

Decarbonising heating & hot water services for small to medium applications

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Apricus Eco Hot Water & Heating

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Life, the universe and everything

The Tao of pellets

I want to break free

Burn baby burn

I need a hero

How much is that doggy in the window?

Money, money, money

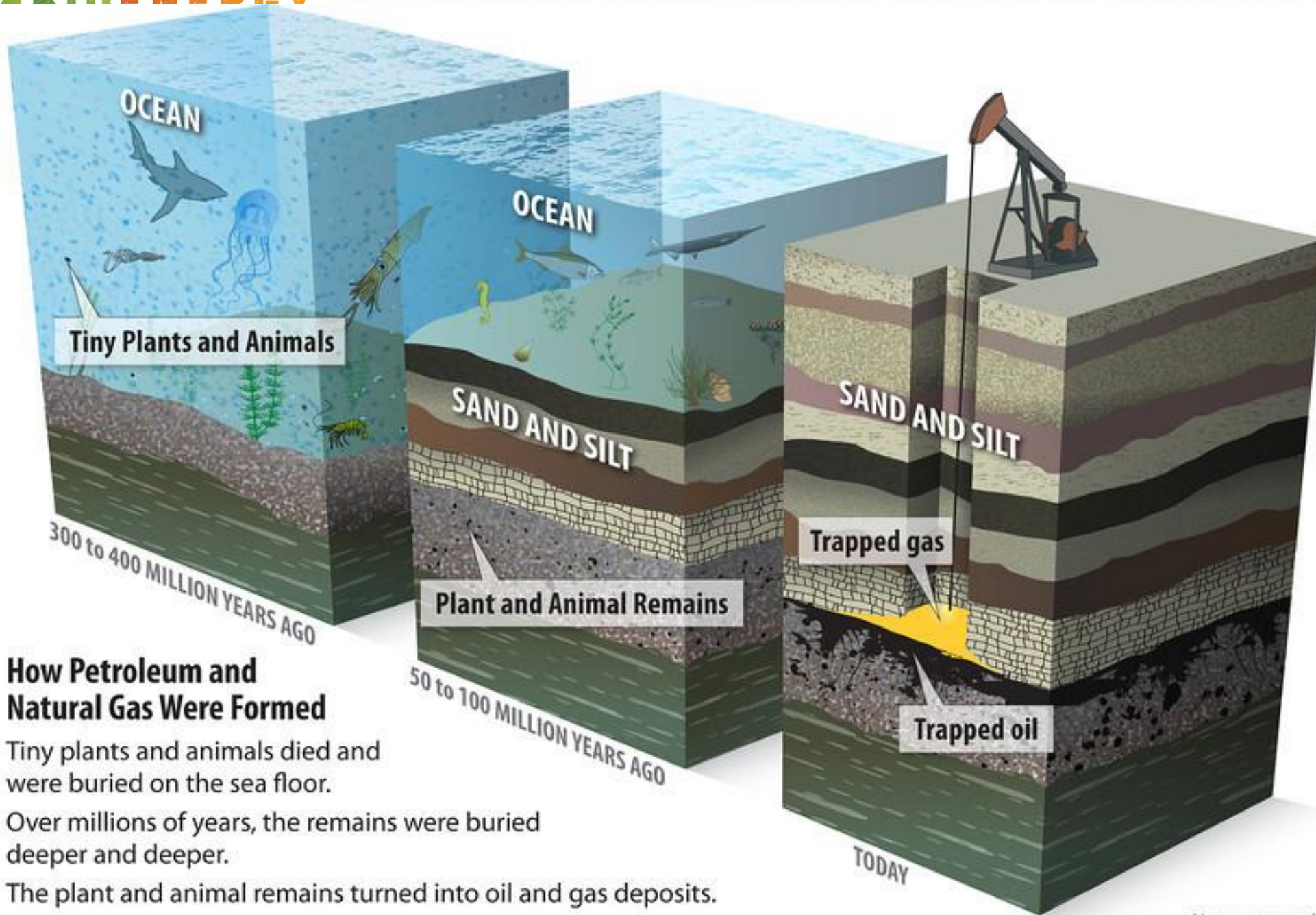
Life, the universe and everything











How Petroleum and Natural Gas Were Formed

Tiny plants and animals died and were buried on the sea floor.

Over millions of years, the remains were buried deeper and deeper.

The plant and animal remains turned into oil and gas deposits.

Note: not to scale





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What are wood pellets?

- Biomass fuel - 100% renewable and affordable
- Made in NZ from waste wood, sawdust & post harvest forest residue
- Diverts wood waste from landfill and forest residues from aerobic decomposition
- **Biomass has lowest carbon emissions of any fuel in NZ at 0.003 kgCO₂e / kWh**
- Direct replacement of fossil fuels for space heating, DHW & process heat



Wood pellets

Huge potential for diversion of unused wood waste to biomass

Annually wood waste sent to landfill in NZ :

- 250,000 tonnes to municipal landfills (council controlled)
- 1.2 MILLION tonnes to non-municipal landfills (commercial / private)

PLUS post harvest residue from forestry



CARBON EMISSIONS

Heating technology	Fuel	Reduction in CO ₂ emissions if replaced with wood pellets
Pellet boiler	Wood pellets	Base case
Gas boiler	Natural gas	-98.5%
	LPG	-99%
Diesel boiler	Diesel	-99%
Coal boiler	Coal	-99%
Heat pump	Electricity & COP of 3	-91%

Indicative cost of pellet fuel May 2022:

Auckland	\$0.09 / kWh	\$450 / tonne
Hamilton	\$0.08 / kWh	\$380 / tonne
Taupo	\$0.07 / kWh	\$350 / tonne
Wellington	\$0.10 / kWh	\$500 / tonne
Nelson	\$0.08 / kWh	\$420 / tonne
Christchurch	\$0.11 / kWh	\$560 / tonne
Dunedin	\$0.10 / kWh	\$500 / tonne
Invercargill	\$0.10 / kWh	\$500 / tonne

Fossil fuel costs May 2022:

Nationwide indicative figures

Diesel \$0.20 / kWh \$2 / litre

Up to 280% more expensive than pellets

Natural gas \$0.11 / kWh

Up to 160% more expensive than pellets

LPG \$0.17 / kWh \$105 / 45kg

Up to 240% more expensive than pellets

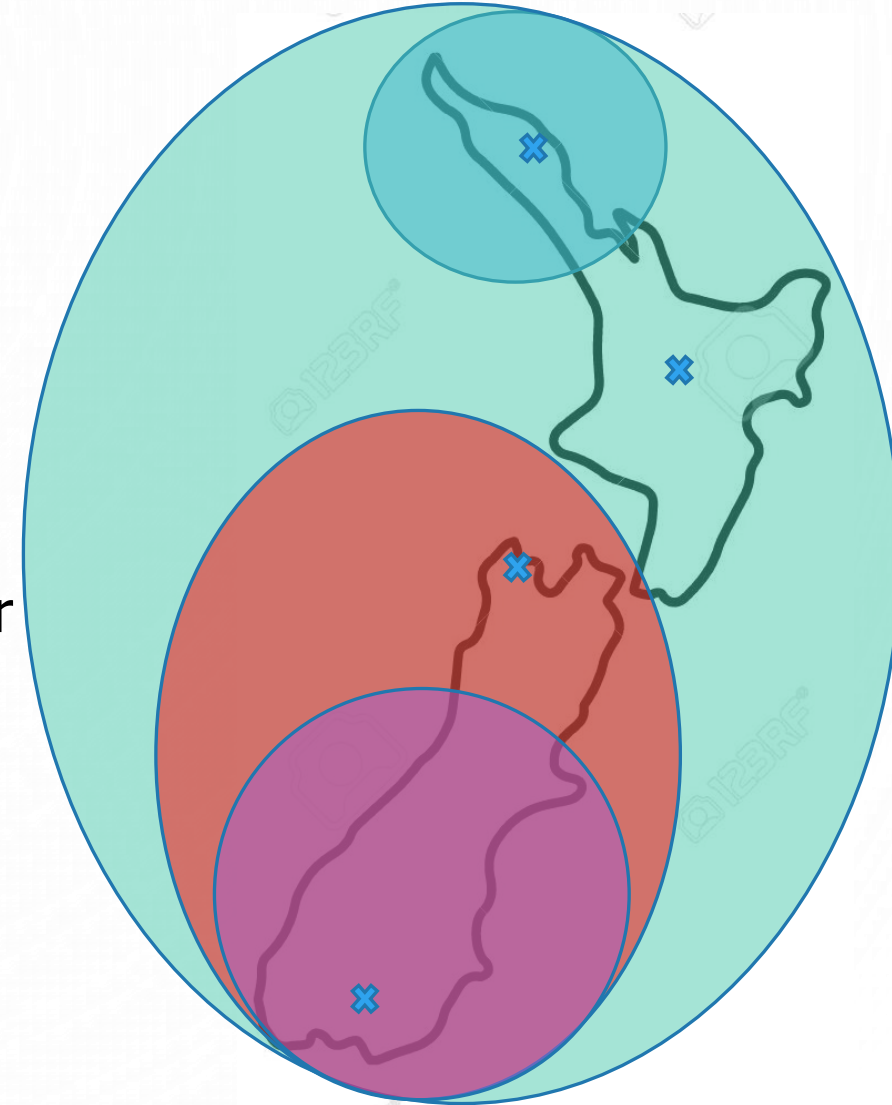
Very stable price because made from waste materials

Up to 10 year price & supply contracts offered

NZ manufacturers

- Azwood – Nelson – 20-30k tonnes / yr
- Niagara – Invercargill – expanding to 90k tonnes / yr
- Nature's Flame – Taupo – expanding to 120k tonnes / yr
- Waipapa Pine – Whangarei – 10-15k tonnes / yr

Bulk delivery by truck with no manual handling required through-out country



DELIVERY OF PELLETS

- Blower trucks for all of North Island, some areas in South Island – increasing over time
- Elevator and auger trucks in rest South Island
- Comparable frequency & disruption to LPG and diesel truck deliveries
- Much less frequent visits than rubbish trucks!
- Larger store optimises cost of fuel by reducing proportional cost of freight per tonne



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DELIVERY OF PELLETS



PELLET STORAGE



ÖkoFEN Flexilo 8 tonne pellet store - empty



ÖkoFEN Flexilo 8 tonne pellet store - full

PELLET STORAGE

Outdoor housing for Flexilo pellet storage



PALMNY



PAPAIOEA
PALMERSTON
NORTH
CITY



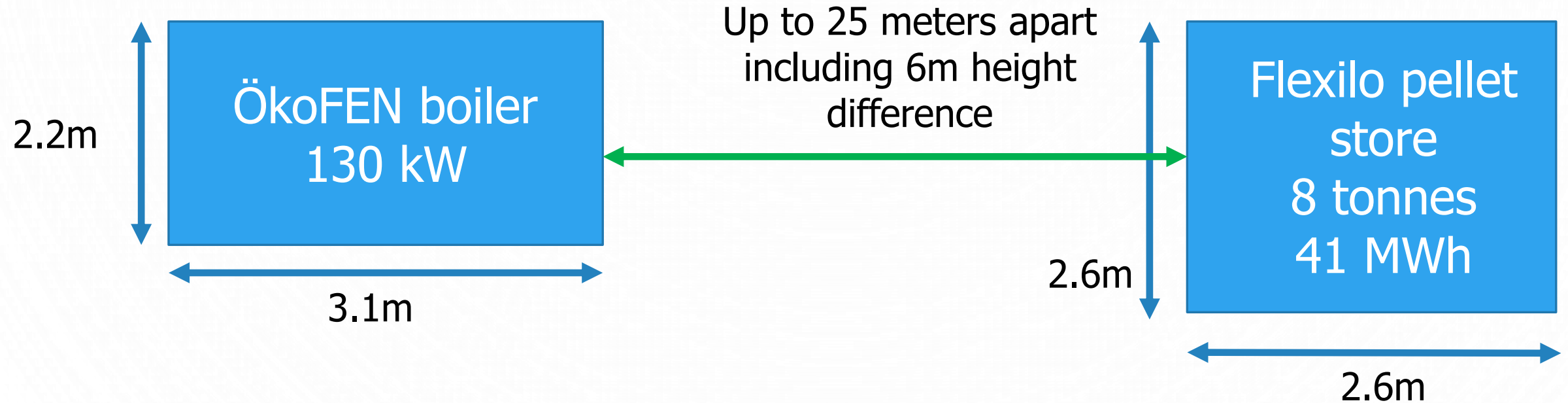


130kW ÖkoFEN pellet boiler

The Victoria Esplanade glasshouses, PNCC

- 150kW gas boiler – needs replacement for decarbonisation & age of unit
- **31,493 kgCO₂e per year**
- 130kW ÖkoFEN pellet boiler in same place
- External 8 tonne Flexilo pellet store 10 meters away
- **475 kgCO₂e per year = 98.5% reduction**
- **\$160,000 installed including building works**

ÖkoFEN pellet boiler & fuel store at Victoria Esplanade, PNCC



DETIDEMENT VILLAGE CENTRAL BUILDING

Boiler flue termination at roof

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

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

2 x 8 tonne bulk pellet fuel bags

20 metres

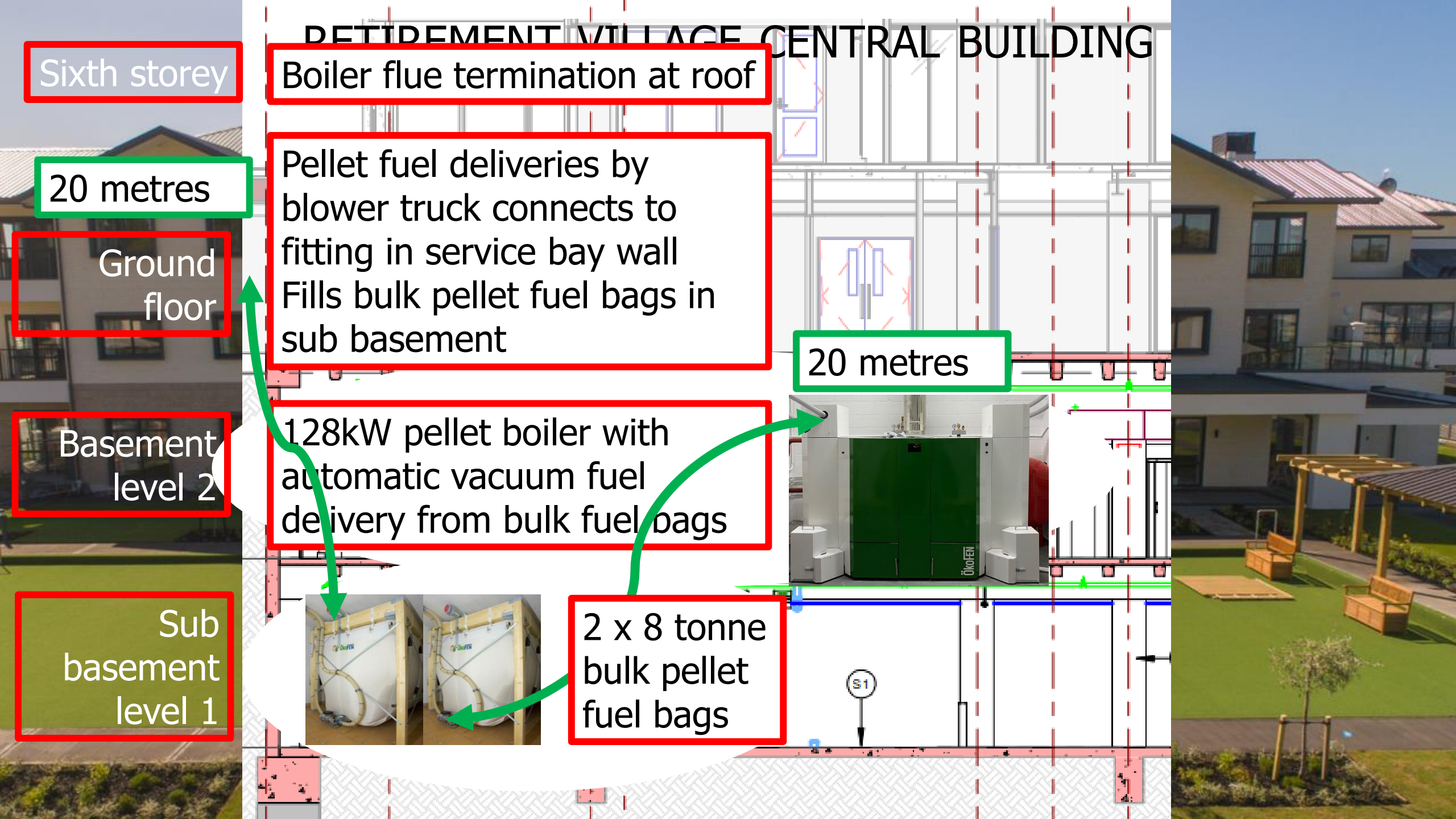
Sixth storey

20 metres

Ground floor

Basement level 2

Sub basement level 1



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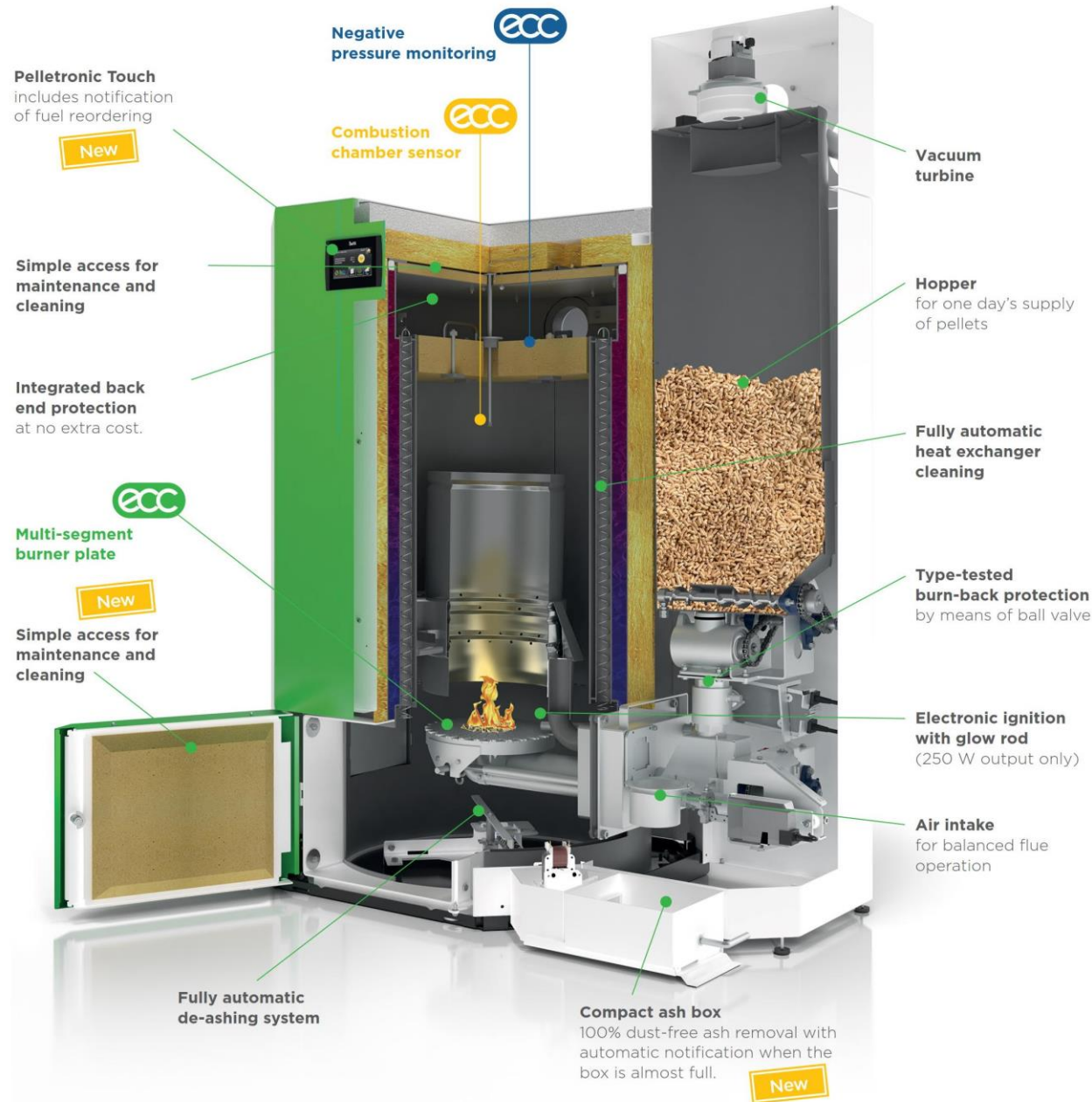
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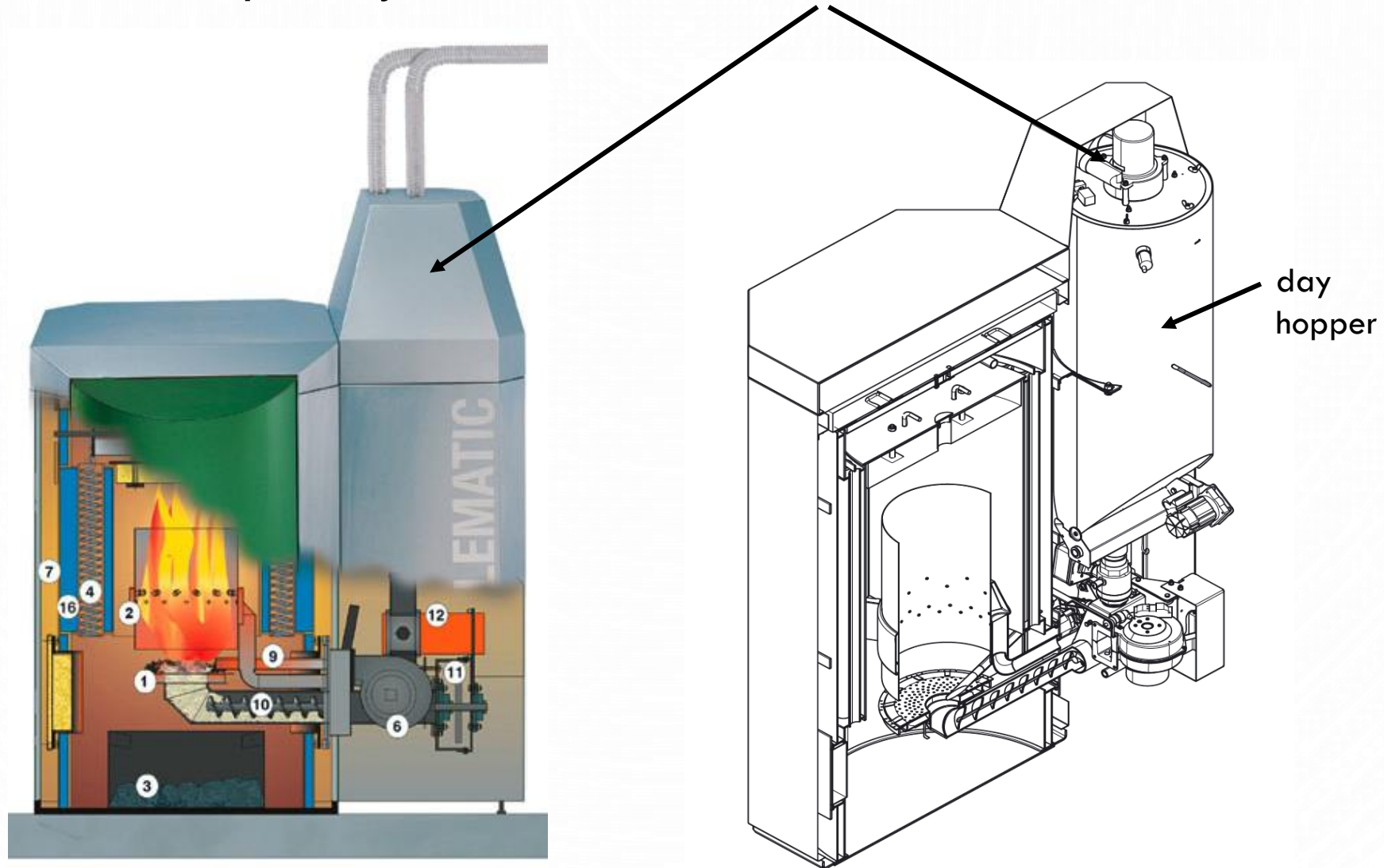
Important questions when switching from fossil fuels

1. How much heat do we **actually** need? What energy efficiency gains can be made?
Fossil fuel boilers frequently oversized, often 100%, & using poorly performing systems
2. How much can a pellet boiler cascade cover redundancy required?
Multiple pellet boilers can create inherent redundancy, avoiding requirement for traditional duty / stand-by design & costs.
3. Is the heat load spread out over time or concentrated at certain times?
Can heat storage help to flatten the (heat) curve?
Pellet boilers can provide heat in both scenarios but the boiler size and complete system design will vary depending on the nature of heat load.
4. What is the site specific balance between space available for pellet fuel storage, optimum size & frequency of fuel deliveries and resilience provided with fuel stored?
More storage = space AND = lower freight cost AND = greater site resilience

ÖKOFEN PELLET BOILERS

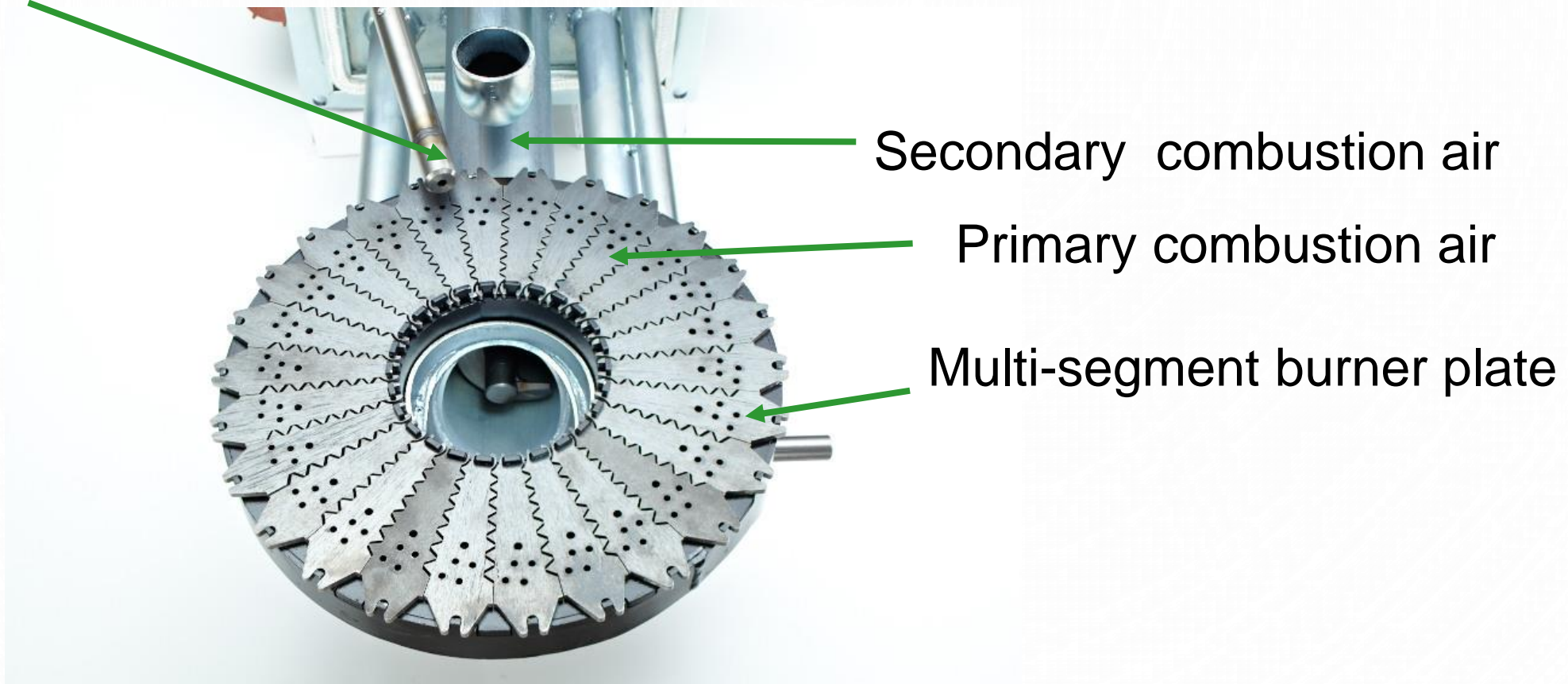


Pellet transport system = **vacuum suction turbine**



UNDERFED GRATE

Ignition – blower with a 250 watt heating cartridge

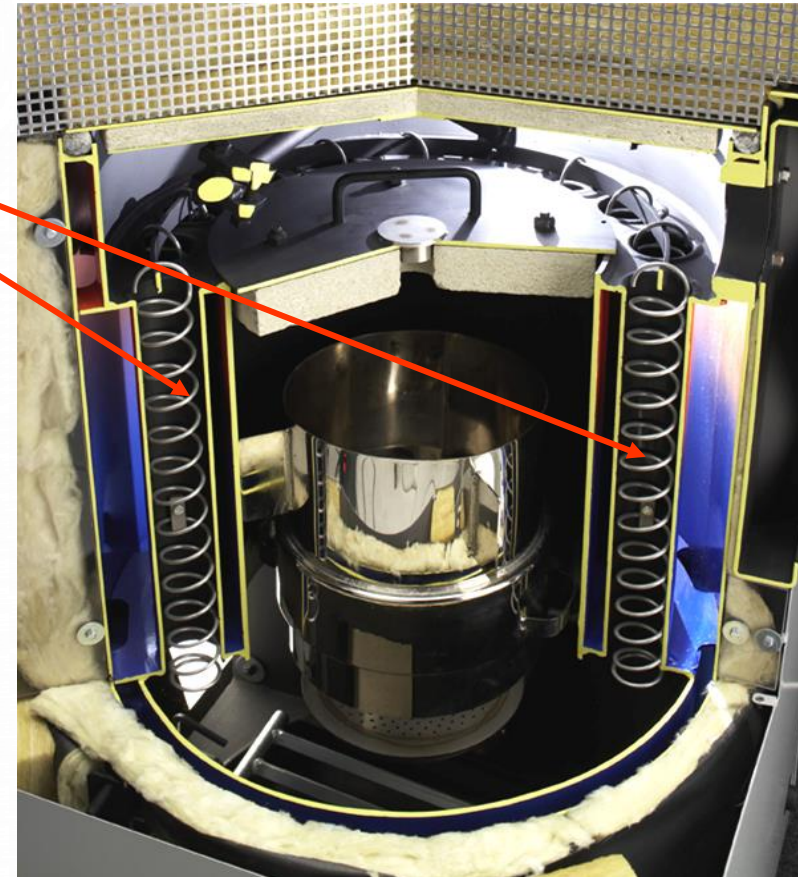




- Pellets fed from centre & below
- Movement of pellets from middle to outside of burn plate matches 3 phases of combustion:
 1. Heating & dewatering
 2. Gas release
 3. Combustion
- Fuel feed does not disturb fire bed

Automated cleaning system of heat exchange area of fly ash

- convenience
- constant performance



Automatic, mechanical ash transfer to external box



256kW ÖkoFEN pellet boiler

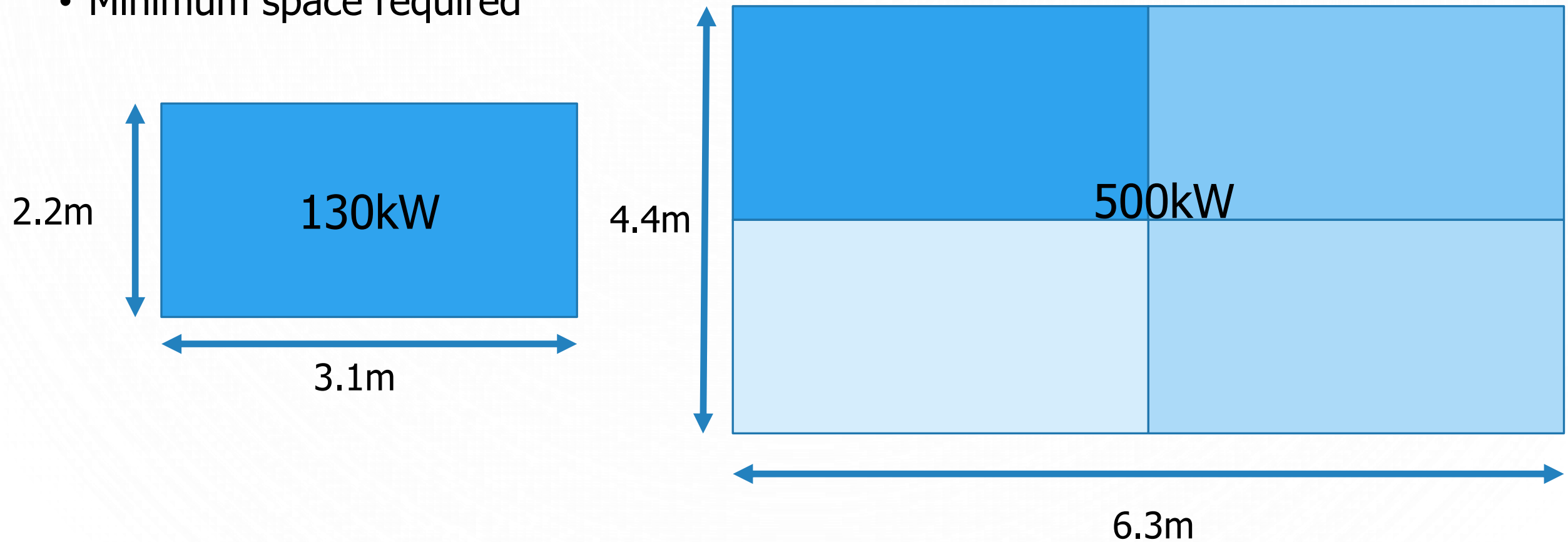
BOILER CASCADES



- Cascades provide flexible install options
- Particularly suitable for retrofit in existing buildings
- Multiple smaller boilers manoeuvred more easily in to inaccessible & upper storey plant rooms
- Larger systems possible with multiple cascades
- Huge modulation range & redundancy capacity
7% to 100%

SPACE REQUIRED

- Flexible layout of boilers
- Placed based on space available and shape of room
- Minimum space required



ASH REMOVAL

Ash from pellets

- Certified organic fertiliser
- Around 5kg per tonne of pellet fuel
- 5kg ash per 5MWh heat energy
- Usually empty once every month or two



Netherton School, Paeroa, Waikato

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But, but, but where can we put them??

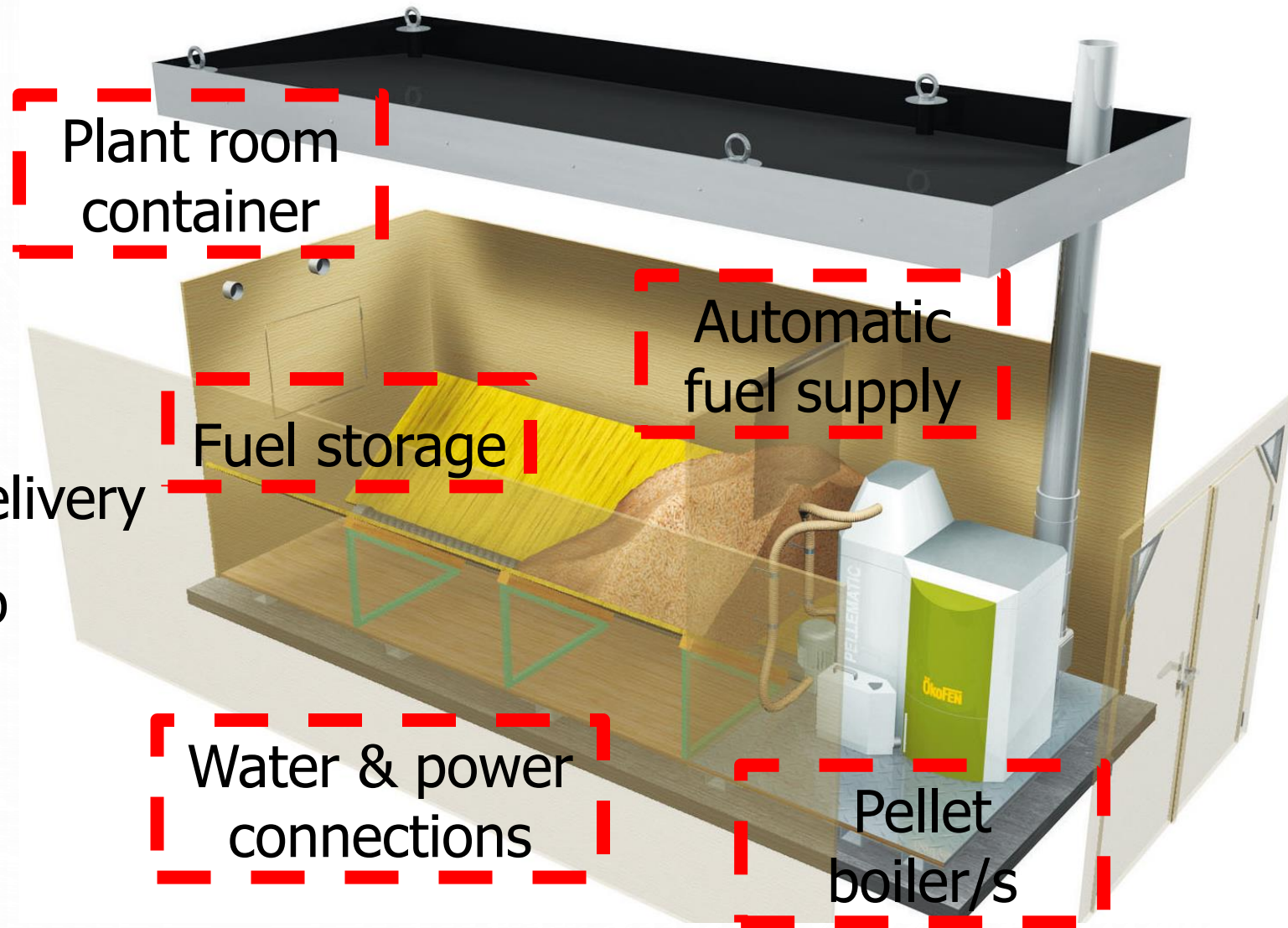
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- ✓ Energy Box containerised pellet boiler plant rooms
- ✓ All components for pellet boiler system
- ✓ High level cost control
- ✓ Consistency of design & delivery
- ✓ Guarantee of workmanship
- ✓ Flexible site placement
- ✓ Modular and expandable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



ÖkoFEN 130kW Energy Box

- 20' container (high cube)
- 130kW boiler
- 7 tonnes pellets (36 MWh)
- Plug & play placement
- Container can be next to building or at a distance with underground services to building

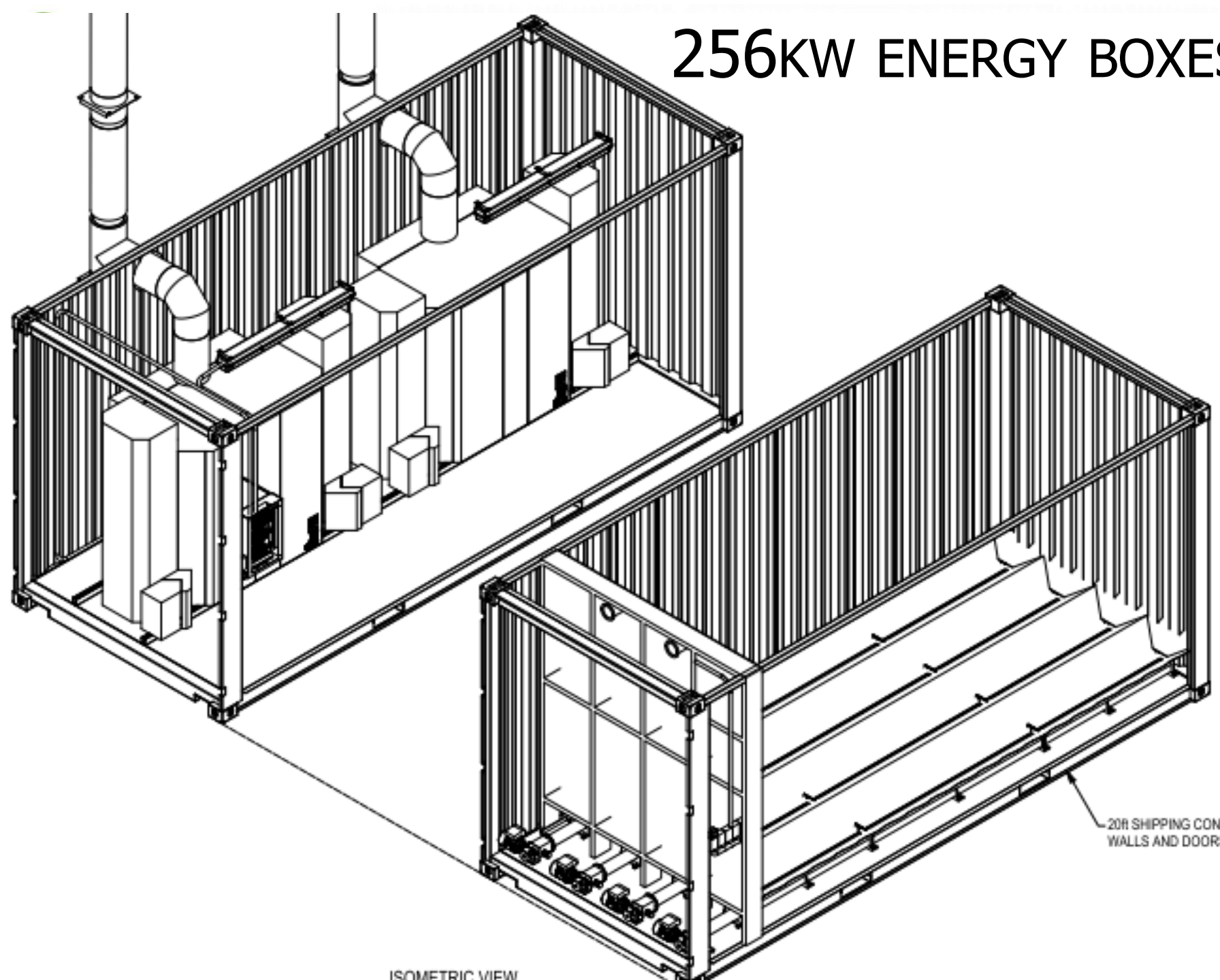


ÖkoFEN Energy Box at Waikato Uni, Hamilton

- Direct connection to hot water cylinders & central heating in student accommodation
- One Energy Box can service four buildings
- Integrated 5 tonnes fuel store
- Refuel twice / year



256KW ENERGY BOXES



ÖkoFEN 256kW Energy Box

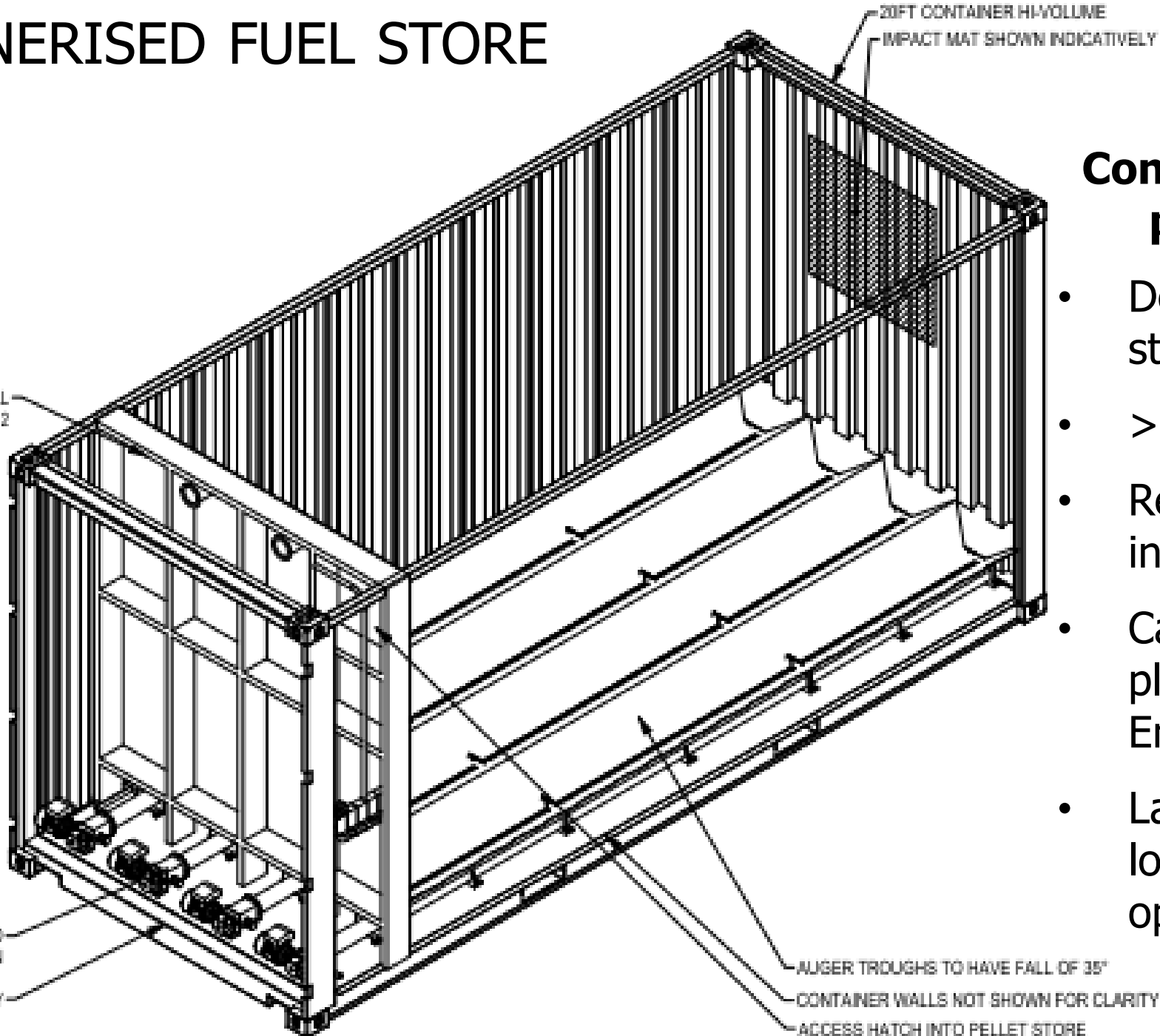
- 2 x 20' containers (high cube)
- 256kW boiler
- 21 tonnes pellets (107 MWh)
- Containers can be side by side, end to end or stacked with stair access to upper plant room

CONTAINERISED FUEL STORE

Containerised 20' pellet store

- Dedicated pellet store
- >25m from boilers
- Reduces footprint inside building
- Can be used with plant room or Energy Box installs
- Large capacity for low cost of fuel & optimum resilience

PELLET STORE BULKHEAD WALL
REFER TO M30 SHEET 2



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- Single 20' container for up to 130kW output and fuel store
- Direct connection to heating system or process heat load
- Usually does not require Building Consent because dedicated plant room in pre-engineered structure
- Most areas is a permitted activity under Regional Plan and does not required Resource Consent because of limited boiler output

System output	Container size/s	Fuel store Tonnes & MWh	Notes	Indicative cost
64 kW	1 x 20 foot (2.4m x 6m x 2.7mH)	5.7 T 29 MWh	Modifiable to 36kW	\$105,000
130 kW		5.7 T 29 MWh	More room available for other system components	\$135,000
130 kW		7 T 36 MWh	Two independent boilers, more resilience	\$150,000

- Two 20' containers or one 40' container for up to 256kW output and 20 tonne fuel store
- Three 20' containers or two 40' containers for up to 512kW output and 20 tonne fuel store
- Additional containers for more fuel store redundancy or as plant room for other components

System output	Container size/s	Fuel store Tonnes & MWh	Notes	Indicative cost
192 kW	2 x 20 foot	21 tonnes 107 MWh or multiple fuel stores for more capacity	Various options for container layout – side by side, end to end, stacked, space between Containers can be clad or fitted with roof lines to blend with surrounding buildings	\$225,000
256 kW	or 1 x 40 foot			\$265,000
320 kW				\$310,000
384 kW	3 x 20 foot			\$375,000
448 kW	or 2 x 40 foot			\$440,000
512 kW				\$490,000

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Climate Emergency Response Fund

\$4.5 billion in 2022 Budget

Government Investment in Decarbonising Industry (GIDI)

\$650 million

State Sector Decarbonisation

\$219.5 million

Crown Loans

Energy Transition Accelerator

\$400 million May 2021





Plant replacement & energy efficiency finance

\$0 upfront costs, up to 10 year terms

\$3k to \$5 million financing available



ONE STEP > AHEAD





Designers and distributors of renewable heating & hot water systems

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