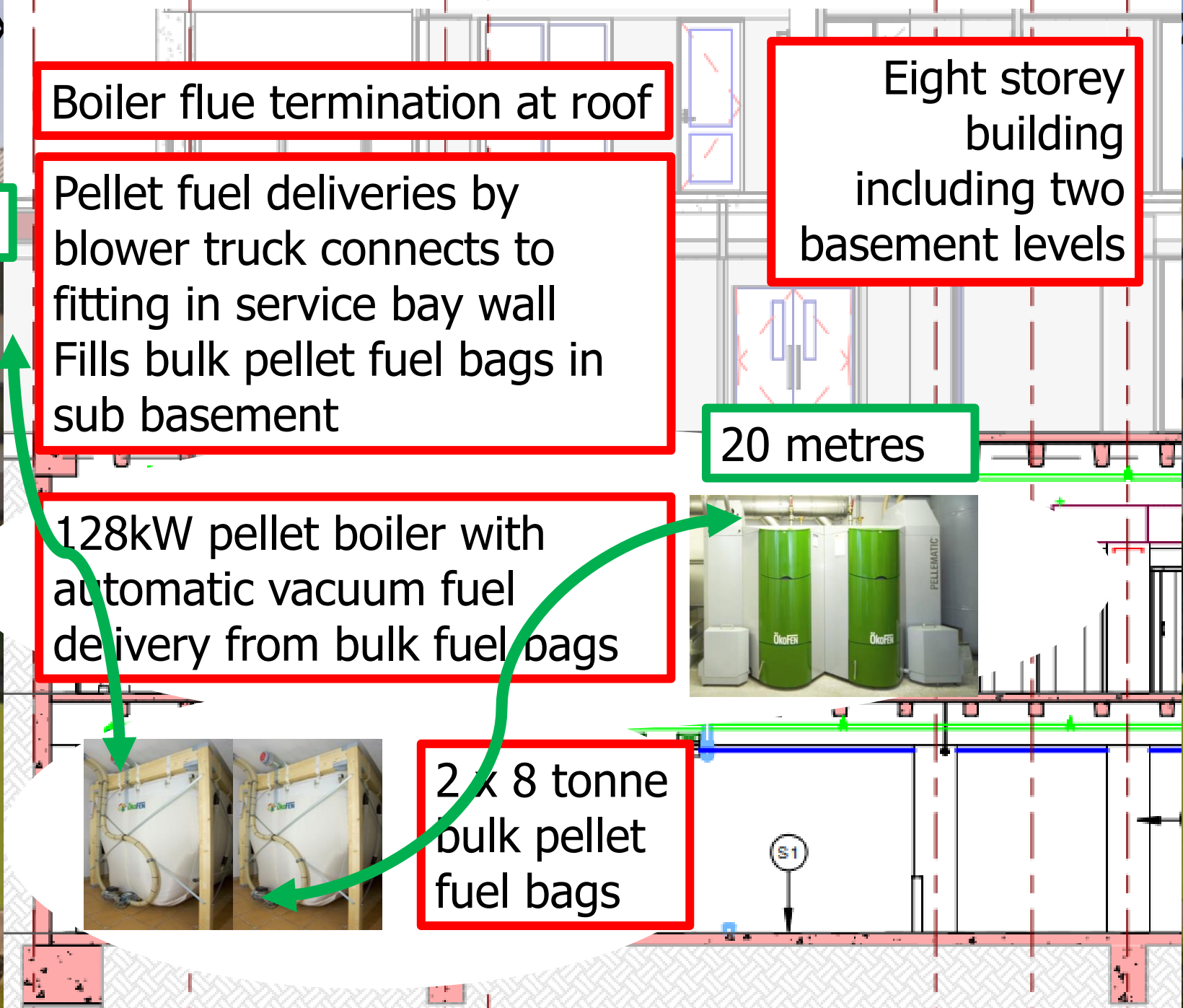


Basement level 2

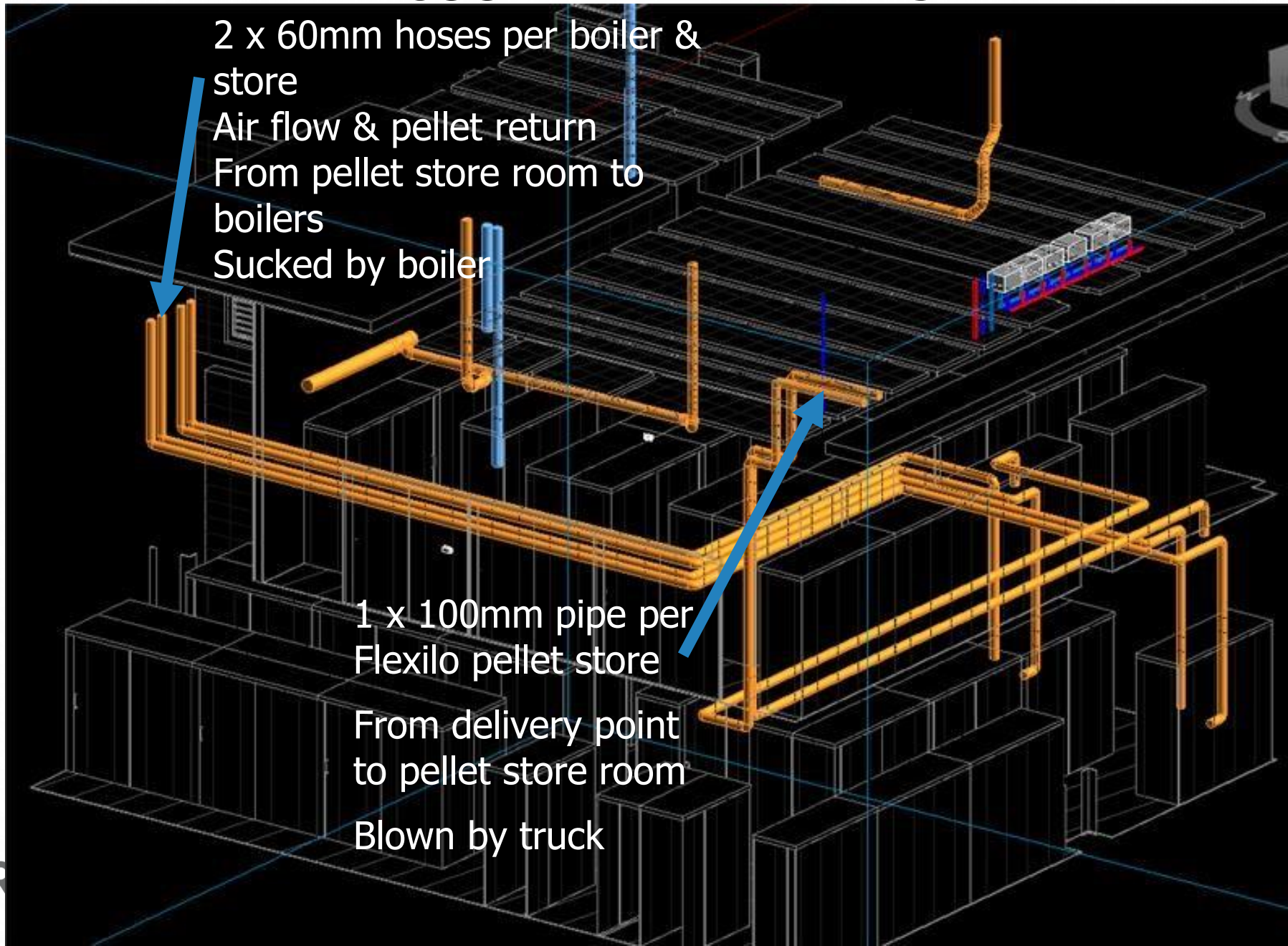
Sub basement level 1



2 x 8 tonne bulk pellet fuel bags

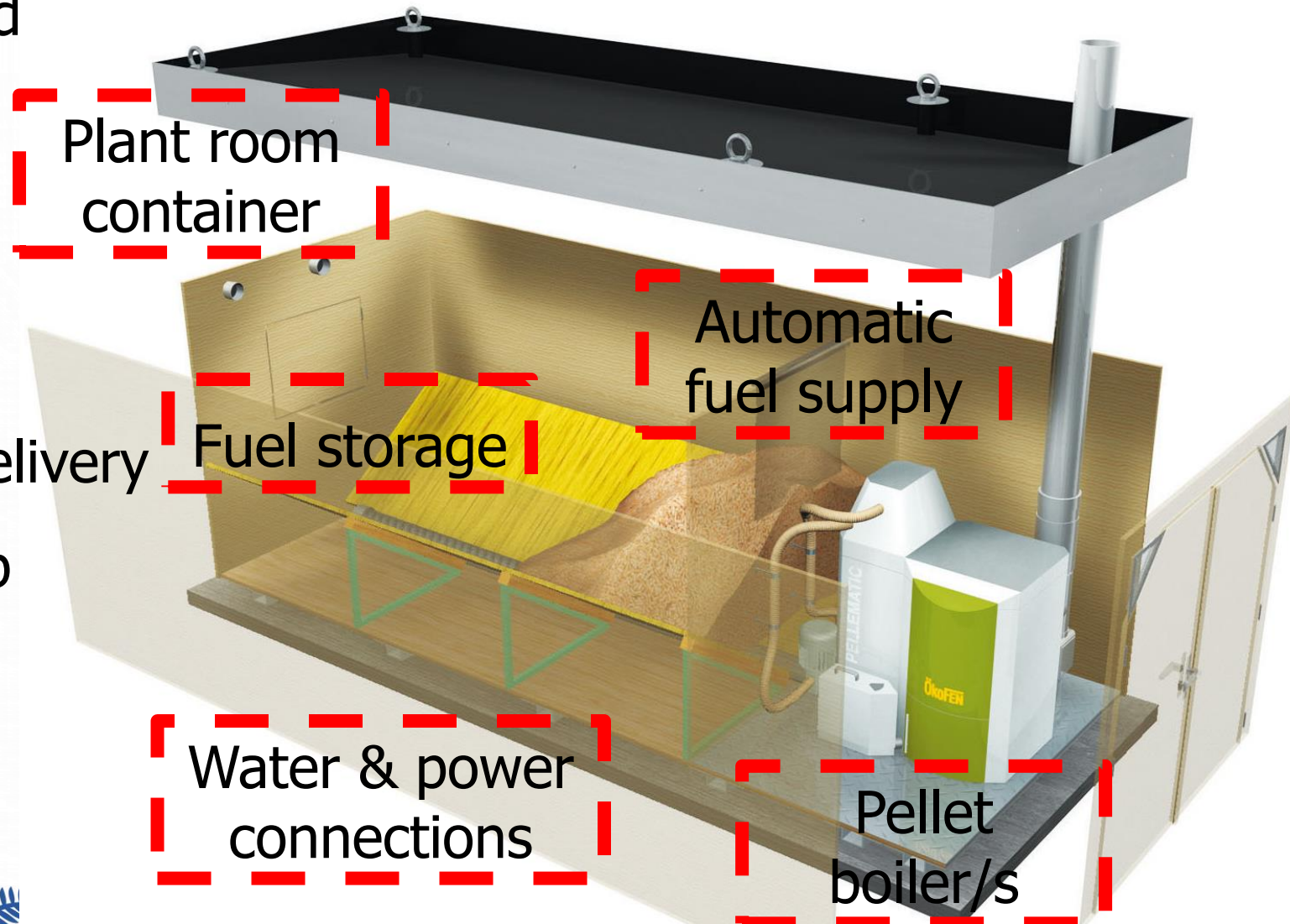


# VACUUM PELLET TRANSFER



# ENERGY BOXES - CONTAINERISED SYSTEMS

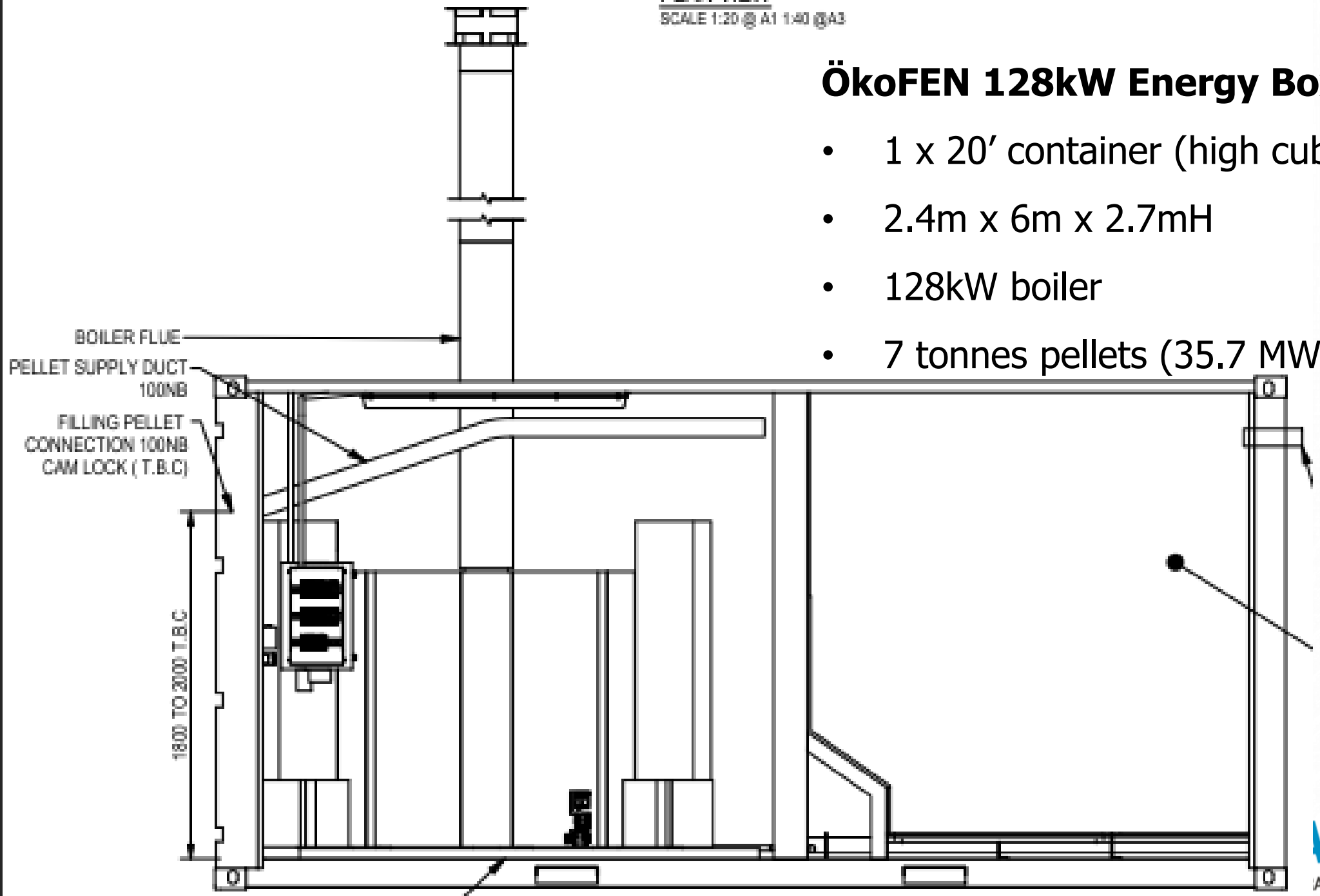
- ✓ "Energy Box" containerised pellet boiler plant rooms
- ✓ All components for pellet boiler system
- ✓ High level cost control
- ✓ Consistency of design & delivery
- ✓ Guarantee of workmanship
- ✓ Flexible site placement
- ✓ Modular and expandable

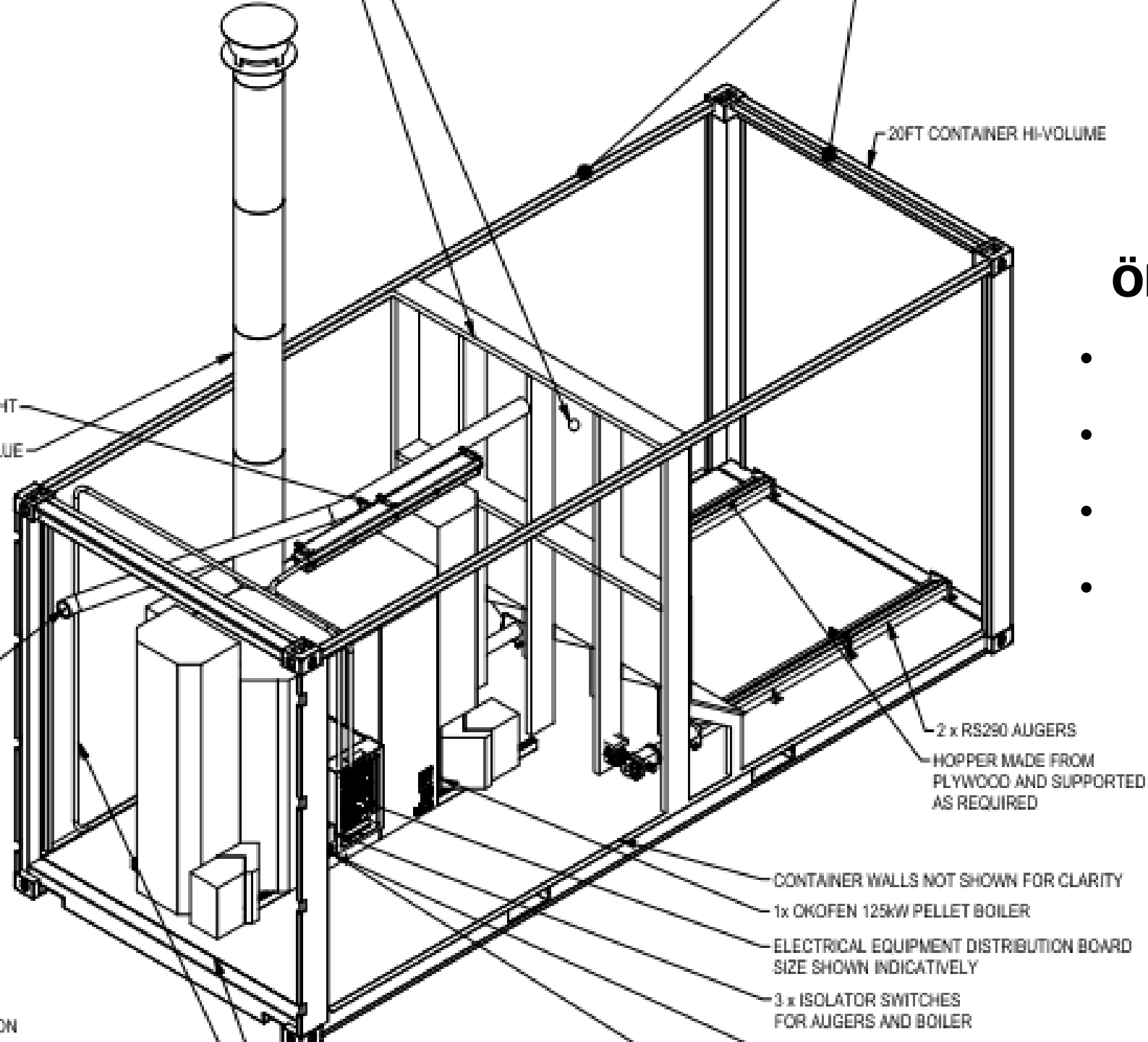


PLAN VIEW  
SCALE 1:20 @ A1 1:40 @ A3

# ÖkoFEN 128kW Energy Box

- 1 x 20' container (high cube)
- 2.4m x 6m x 2.7mH
- 128kW boiler
- 7 tonnes pellets (35.7 MWh)





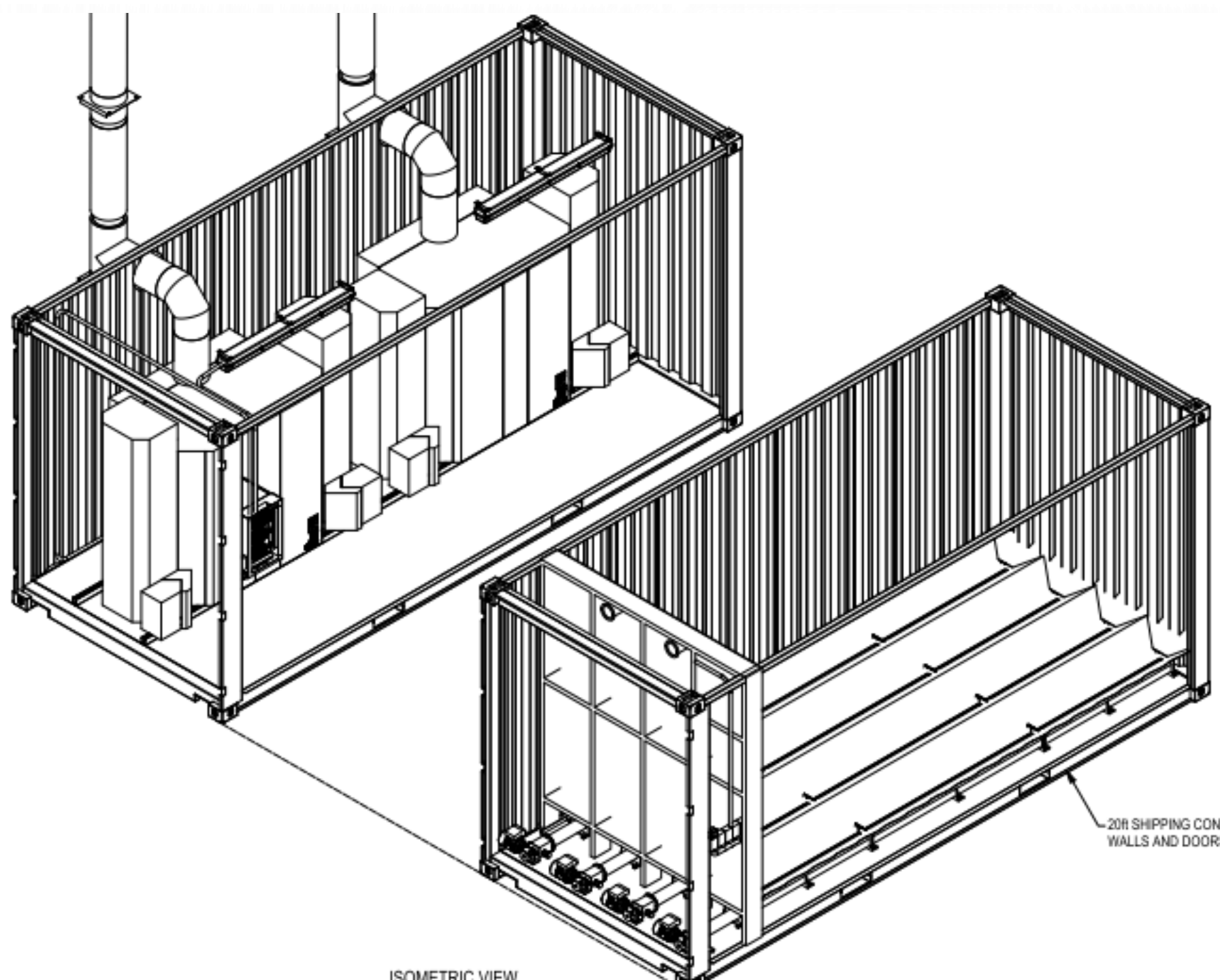
## ÖkoFEN 128kW Energy Box

- 1 x 20' container (high cube)
- 2.4m x 6m x 2.7mH
- 128kW boiler
- 7 tonnes pellets (35.7 MWh)



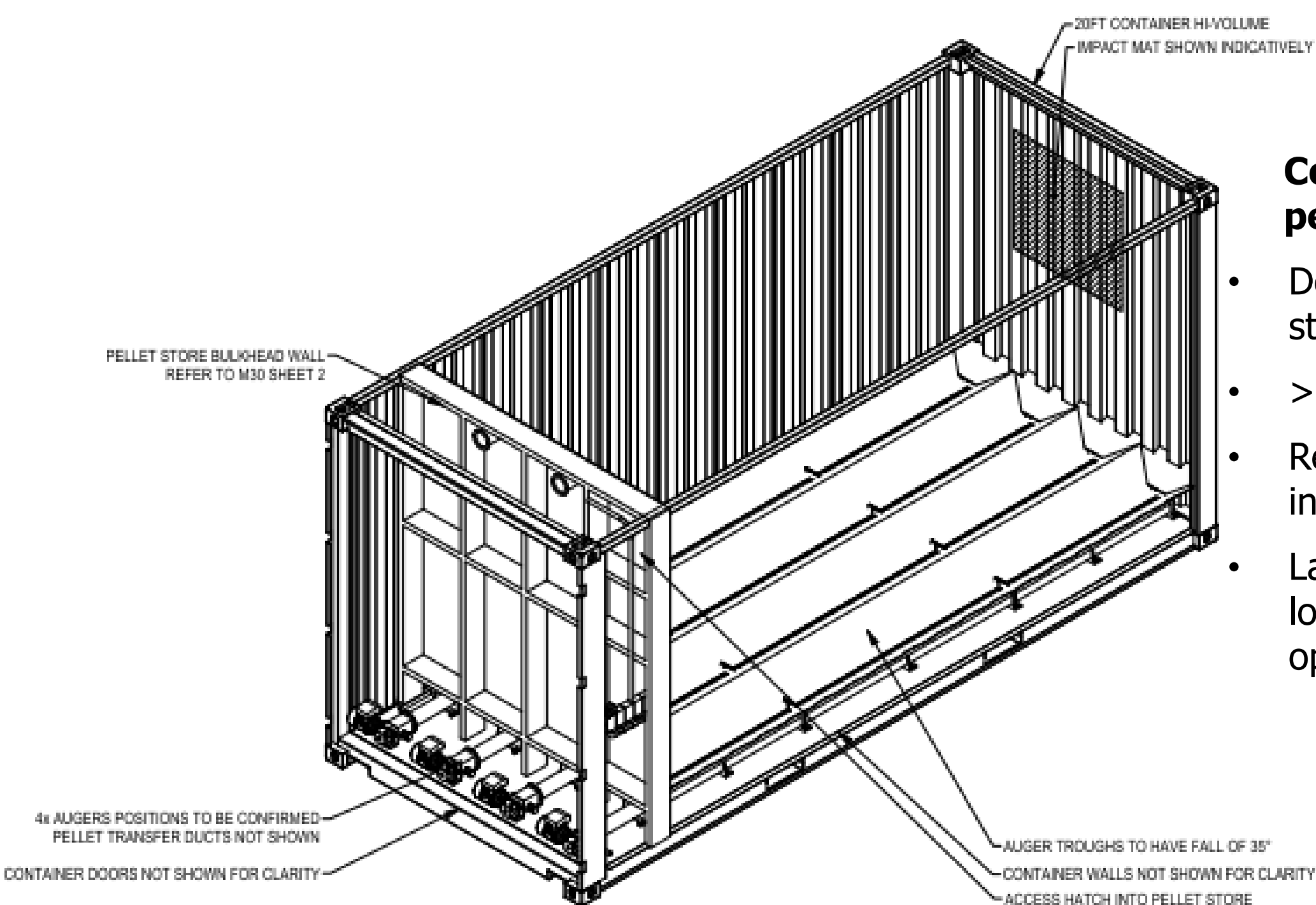
## ÖkoFEN 256kW Energy Box

- 2 x 20' containers (high cube)
- 2 x 2.4m x 6m x 2.7mH
- 256kW boiler
- 21 tonnes pellets (107 MWh)
- Containers can be stacked, side by side or end to end



## Containerised pellet storage

- Dedicated pellet store
- >25m from boilers
- Reduces footprint inside building
- Large capacity for low cost of fuel & optimum resilience



# ENERGY BOXES

BLEND IN WITH SURROUNDING BUILDINGS

40' ENERGY BOX IN AUSTRIA

# ENERGY BOXES



OR MAKE A STATEMENT!

## MULTI STOREY BUILDINGS

- Large number of existing buildings with fossil fuel boilers, mainly gas
- Often system designed for high temperature heating water circulation
- Upper storey / rooftop plant rooms
- Limit on structural capacity for heavier loads & space in upper storeys
  
- Improve energy efficiency & system controls to reduce heat load / lower peaks
- Smaller boilers are easier / possible to get in service lifts and arrange in plant rooms
- Site specific air conveying systems for multi-storey pellet delivery from basement / ground level bulk fuel store
- Separate bulk pellet store, small day fuel store and boilers between multiple storeys of building

## MULTI STOREY BUILDINGS

### Massey University Albany campus

Spanish Mission style buildings with ceramic tile roofs

Library – 6 storeys with gas boilers & HVAC plant room in roof space

Access via service lift & ceiling hatch

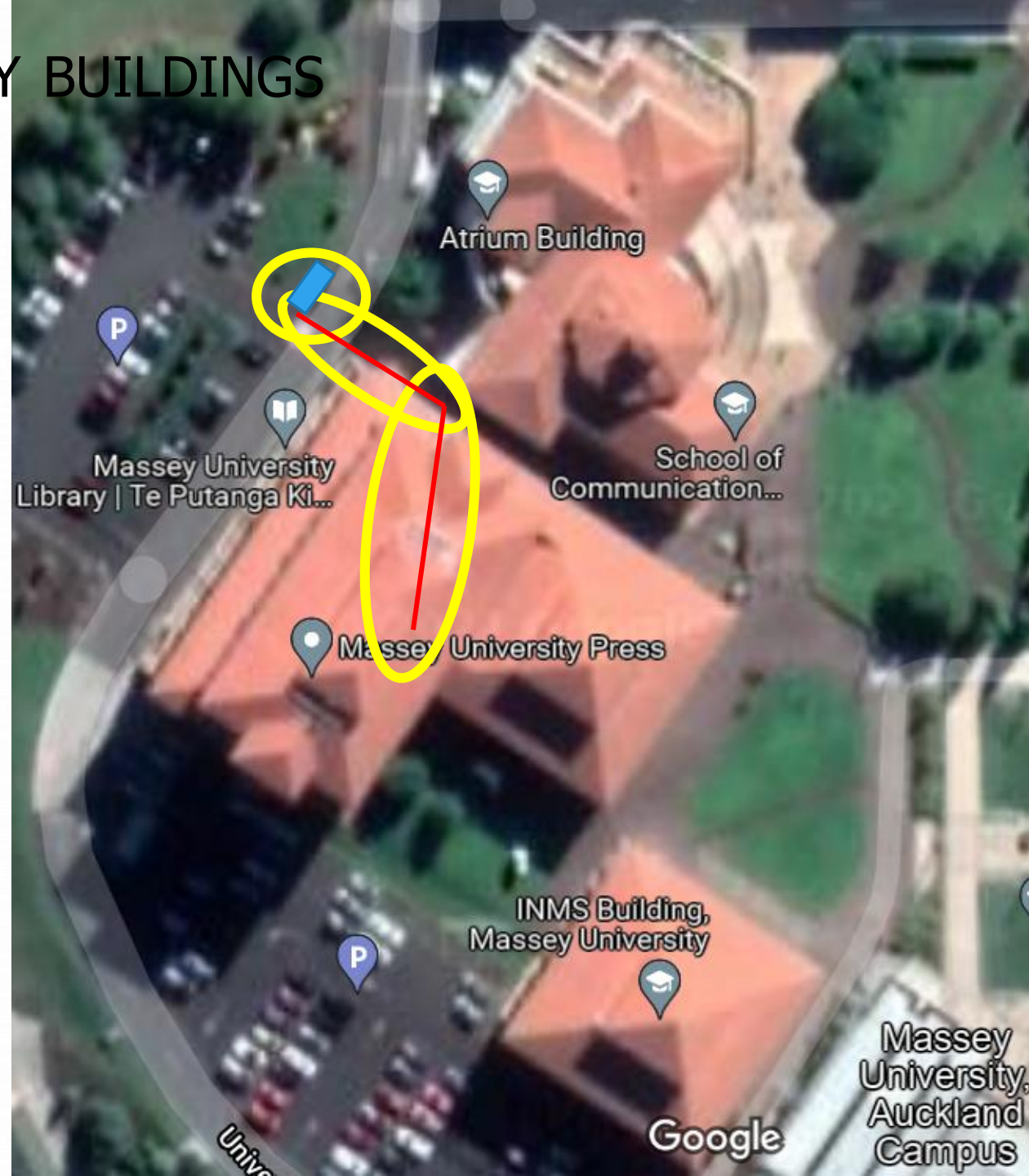
640kW output as 5 x 128kW pellet boilers

Moved in to position as 10 x 64kW boilers

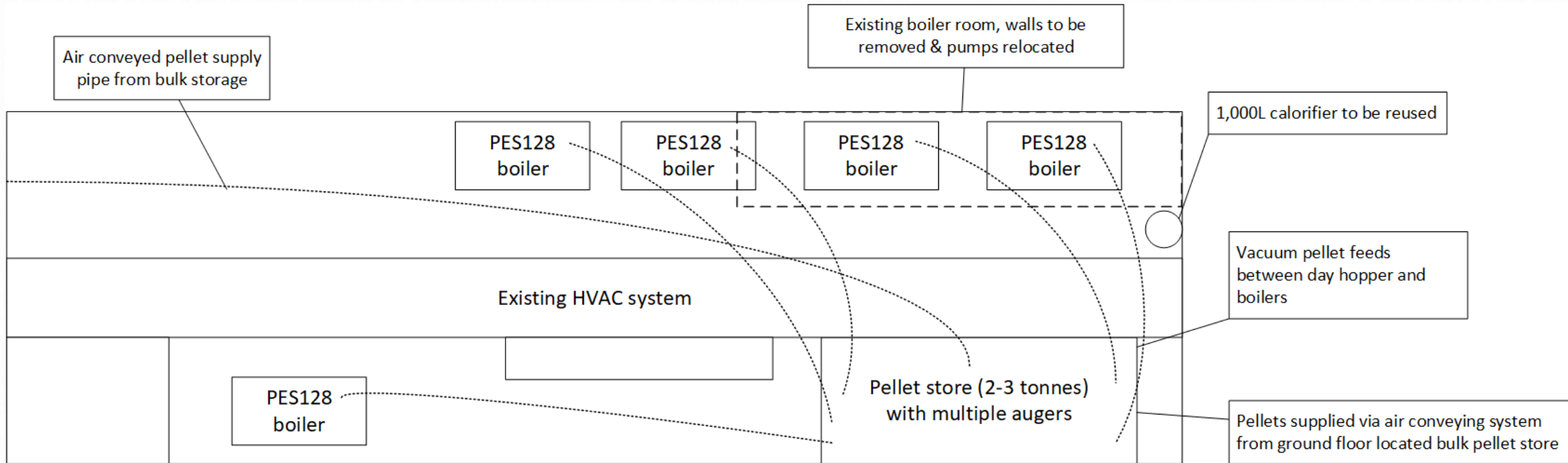
Bulk pellet store in 20' container at ground

Air conveying system moves pellets 7 storeys

Small (1-2 tonne) pellet day store in roof



# MULTI STOREY BUILDINGS



# HYDRAULIC DESIGN

## Considerations for system design

- Does specific boiler require a buffer to manage thermal inertia?
- How quickly can the boiler start / restart to respond to thermal load?
  - Slower boiler response / larger peaks = greater requirement for thermal storage buffer
  - Stable vs very variable temperatures generally more suitable & deliver greater efficiency
  - Pellet boilers are always slower to respond than gas boilers
- Hydraulic separation
  - Boiler pump/s separated from main circulation pump in most cases
  - Dosed boiler water separated from potable DHW with HX



# SYSTEM CONTROLS

## On-board boiler and building management systems

- Pellet boilers usually include sophisticated complete system controls
- Generally optional
- If used hydraulic design of complete heating system needs to match control logic and design principles
- European heating system design that may not suit NZ climatic conditions, building design, client expectations, installers and maintenance team
- Alternatively – boiler controls can be limited to combustion management and target temperature of a point of hydraulic separation (buffer, HX, hydraulic separator)
- All demand management controls can be outside scope of boiler

# BOILER FLUES

- Pellet boilers will have fan forced flues with variable speed control fan
- Level of control and associated emissions will vary depending on boiler manufacturer
- Flue does need to clear nearby obstructions to ensure adequate draft and avoid backwash in to windows, ground level,
  
- Insulated flues
- Multi storey flues practical for low level plant rooms in taller buildings
- Baffling / velocity control systems may be required for taller flues to control draft
- Multiple boilers manifolded in single larger flue

## Pellet boiler toolkit

V2 February 2021

### ÖkoFEN pellet boiler maintenance & service guidance

Cost per each single ÖkoFEN boiler

Does not include any labour or materials for servicing any other components of the system, e.g. travel, management oversight, heating system servicing and any consumables are not included

NOTE - servicing required after 40 tonnes pellets or 3,000 hours, whichever sooner

Number of ÖkoFEN boilers at site	4	
Total tonnes of pellets for site / yr	94	0.5875 Boiler annual servicing factor
Number of services / boiler / yr	1	

Hours per boiler (4 hours suggested)	Hourly rate	Mark up on parts	Labour cost per boiler
4	\$ 120	1.3	\$ 480

Modify any figures in yellow to change total costs

### STANDARD SITES - DHW NOT CRITICAL SERVICE

Years	Expected Visits	Labour	Parts	Total per boiler	Total for site	Total for site over period	5 year maintenance costs estimated	All replaceable parts covered under warranty for first 2 years
1-2	1	\$ 480	\$ -	\$ 480	\$ 1,920	\$ 3,840		Years
3-5	1.5	\$ 720	\$ 874	\$ 1,594	\$ 6,378	\$ 19,133	\$ 22,973	1 to 5
5-10	2	\$ 960	\$ 1,019	\$ 1,979	\$ 7,918	\$ 39,589	\$ 39,589	5 to 10
10-15	2.5	\$ 1,200	\$ 1,423	\$ 2,623	\$ 10,492	\$ 52,461	\$ 52,461	10 to 15
Average annual maintenance costs for site over 15 years						\$ 7,668		
Per boiler over 15 years						\$ 1,917		

### SITES WITH DHW AS CRITICAL SERVICE - ONLY SERVICE 1 BOILER PER VISIT

Years	Expected Visits	Labour	Parts	Total per boiler	Total for site	Total for site over period	5 year maintenance costs estimated	additional time for repeat visits, i.e. not all boilers can be serviced on same day for redundancy reasons
1-2	2	\$ 960	\$ -	\$ 960	\$ 3,840	\$ 7,680		
3-5	3	\$ 1,440	\$ 874	\$ 2,314	\$ 9,258	\$ 27,773	\$ 35,453	65%
5-10	4	\$ 1,920	\$ 1,019	\$ 2,939	\$ 11,758	\$ 58,789	\$ 58,789	
10-15	5	\$ 2,400	\$ 1,423	\$ 3,823	\$ 15,292	\$ 76,461	\$ 76,461	
Average annual maintenance costs for site over 15 years						\$ 11,380		



Designers and distributors of renewable heating & hot water systems

Marcus Baker

[marcus@ecohotwater.co.nz](mailto:marcus@ecohotwater.co.nz)

07 312 3382 – 021 027 50220

[www.ecohotwater.co.nz](http://www.ecohotwater.co.nz)

