COLORADO STATE FOREST SERVICE
COLORADO STATE UNIVERSITY

Biomass Ready Guidebook

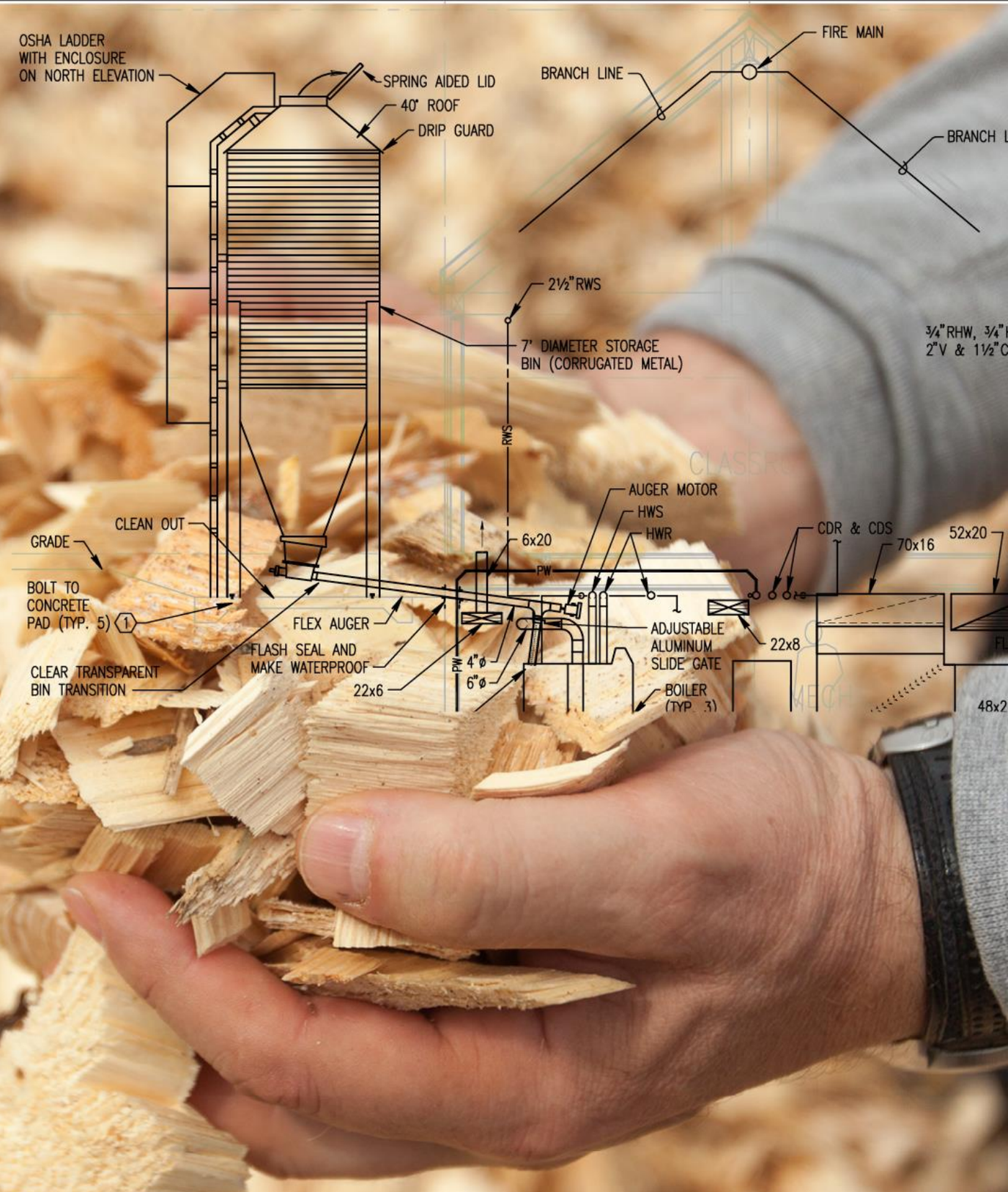
Delivery Path

Storage Area

Boiler Room

Connection

HVAC Integration




696-PJ2


Moose Visitor Center
Colorado State Forest
Colorado State Parks


Safgard
LOW WATER CUT-OFF
A.O.SMITH
Water Heaters
CONSERVATIONIST 90
DANGER
Burnham
COLORADO BOILER
INSPECTION SECTION
Colo #
50068

How about adding a biomass boiler?

No


N2

Please…

Don’t Accidentally Design it Out….

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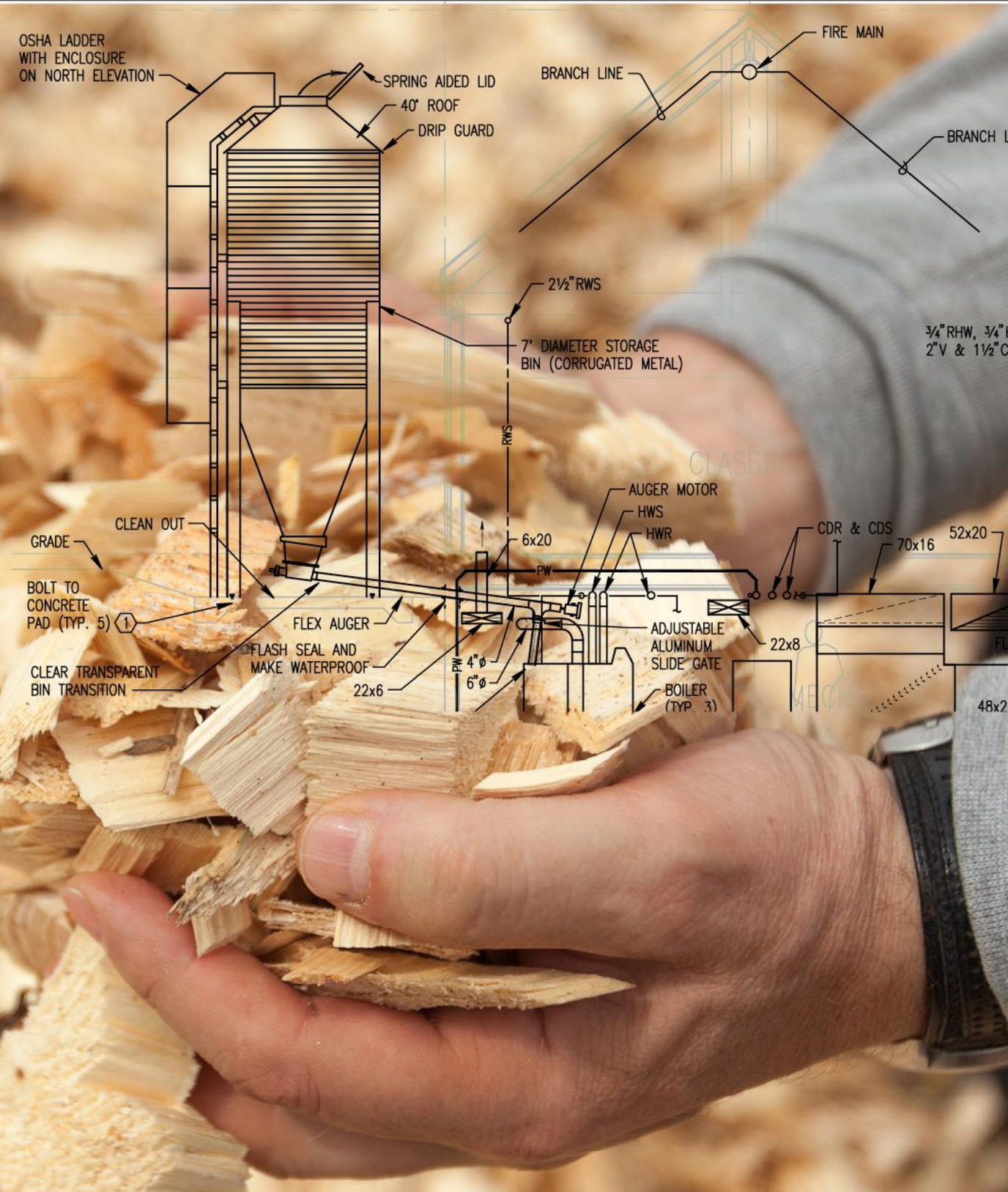
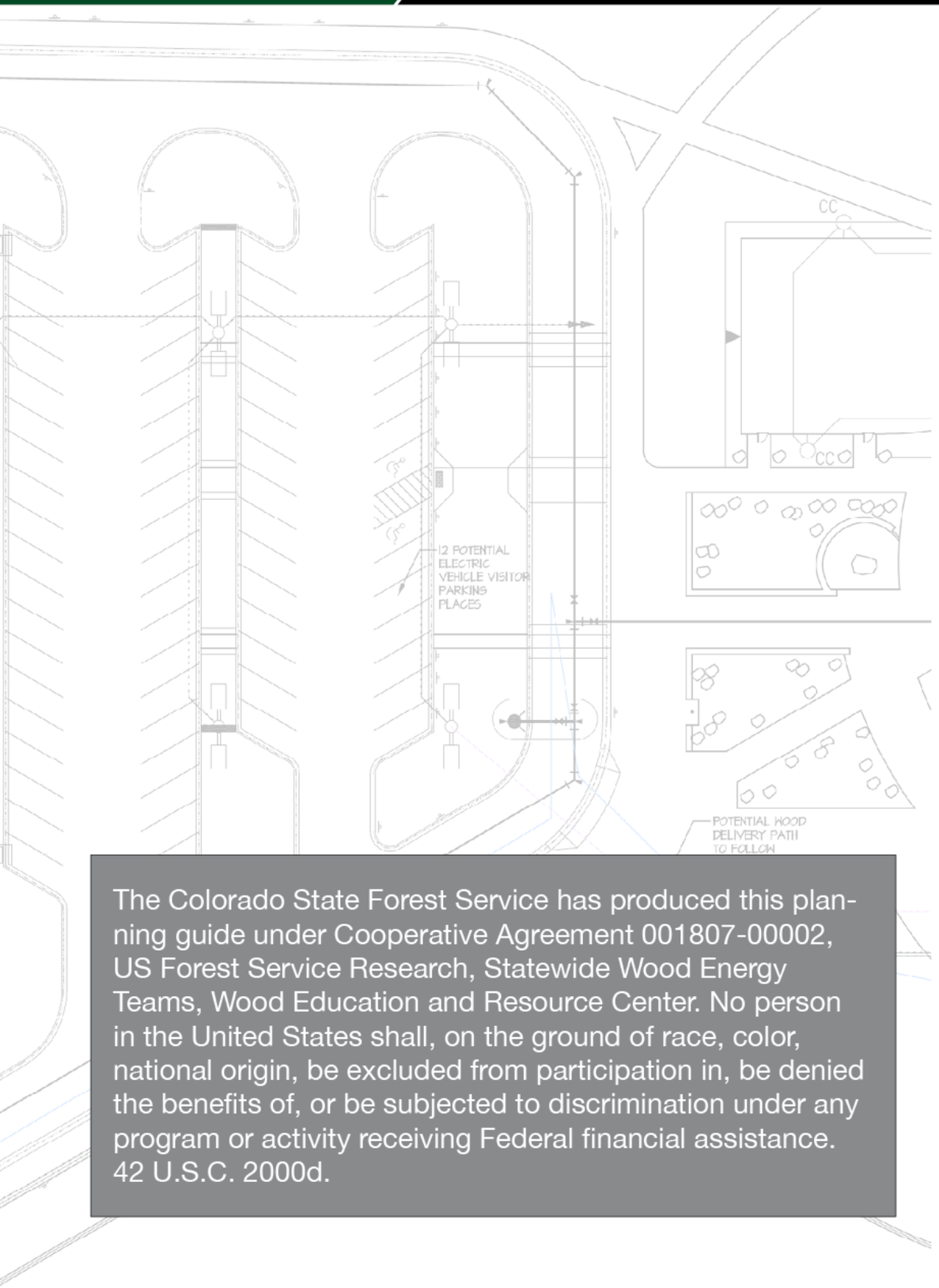


The Biomass Ready Process



The Colorado State Forest Service has produced this planning guide under Cooperative Agreement 001807-00002, US Forest Service Research, Statewide Wood Energy Teams, Wood Education and Resource Center.

Biomass Ready is a quick and easy process to help teams design new community buildings that can better adapt to an uncertain energy future.

Today the economics of biomass may not be favorable, but your community will own and operate your new building for decades – perhaps even a century. Over the lifetime of your building, your community may decide to install a biomass boiler system. Will your building be ready?

Biomass Ready will help you avoid inadvertently creating barriers that make adding biomass in the future prohibitively expensive.

If you can add a biomass system to your building without extensive deconstruction or demolition, your building is

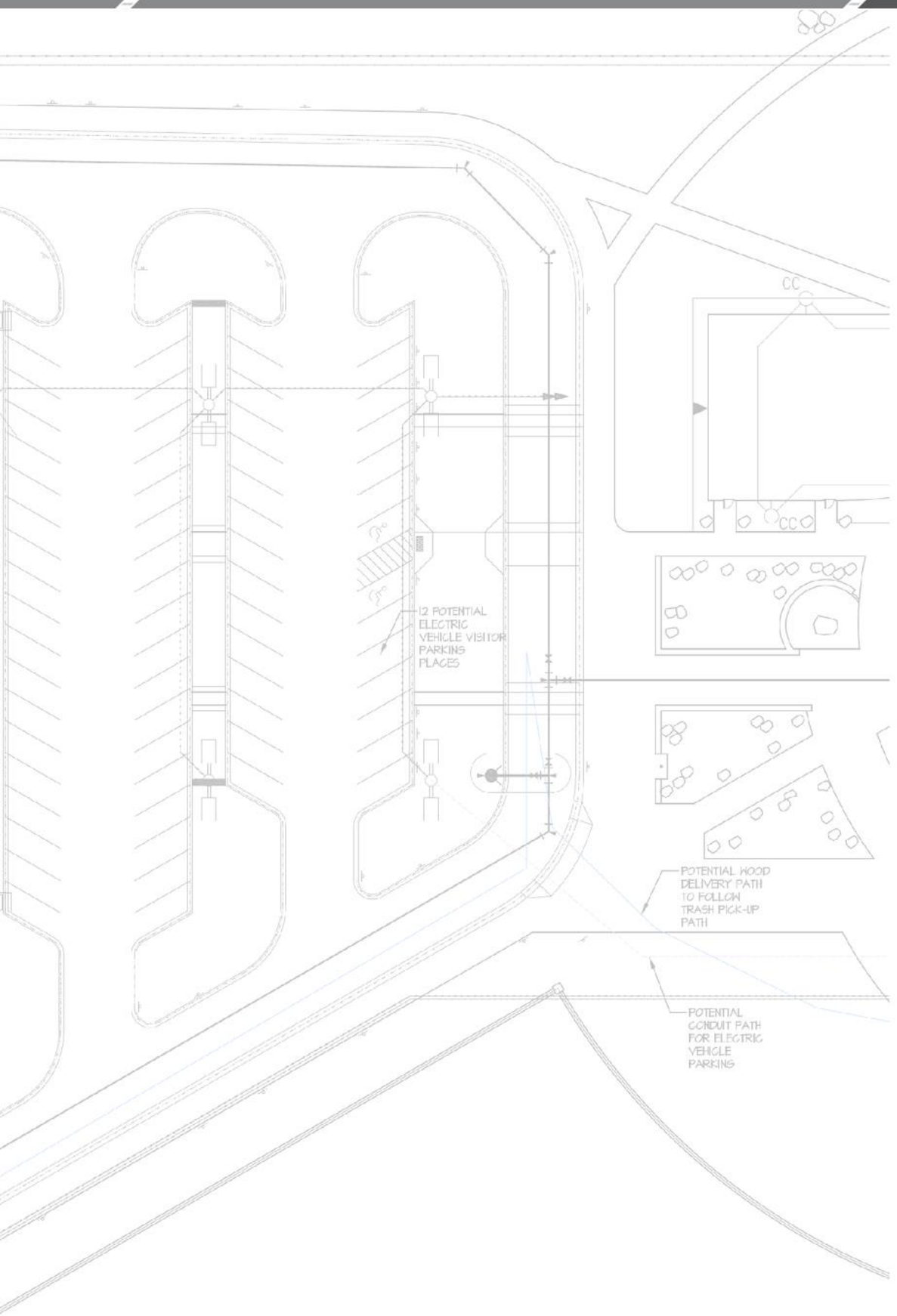
Biomass Ready!

And Biomass Ready *is simple enough that you can include it in your RFP process – encouraging your bidders to compete on designing a future-flexibility!*

For more information visit:

csfs.colostate.edu/cowood/wood-to-energy/

Model Projects



Tillamook Forest Center, OR

Space Heated: 12,100 sq. ft., **Boiler Size:** 0.410 MMBtu/h

Storage: 64 sq. ft. (8’ x 8’) **Boiler:** 280 sq. ft. (20’ x 14’)

South Park School, Fairplay, CO

Space Heated: 120,000 sq. ft., **Boiler Size:** 1.5 MMBtu/h

Storage: 720 sq. ft. (20’ x 36’) **Boiler:** 672 sq. ft. (28’ x 24’)

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Storage: 748 sq. ft. (22’ x 34’) **Boiler:** 600 sq. ft. (20’ x 30’)

What Makes a Biomass System Retrofit Expensive?

Delivery

How will biomass fuel be delivered to your storage area? Biomass fuel for community-scale projects is delivered by truck of the size given in the Biomass Design Parameters. You'll need to know where you can add a paved driveway suitable for truck delivery during business hours. Add this driveway to your site layout diagram and label it something like "Future Biomass Delivery Driveway."

Storage

Where will you store the biomass fuel? Most biomass facilities store between a week of fuel and a whole heating season of fuel. That fuel is usually stored next to a biomass boiler to make supplying the fuel easy. Add a rectangle to your site diagram of the dimensions specified in the Biomass Design Parameters. Label this square something like "Future Biomass Storage Facility."

Boiler

Where will you put the biomass boiler? Biomass boilers are often used to supplement conventional heating systems, but can also be the primary source of heat. Biomass boilers are larger than conventional boilers and are often housed in a separate building or shipping container. These structures are usually located immediately adjacent to (or part of) the biomass storage facility. Add a rectangle to your site diagram of the dimensions specified in the Biomass Design Parameters. Label this square something like "Future Biomass Boiler Facility."

Connection

How will you connect your boiler to your building? Heat distribution piping is expensive – especially if it needs to be buried – so the closer the boiler building is to your new building, the better. Add a line or path to your site diagram connecting the biomass boiler facility to your building's mechanical room. Label this line something like "Future Biomass distribution pipe."

Integration

How will you integrate the biomass system with your HVAC system? This is often the biggest challenge. Biomass boilers deliver hot water. Many modern conventional heating systems work the same way. If you select one of those systems, adding biomass is simple. But if have a stand-alone heating appliances in each room, adding a central biomass system can be prohibitively expensive.

Tillamook Forest Center

Tillamook Forest Center

Facility

Name: Tillamook Forest Center

Location: Tillamook, Oregon (map)

Primary Use: Visitor and Interpretation Center

Total Square Footage: 1 building, 12,100 sf.

HVAC System: Hybrid forced-air and 180º F hydronic

Construction Date: 2004

Biomass System

Boiler Size: 409,500 Btu/h

Percentage heated with biomass: 100%

Biomass Fuel: Bulk wood pellets

Integration Approach: heating coil in the air handler for the large space, several hydronic loops for the offices and small spaces.

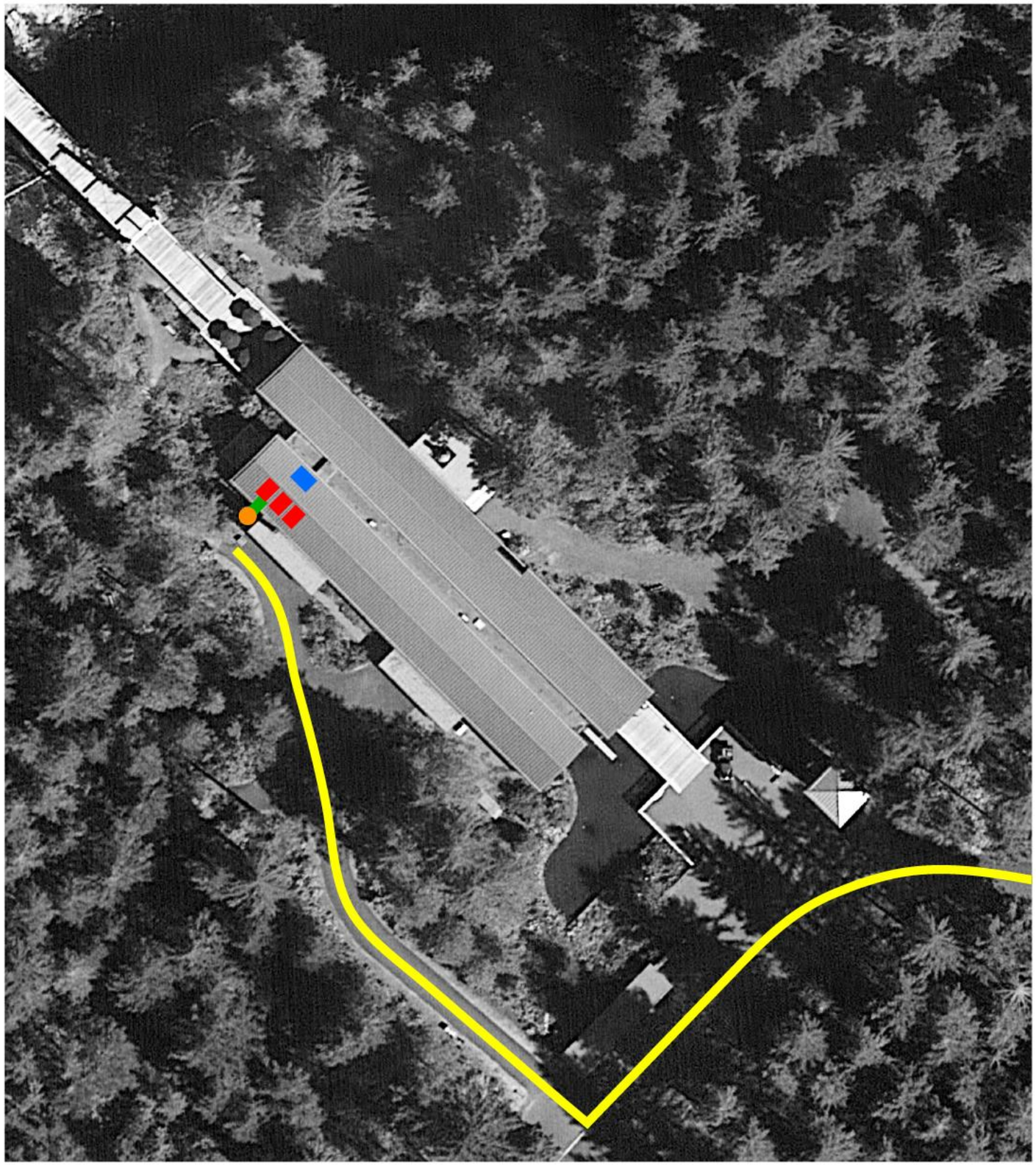
Completion Date: 2004

Project Goals & Features

One of the goals of the Forest Center was show how to harmonize with nature and with our forests. The Center is 100% heated by three wood pellet boilers – no conventional fuel back system.

The building is cooled in the summer by heat pump connected to the pond in front of the building. The water in the pond is treated and used by the fire prevention sprinkler system.

Tillamook Forest Center



Delivery

Grain Delivery Truck

Storage

64 sq. ft. (8’ x 8’)

(24’ tall)

Boiler

280 sq. ft. (20’ x 14’)

Connection

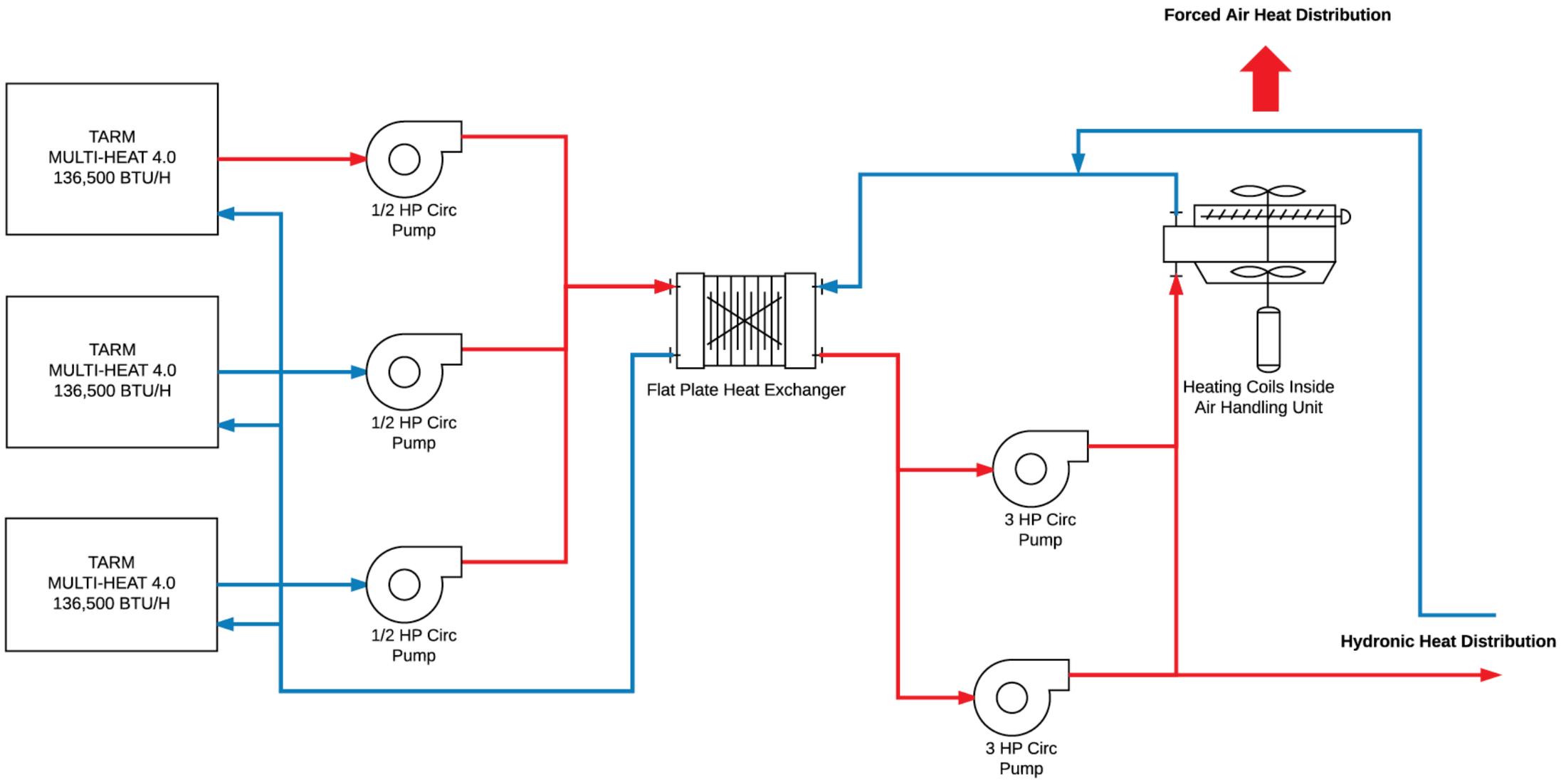
15’ of 3” insulated pipe in mechanical room

Integration

Heating Coil in Air Handler for main space (primary)

Tillamook Forest Center

System Overview



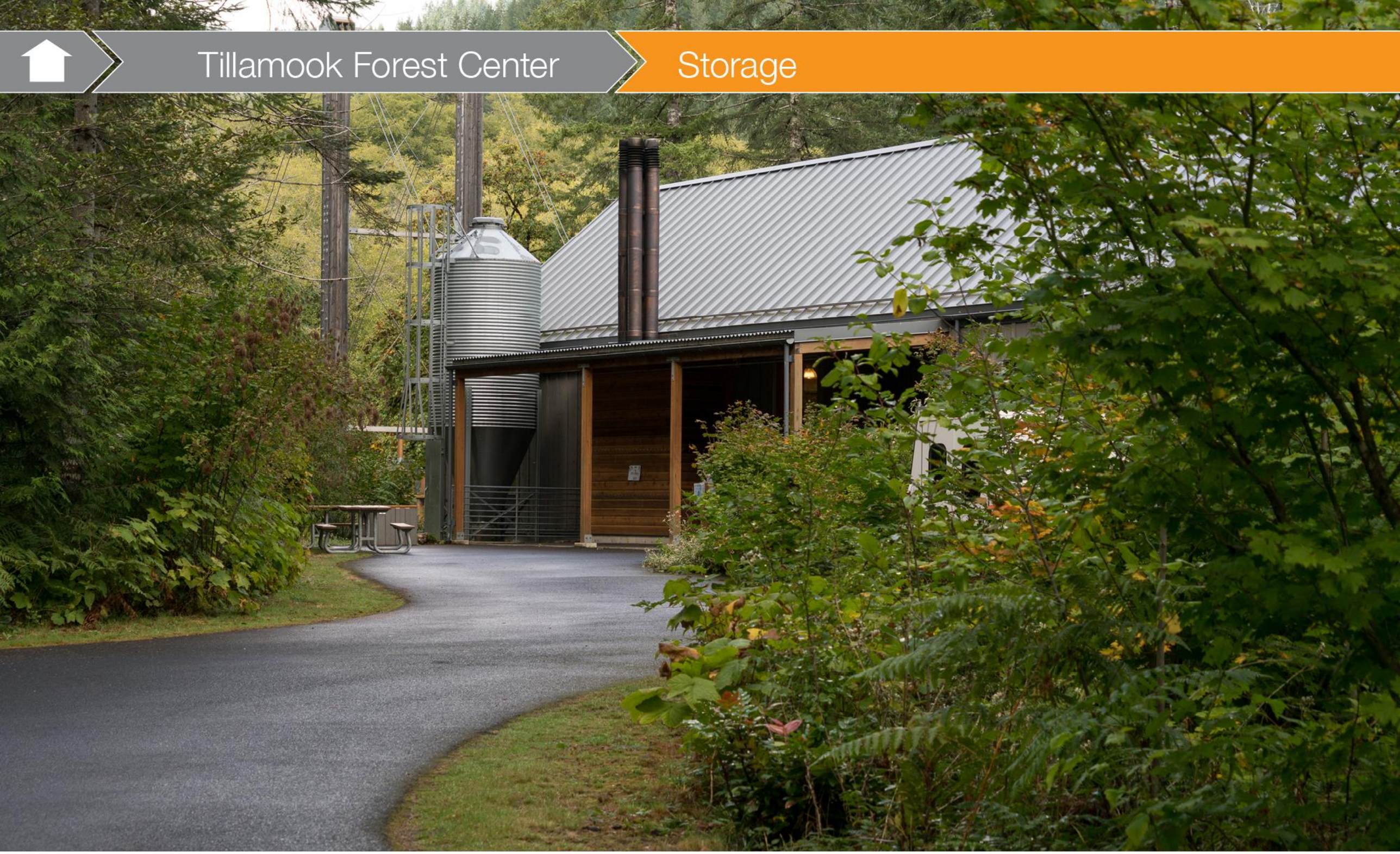
System Diagram: Heat is delivered from the boilers to the building using both forced-air (like a furnace in a typical home) and hydronic (hot water loop). A flat plate heat exchanger (center of diagram) is used to isolate the boiler water from the building's hydronic water loop. The three biomass boilers are the only source of heat in the building.

Delivery

Credit: Tillamook Forest Center

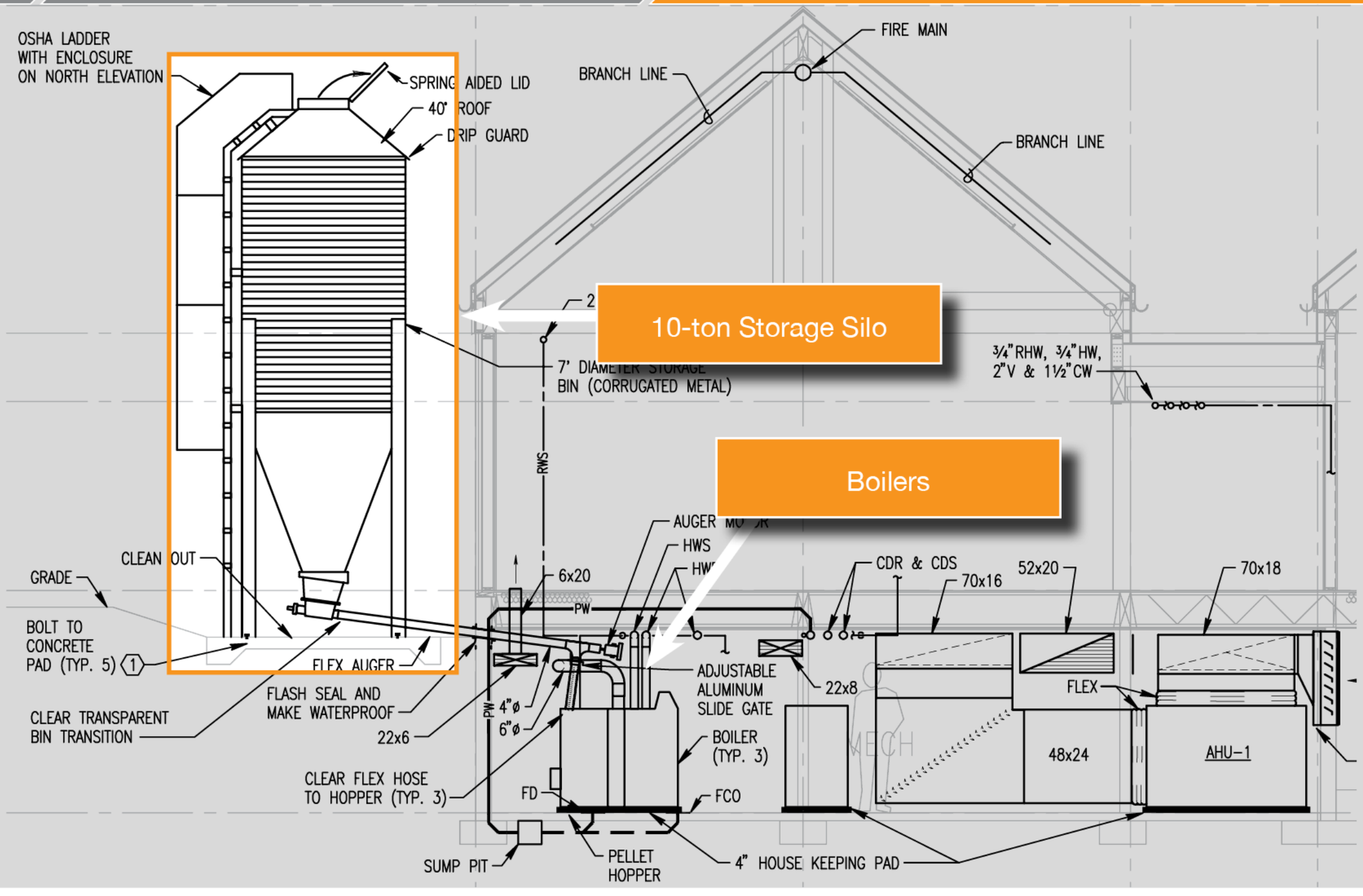
Delivery: Wood pellets are delivered in bulk using a grain delivery truck. The trailer is about 30 feet long with six 5-foot compartments, useful for measuring delivered quantity. Pellets are fed through a 9” trough auger, 12” vertical auger, and then a 9” boom auger (that’s the one feeding into the top of the silo). The closest pellet mill is about 70 miles away, not ideal, but workable.

Storage



Storage: Approximately 64 sq. ft. (8’ x 8’) are needed for the 7’ diameter, 24’ tall, 10-ton grain silo used to store enough pellets to heat the building for a typical winter season. The architects incorporated the agricultural silo into the building’s design helping reinforce the theme of a working sawmill.

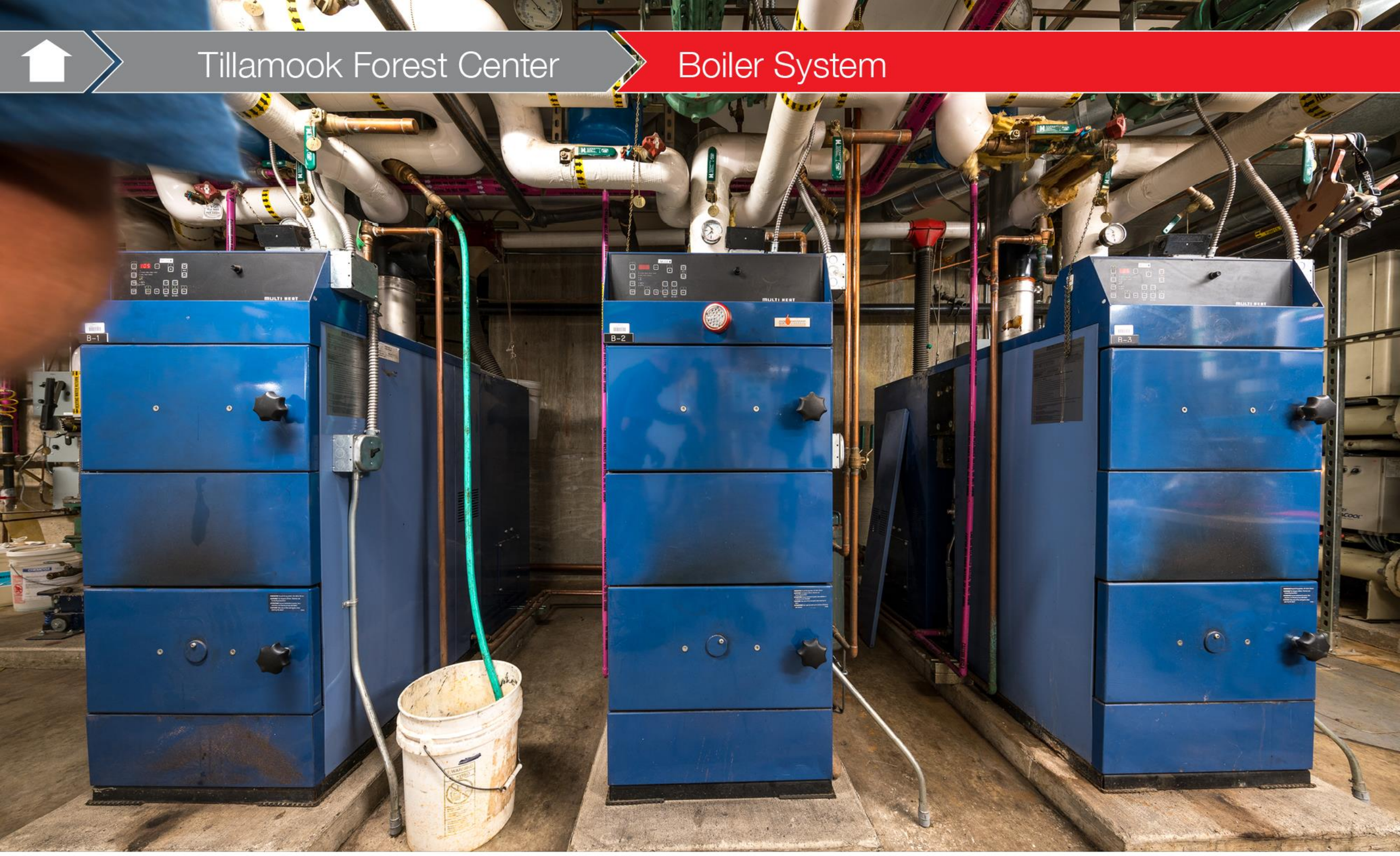
Storage



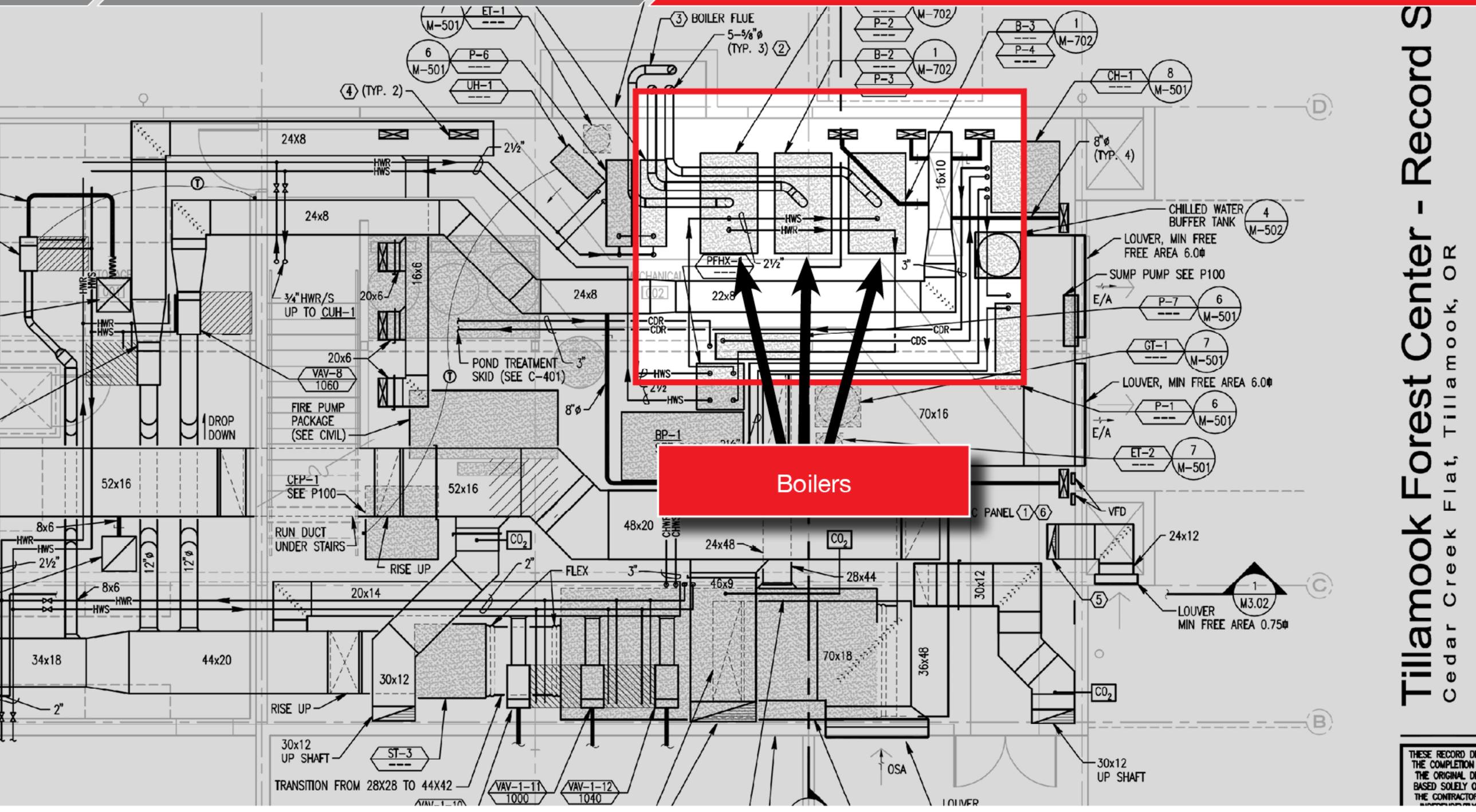
Storage: This elevation view shows the proximity of the pellet silo to the pellet boilers in the mechanical equipment room. The silo is 24' tall and 7' in diameter. *Having the mechanical equipment room (MER) on an appropriate exterior wall makes it easy to move the fuel (pellets in this case) from the storage silo or bin to the boiler.*

Tillamook Forest Center

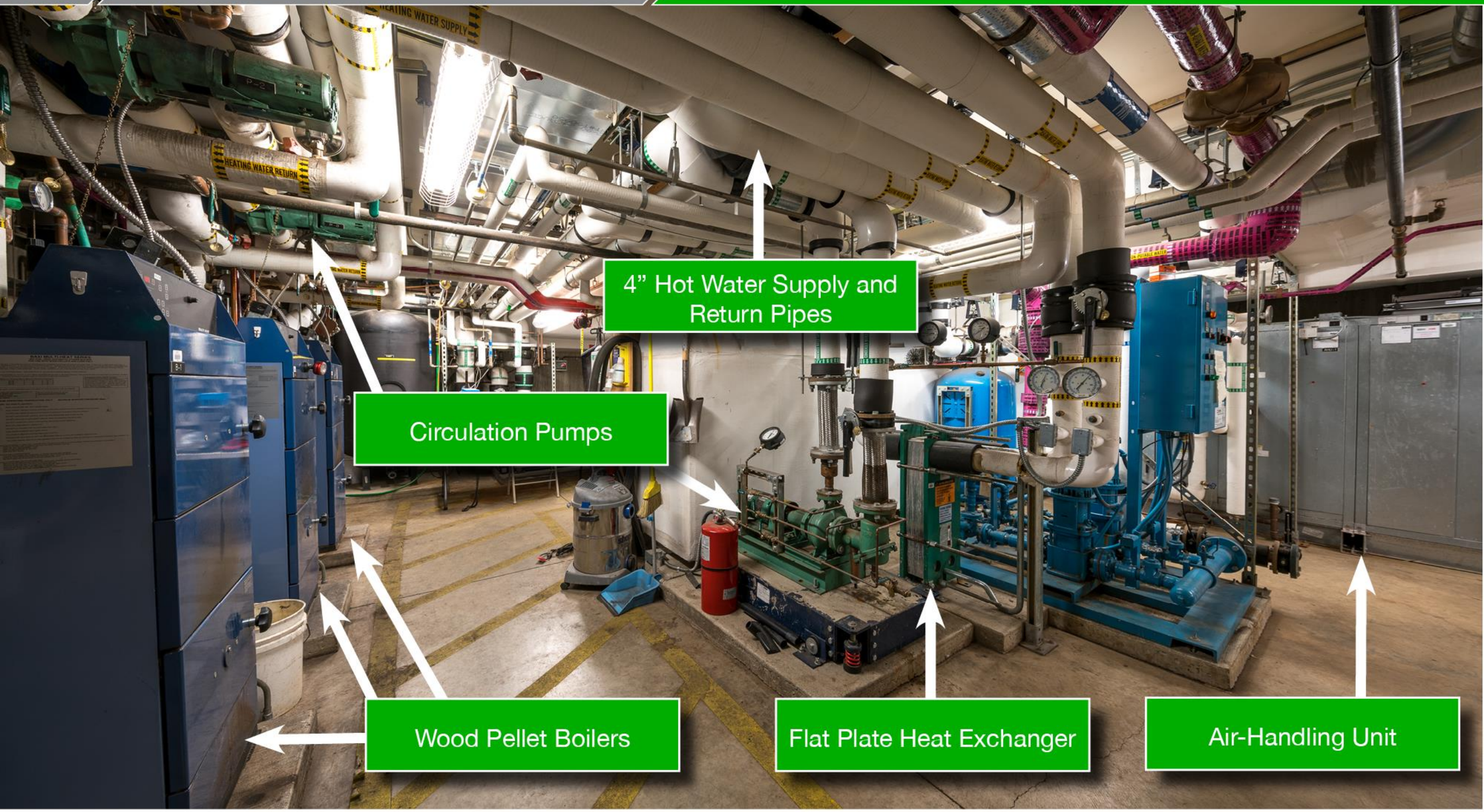
Boiler System



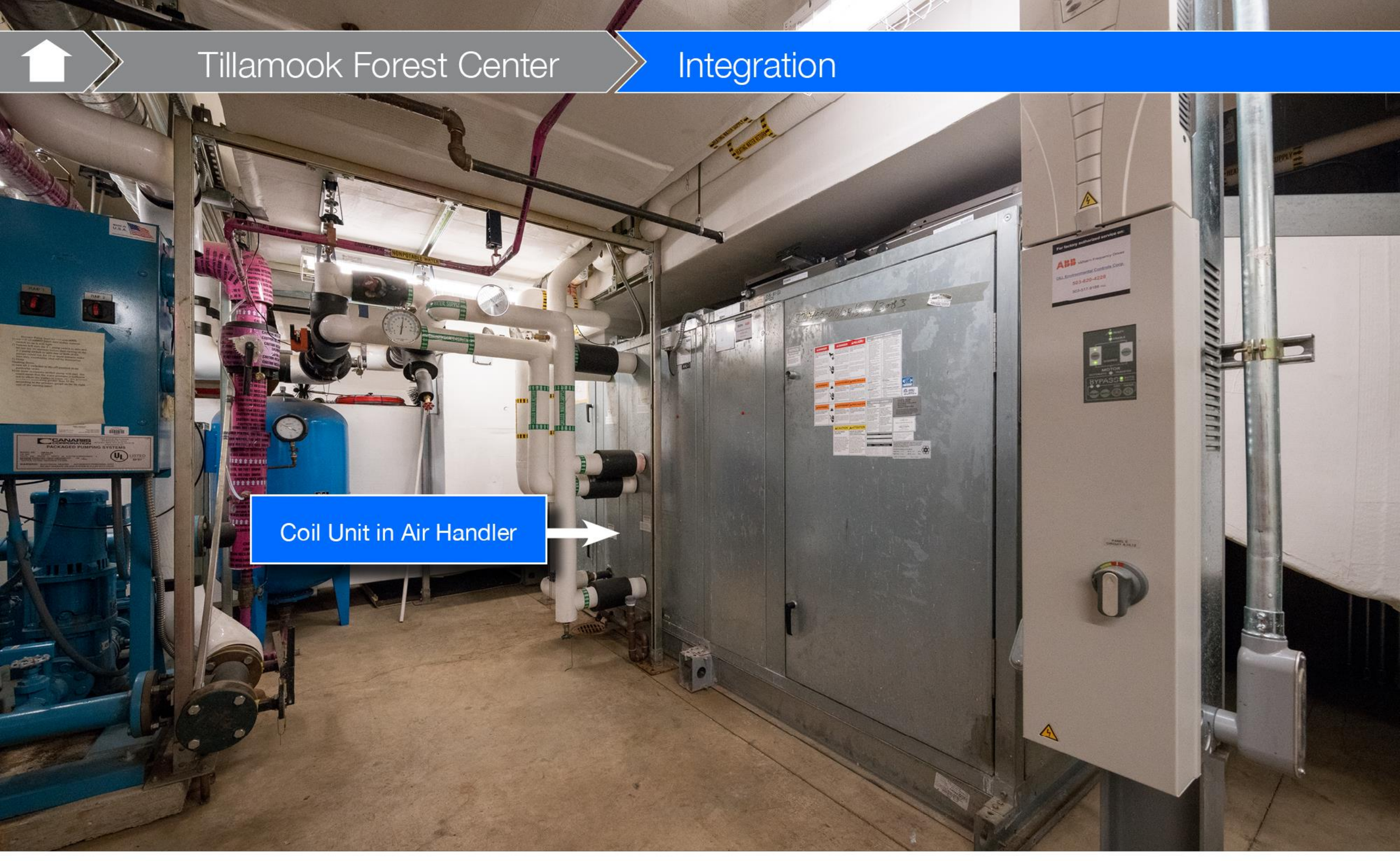
Boiler System: approximately 280 sq. ft. (20’ x 14’) of the 1,500-square foot mechanical equipment room is dedicated to the biomass boiler system. The system is made up of three TARM 136,500 Btu/h wood pellet boilers. Each boiler has an internal pellet storage bin that is semi-automatically filled from the large pellet silo outside.



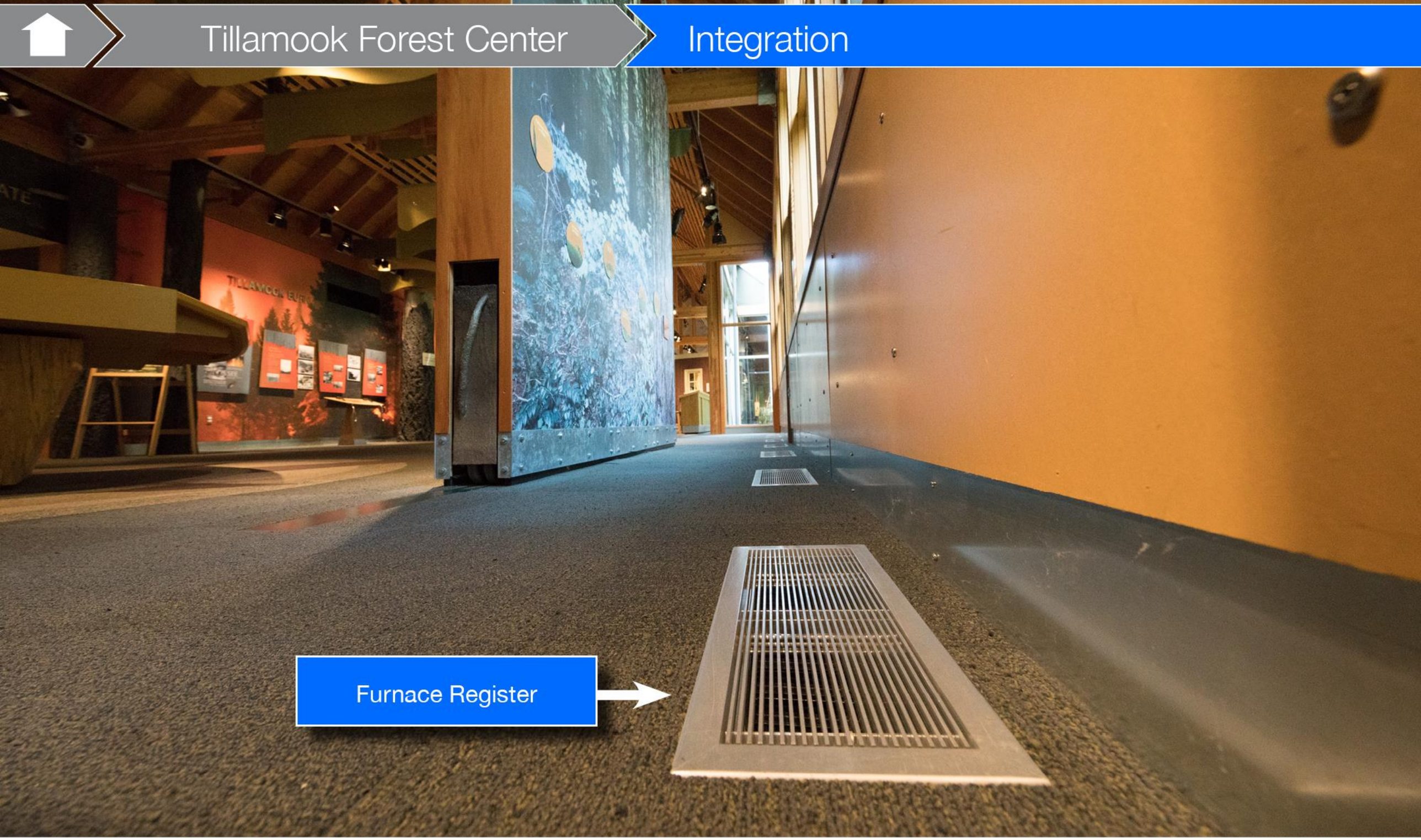
Boiler System: The three TARM 136,500 Btu/h wood pellet boilers and related equipment take up about one third of the mechanical equipment room. The rest of the space is used by the air handling system, an air conditioning chiller that uses cool water from a pond in the front of the building, and a fire suppression sprinkler system that also uses treated pond water.



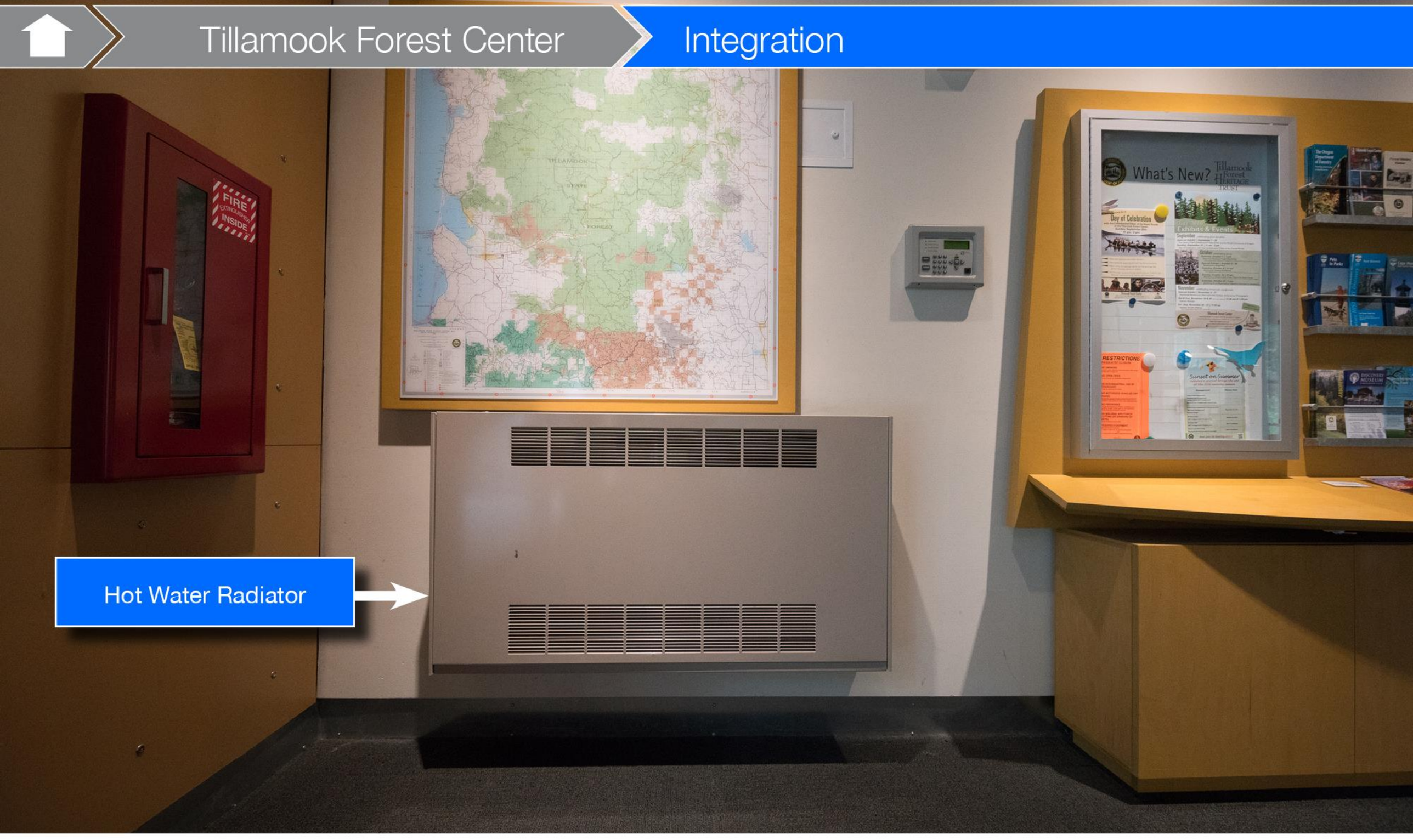
Connection: Heat is delivered to the building from the boilers using a combination of forced-air (like a furnace in a typical home) and hydronic (hot water loop) systems. A flat plate heat exchanger (center of diagram) is used to isolate the boiler water from the hydronic water loop that goes both to the fan coil unit inside the air handling unit. The three biomass boilers are the only source of heat in the building. There is no backup heat for the building.



Integration: The hot water distribution loop from the biomass boiler integrates with the building's domestic hot water (DWH) system through these two flat plate heat exchangers. If your building will have a forced-air heating system, be sure to have enough room for an additional heating coil that can connect to a future biomass system.



Integration: Heat for the main exhibit halls is delivered through forced air registers in the floor (like those found in many homes). Forced air heating systems do double-duty—delivering heat and fresh air.



Integration: Offices, rest rooms, and the entry area (above) are heated with hot water radiators like this one. The many independently controlled zones throughout the building provide flexibility to deliver heat only where it is needed. On days when the Center is closed to the public, individual offices can be heated without having to heat the entire building.

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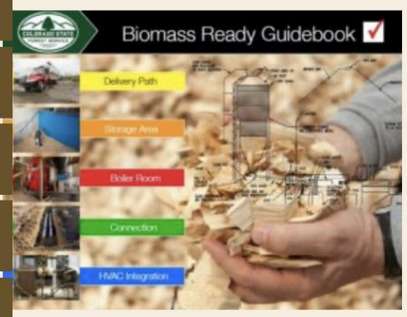
Bioready Worksheet

Phone: (970) 247.5250 | Email: tim.reader@colostate.edu

Download the Biomass Ready Guidebook!



1

Choose an existing project from the list of representative community biomass projects working today. Pick a project with maximum heat demand that is in the general

Open “https://biomassready.org” in a new tab

Biomass Ready App

Biomass Ready is a quick and easy process to help teams design new community buildings that can better adapt to an uncertain energy future.

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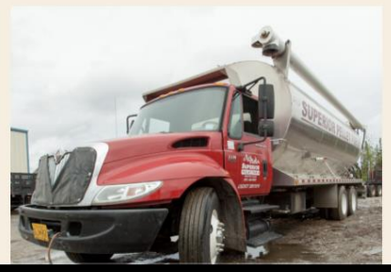

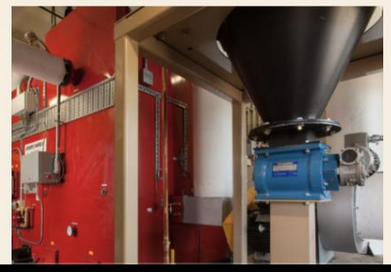


The tool will automatically show you the key Biomass Ready Parameters and create your five Biomass Ready Design Challenges. The heat capacity of a biomass system doesn't dramatically impact the footprint of the facility – so an exact match isn't needed..

0%

3

Work with your design team to create a Design Response for each Challenge.
Briefly document your Design Response inside this tool and on your construction diagrams.

Clear Form Data

This tool is designed to not take too long but if you take a break, shut down your computer, need to go to lunch etc., without completing your analysis, your data will be stored and you can return to your Biomass Ready Analysis as long as it is on the same computer in the same internet browser.

Describe

Project Name

Project Description

biomassready.org

Bioready Worksheet

1.) Describe | 2.) Similar to | 3.) Delivery | 4.) Storage | 5.) Boiler | 6.) Connection | 7.) Integration | 8.) Ready

If all five Design Responses require no major deconstruction, then your project is **Biomass Ready**!

0%

5

Even if adding a biomass system will require extensive deconstruction or demolition, at least you and your team will have made informed design decisions. An informed project is **Biomass Aware**.

Similar to

Example Projects*

Tillamook Forest Center, OR

Space Heated: 12,100 sq. ft., Boiler Size: 0.410 MMBtu/h Storage: 64 sq. ft. (8’ x 8’) Boiler: 280 sq. ft. (20’ x 14’) Read About Tillamook

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Delivery

Show on your construction document how a truck of class 34′ Roll-off Truck might be able to deliver wood fuel to your storage location.

Supporting Documents

Reference doc name and/or page #

✓ Edit Truck Size?

Your Strategy

Open #delivery on this page in a new tab

biomassready.org

Bioready Worksheet

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Open #storage on this page in a new tab

Storage

Show on your construction document where a wood fuel storage structure with a footprint of 800 sq. ft. (32′ x 25′) could be built.

Supporting Documents

Reference doc name and/or page #

Edit Storage Footprint?

Your Strategy

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WERC

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Boiler

Show on your construction document where a biomass boiler structure with a footprint of 620 sq. ft. (25′ x 25′) could be built.

Supporting Documents

Reference doc name and/or page #

✓ Edit Boiler Room Footprint

Your Strategy

biomassready.org

Bioready Worksheet

1.) Describe | 2.) Similar to | 3.) Delivery | 4.) Storage | 5.) Boiler | 6.) Connection | 7.) Integration | 8.) Ready

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Connection

Show on your construction diagram where the heating loop that connects the boiler to your building would be buried.

Supporting Documents

Reference doc name and/or page #

✓ Change Connection Specs

Your Strategy

Open #connection on this page in a new tab

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Bioready Worksheet

1.) Describe | 2.) Similar to | 3.) Delivery | 4.) Storage | 5.) Boiler | 6.) Connection | 7.) Integration | 8.) Ready

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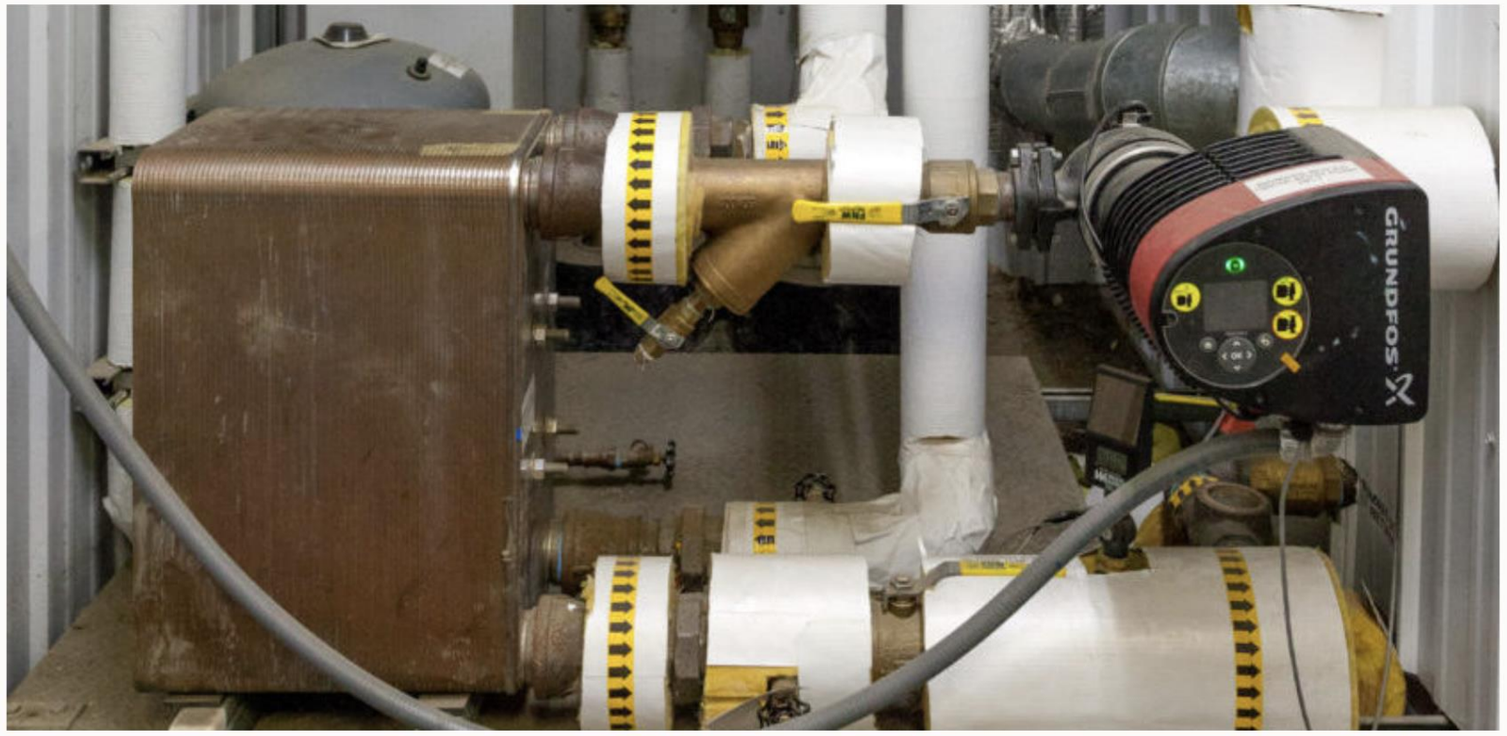
Integration



Your HVAC system is compatible with 180-degree hotwater loop from the biomass boiler.

Supporting Documents

Reference doc name and/or page #

✓ Edit Integration w/ HVAC

Your Strategy

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Ready

Project Name

Model Project

The "Tillamook Forest Center" model project

Delivery Deconstruction

None Some Extensive

Storage Deconstruction

None Some Extensive

Boiler Deconstruction

None Some Extensive

Connection Deconstruction

None Some Extensive

Integration Deconstruction

None Some Extensive

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