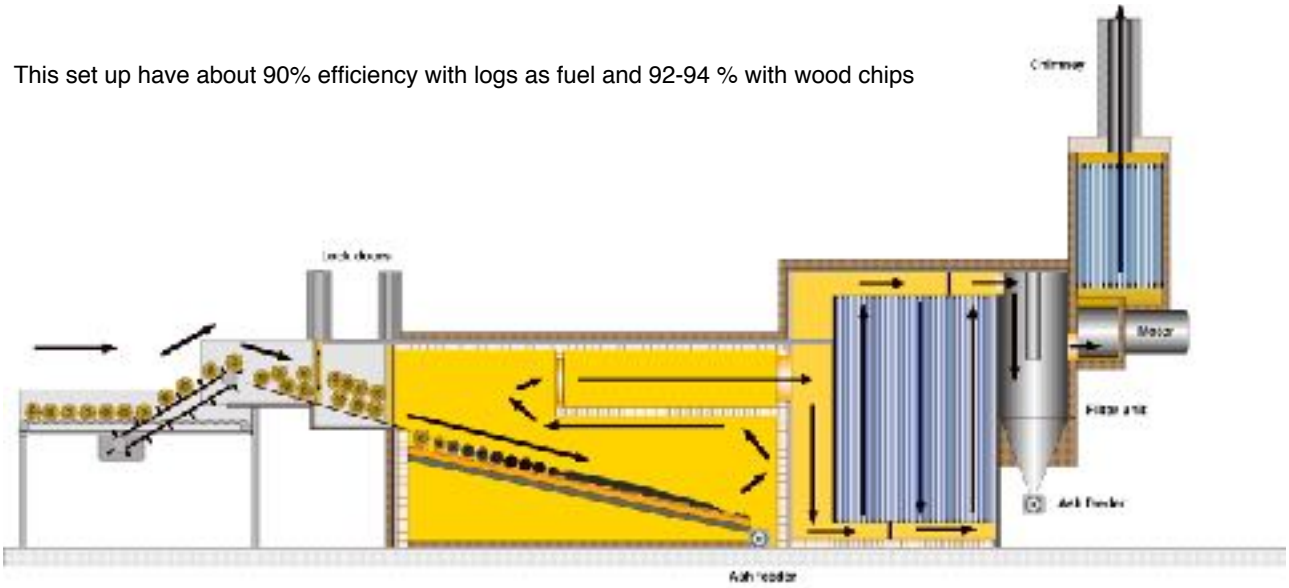
Sunnytek Solar Sweden

Steam boiler solutions for tea industry

This set up have about 90% efficiency with logs as fuel and 92-94 % with wood chips



Sunnytek & Partners are happy to offer a modern solution for boilers for tea industry. Here we explain our solution and give some back ground about what we have done and why.

Design anno 1830

Todays solution is normally based on the old Scotch marine boiler with roots since 1830. It was 80 years old when Titanic sunk with same type of boilers on board. This solution is simple and robust but for sure not a high efficiency design saving wood in a good way. When used with no economiser or energy recovery it is often a system with about 70% efficiency. If we also open doors whens we feed logs into boiler the intense cold air storm blow through boiler and cool it down a bit extra. 5 minutes with open door dropped 1 Bar in pressure of a boiler and at same time smoke pout of chimney was much darker. There is no doubt this is not suitable technology for future demands.

Tomorrows solution is what we now introduce is based on technology used in Scandinavia för over 30 years in all heat centrals we use for district heating during our cold winters. Totally several hundred systems are installed with a similar design off boiler. Size is typically 2 MW to 20 MW so they are often a bit larger than what is needed here. Most boilers use wood chips or pellets / briquettes but log feeding is also possible or dual / triple fuel can be OK.

Modern demands needs best efficiency and lowest Life Cycle Costs all included. It also includes reduced smoke and exhaust gases and clear green thinking. Key is also reduced staff and more automatic functions and feed back. The solution we offer handle all these parameters in a far better way than earlier. Payoff time is also reasonable short so Life cycle costs are much better.

Boiler options and add ons are essential and when we look at system and not details we have interesting options that improve all a bit extra. One thing is how to make dry wood and reduce moisture in wood as much as possible. Here there is large room for savings in costs and environmental effects.

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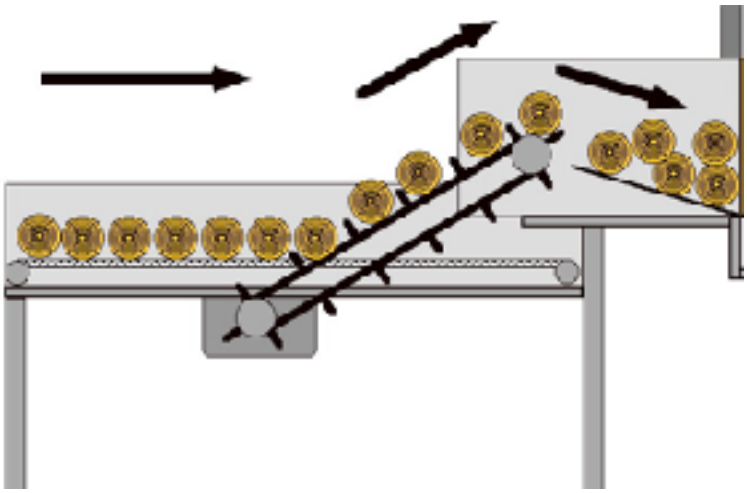
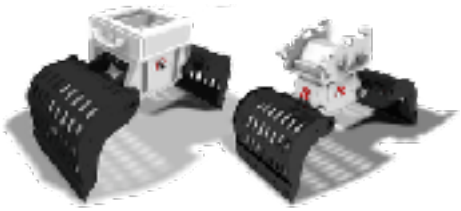
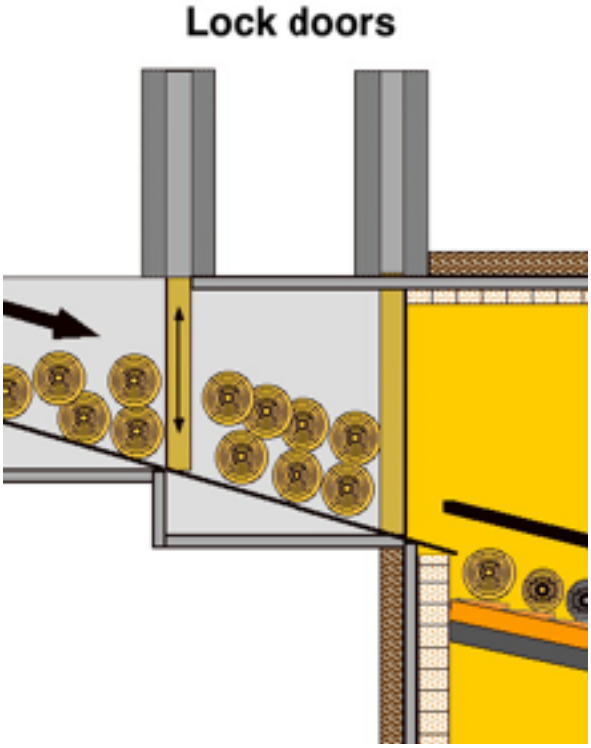
Our solution step by step





Section 1. Log table with separator. Logs are normally put on a table by a tractor with a gripper system. Here a separation unit sort out logs 1 by one and they are stored in a stand by position close to the lock door. Number of logs here is controlled and is preset. System is automatic and needs only the tractor driver to supply wood pieces. Alarm unit can send a signal by radio to tractor when magazine is getting empty.



Section 2. Lock system and boiler feeder. When we feed logs into boiler we open door 1 to the lock chamber and logs get into the lock area. The n door 1 get closed and sealed. After this we open the lock door 2 and all wood pieces fall down into to gasifier and fire place area inside boiler. Then lock door
is closed again. Doors seal boiler from atmosphere and the fans are not disturbed by a cold storm wind passing through the fire place. Cold air disturb balance in fire and often get smoke out of chimney. The cold air will also cool down boiler and reduce efficiency. Boilers are often feed with wood 2-3 times / hour and old boilers with open doors loose a lot of energy by this. Experts say 5% efficiency or more can be lost in the boiler.
Our solution save the power and also labor as it is highly automatic. Functions are controlled boy the PLC unit.

Option is to log weight of logs into boiler and moisture content to have feed back of process. If this is compared with steam output we can see disturbances in boiler and find problems. Fine tuning can save large costs per year.

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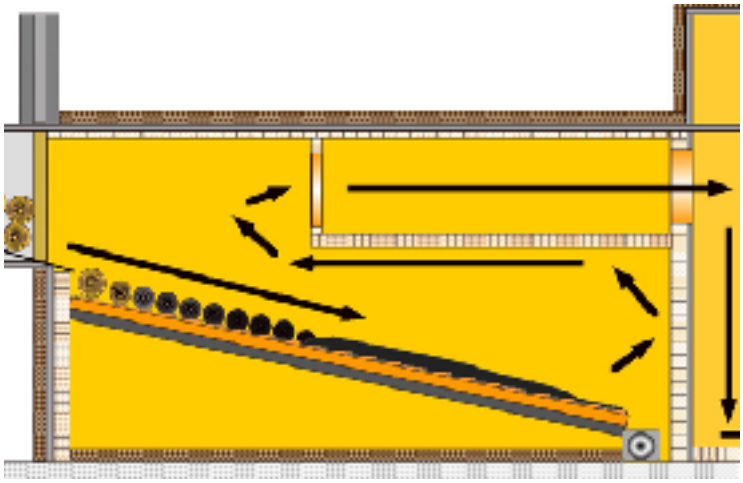
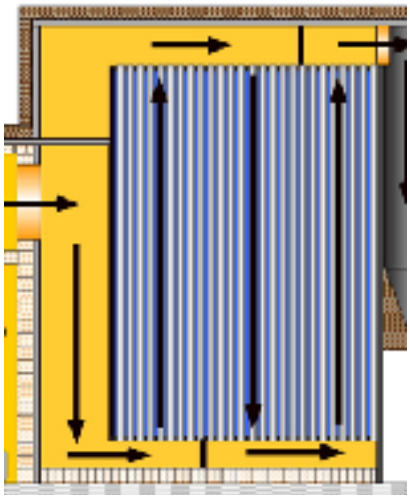
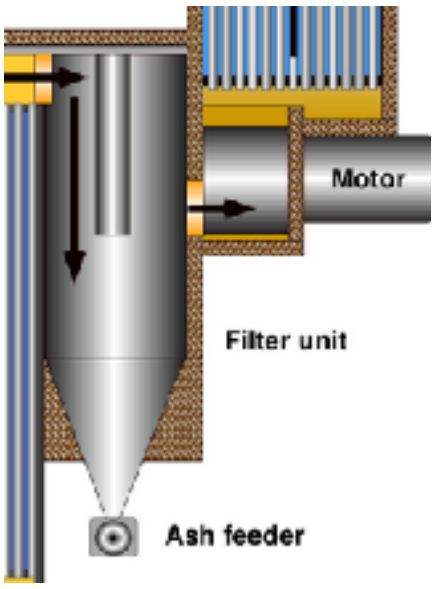


Section 3. Fire place / gasifier unit is the heart of the boiler. This is an area totally covered by ceramics bricks that can resist intense heat and also insulate to keep temperature as hight as possible. As we have a flow of air with oxygen and a good thermal insulation fire get very hot and efficient. Here we burn logs to very low volume of ash and remains are very small. The high temperature reduce exhaust gases and smoke a lot and bolder can fulfil new European demands in green classifications.
Old generation of boilers have cold steel surfaces direct in contact to flames and close to wood making burning temperature much lower. This reduce efficiency a lot and give much more smoke when burning. Start up time is also shorter of the entire boiler.



Section 4. Boiler section with a tub package to collect heat from all hot gases. The gases are very hot (1000-1500C) from fire place and here a multi tubular design connect heat from gases. Walls are in some cases 2 side walls with water jacket also work as heat collectors. System pass through section in a zig zag way to remove as much a possible of all heat.
There is an option with automatic sweeping to keep boiler surfaces clean . This can operate without turning system off and is infrasonic. All surfaces are well insulated to keep heat inside and have a protection shield in steel at surface.



Section 5 Filter section can be touted between bolder and economiser or after economised depending on design and what is best. All boilers have a filter unit that remove particles in gases and get al soot away. Particles fall down and is removed by a transport screw. Booth soon from fire palace and filters are transported to a cowered container to keep dust away and area clean.
Boiler ventilation fans are often mounted between filter unit and the economiser unit and handle very hot gases.

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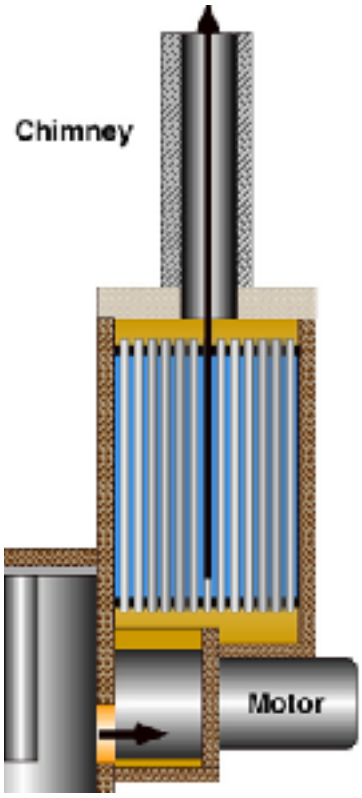
Section 6 Economiser unit is a heat exchanger taking a large part of remaining energy out of gases. This is normally aa tubular design where hot gases pass through tubes or reverse and heat is transmitted to the water. Input temperature is in area of 200-300C from boiler and out of economiser we have 110-170 C depending on design and use of boiler. This unit squeeze 5-10% extra in efficiency out of the boiler system.



Tea factories are here a bit unique as there is a demand for lower temperature hot water in process. By this renown e can add a extra module or make a system with extra low temperature.
Withering process is happy to have water 50-70 C hot. If so the fans can work shorter time and this saves lots of electricity. As you know fans in withering is by far the largest consumer of electricity in a tea factory.

Option 1 ORC turbine. This is an add on that can be connected and use what comes out of boiler / economiser and convert the energy in hot gases to electricity and hot water in large scale.
ORC turbine have a heat exchanger at chimney and take energy here and convert to a hot liquid/ gas that expands in a special turbine with a generator. Here we can convert 10-12 % of heat to electricity and about 85% to hot water. ORC can operate 20-40 K hours with no service of turbine unit. Typically a 4 ton boiler will give about 100KW in electricity and 800 KW in hot water at 50C temperature.
If we say it is used 7000 hours per year and cost is like in Kenya about USD 0.15 / KWH one boiler with generator will produce electricity for about USD 105000 / year. This makes the ORC system to have a short and good pay off time and Life cycle cost.

Option 2 Processing of wood to lowest possible moisture content. Making fire by water is not very smart so dry wood is very important. We have checked several factories and some use wood of 40-60% moisture in wood when they feed boilers. This can often be over 20 tons of water / day converted to heat which is very bad business. Sunnytek & Partners offers several solutions and an education package how to dry wood in a good way.
We have a special paper about these products and what we offer for our customers of boilers and energy concepts.

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Reference photos of wood boilers in Scandinavia.

Right side. 4.5 MW wood boiler in Norway with gasifier unit at left side and the boiler unit at right. This is a cylinder design boiler with 3 passages.
Next photo shows fan system with its engine.

Tubes with the very efficient Rockwool insulation systems that save heat inside boiler and not in the boiler room

Boiler room for a large 16 MW boiler in Ekenäs. This have a water jacket boiler room and plenty of tube sto collect all heat.

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