



# IMPORTANCE OF BIOMASS PELLETS

# INTRODUCTION

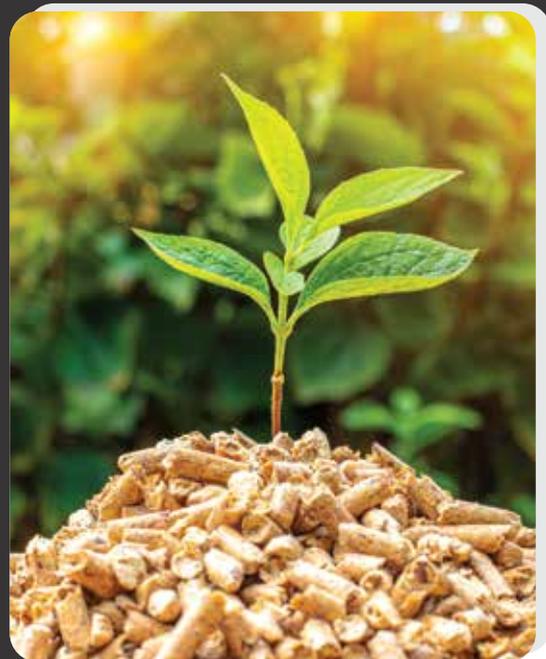
- Pakistan generates a significant amount of agricultural waste annually.
- According to a report by the United Nations Development Programme (UNDP), Pakistan produces around 50 million tons of agricultural waste each year.
- The waste includes crop residues, such as wheat straw, rice husk, and sugarcane bagasse, as well as animal waste, such as manure and poultry litter.
- Agricultural waste can be a valuable resource if properly managed and utilized. It can be used as a source of renewable energy through the production of biogas or biofuels.
- Unfortunately, 90% of this waste is currently burned or left to decompose, causing air and water pollution that contributes to greenhouse gas emissions.

# PROBLEM STATEMENT

- Farmers burn agricultural waste, such as crop residues, straw, and stubble, which can lead to emissions and air pollution.
- Burning of these materials releases a range of pollutants into the air, such as carbon monoxide, nitrogen oxides, and volatile organic compounds which negatively impact the environment and human health.
- In addition, these emissions can contribute to climate change by releasing greenhouse gases into the atmosphere and also contribute to air pollution resulting in hazardous smog and fog.
- This project will help the farmers to utilize the huge piles of biomass by converting them to 'biomass pellets' which is a reliable, more sustainable, and renewable source of energy. In addition, they can generate higher profits at a lower cost due to bulk availability.

# WHAT IS A BIOMASS PELLET?

- Biomass refers to the organic material that comes from living organisms (plants and animals) and is an efficient energy source.
- A biomass pellet is a small, cylindrical solid fuel made from compressed biomass materials, such as sawdust, wood chips, straw, and other agricultural residues.
- Biomass pellets are typically around 6-10 millimeters in diameter and 10-30 millimeters in length, and they are denser and more uniform in size than the original biomass materials.



# WHY THERE IS A NEED FOR BIOMASS PELLETS IN PAKISTAN?

## Renewable Energy Source

Made from organic materials that can be replenished naturally which makes them an attractive alternative to fossil fuels.

## Carbon-neutral

Burning biomass pellets releases carbon dioxide, but because the plants used to create the pellets absorb carbon dioxide during their growth, the process is considered to be carbon-neutral making biomass pellets a more sustainable choice for energy production.

## Versatile

It can be used in a variety of applications, including heating homes and buildings, generating electricity, and powering industrial processes.

## Easy Storage and Transportation

They can also be easily transported and stored, making them a convenient option for energy production.

## Waste Reduction

Using biomass pellets can help reduce waste by utilizing organic materials that might otherwise be discarded, such as wood chips, sawdust, and agricultural residues.

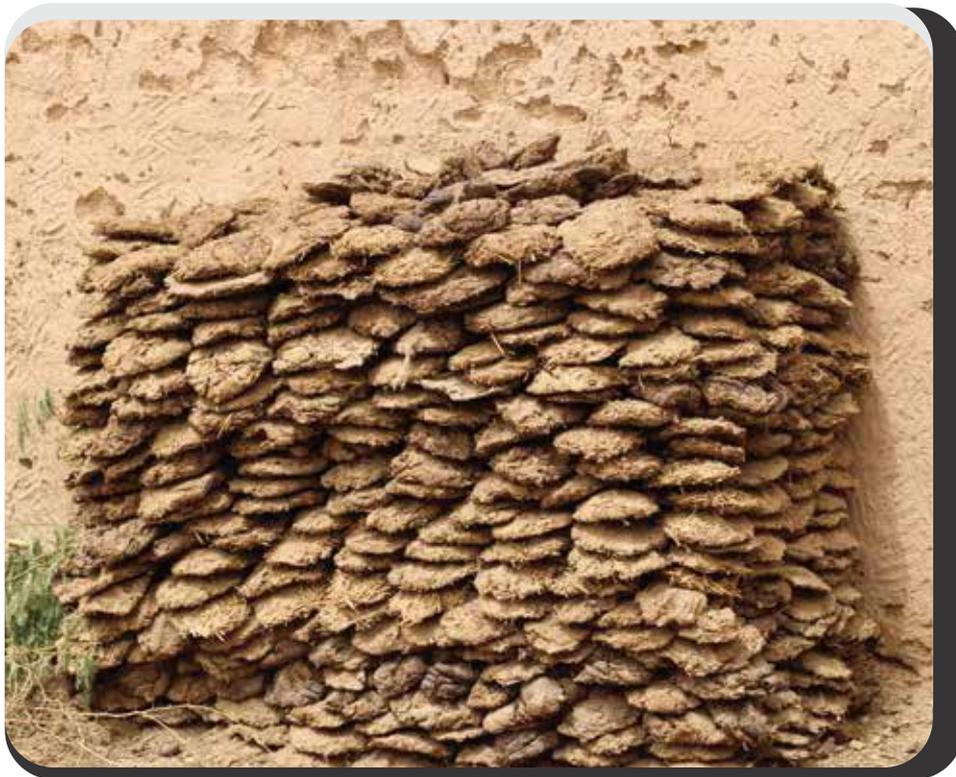
## Energy security

Biomass pellets can be produced locally, reducing the need for imported fossil fuels and enhancing energy security. Important for countries that are dependent on imported energy sources and are vulnerable to fluctuations in international energy prices.

# TOP 3 CATEGORIES OF BIOMASS

There are top 3 broad categories of Biomass namely Animal waste, forest waste and agricultural waste.

ANIMAL WASTE	FOREST WASTE	AGRICULTURAL WASTE
Cow dung	Sawdust	Corn Stalks
Horse Dung	Wood Chips	Baggas
Poultry Waste	Dead trees and Snags	Mustard Stalks
Cattle Waste	Dry Leaves	Rice Husk
Horse Waste		Pressmud
Sheep and Goat Waste		Wheat Straws



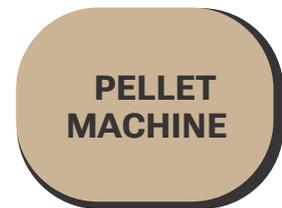
## PELLETIZATION PROCESS



- It crops Biomass into tiny particles



- It reduces the moisture content by 15-20%



- It compacts the biomass by 4-5 times and creates 8-10 mm pellets that is ideal size for burning in a furnace.

# TYPES OF BIOMASS PELLETS AND THEIR COST AND OUTPUT

- The waste product of Sugarcane industry
- Bagasse is available throughout the year (advantage)
- High Moisture content = 50% (after pelletizing the moisture content is reduced to 15-20%)
- If the Raw material cost is Rs 7/kg, after drying the cost of this Raw material will be Rs 11/kg due to weight loss
- Drying cost (Electrical + Furnace) = 2.5 Rs/kg
- The material in raw form will cost Rs 13.5 -14/kg
- Challenge/Root cause for Low production: After crushing – it is converted into small fiber particles which are stuck into pelletizing machine ultimately reducing the production capacity of the machine. For example, if the machine capacity is 1.5-2 tons/hr. It will give max of 800 kg/hr production.
- Calorific Value = 4000 Kcal/kg
- Steam Consumption in boiler = 180 kg/ton of steam
- Overall Cost to make a pellet (inclusive electrical cost + material cost + fixed cost) = Rs 22
- Total Steam consumption in boiler = Rs 4000/ tone
- Ash Content = 1.8%
- Maximum Production per day (considering 1.5 tones/day) = 16 tons/ day @ 20 production hours
- Due to being in fiber form, bagasse requires **high compaction dye** for increasing its bulk density
- Atmospheric Emissions:

TYPE OF EMISSION	PERCENTAGE EMITTED IN AIR
Carbon dioxide	1.8 - 2%
SOX & NOX	Nil



**HAMMER MILL**



**ROTTERY DRYER**



**PELLET MACHINE**

# MUSTARD STALK

- The mustard stalk is a raw material of mustard
- It's a seasonal product. Available from Mid-Feb to Mid April in Sindh. Available from March to April in Punjab
- Available in dry form
- Low Moisture content = 15-20% due to which we have less weight loss and reduced drying cost
- Converted to small fiber particles in the hammer mill but since it's in the dry form already, the hammer mill converts it into powder form
- Production capacity of the plant = 35-40 tons/day @ 20 production hours
- Calorific value = 3500 Kcal/Kg
- Consumption = 200 kg/ton
- Overall Cost to make a pellet (including electrical cost + raw material + fixed cost) = Rs 15/ kg
- Cost of Steam consumption in boiler = Rs 3000/ton
- Ash content = 3%
- Requires **High compaction dye**
- Atmospheric Emissions

Type of Emission	Percentage Emitted in air
Carbon dioxide	2 – 2.5%
SOX & NOX	Nil

# COW DUNG

- The waste product of dairy farms
- Available throughout the year
- High Moisture content = Almost 50%. High moisture content poses a lot of challenges as the cow dung gets stuck in the hammer mill so a specialized hammer mill has been designed for this.
- Raw Material cost is very less as its readily available in bulk quantity
- After drying and weight loss even, the cost of raw material is minimal which is around Rs 6.5/kg
- After drying, it's been converted to powder form so it requires very low compaction.
- Max production of the plant = 30-35 tons/day @ 20 production hours
- Calorific value = 3000Kcal. Since the calorific value is less, its consumption is 240 kg/ton
- Cost of production = Rs 2800/ton
- Overall Cost to make a pellet (including electrical cost + raw material + fixed cost) = Rs 12/ kg
- Ash content = 14%
- Atmospheric Emissions

Type of Emission	Percentage Emitted in air
Carbon dioxide	3 -3.5%
SOX & NOX	Nil

## HAMMER MILL

- It's a high efficiency machine that crushes down different raw materials into the desired form such as cow dung, sawdust, bagasse & rice husks.
- The raw material is moved from the trolley to the feeding conveyor belt of the hammer mill for crushing.
- It consists high RPM motor with metal blades.
- The blower segregates dust particles through a dust collector and then the raw material is transferred to a primary storage area.

## ROTARY DRYER

- The rotary dryer is the main component of the entire plant as it reduces the moisture content of biomass from 50% to 10%-20% to make it usable for biomass pellets.
- Wood fire furnace helps to maintain temperature to get the desired moisture.
- Raw material feeds into the rotary dryer through the belt conveyor from the primary storage area.
- After moisture reduction, the material is transferred to the secondary storage area for the pelleting process.

# PELLETING

- It's a final processing machine having a capacity of 1.5 - 2 tons/hr.
- Converts processed material into pelleting form.
- Having different dies for different raw materials and all dies having different compaction ratios.
- Its feeding starts from the secondary storage area through the belt conveyor.
- It requires a certain moisture percentage in raw material to convert into pelleting form.
- Formed pellets are ready to burn as per the need/ requirement.



# USAGE

## INDUSTRIAL SECTOR (COMMERCIAL)

In Pakistan, several industries are using Imported Coal and Natural Gas to fulfill their energy requirement. All these industries can utilize biomass pellets to generate energy.

- ✓ Power Sector for Thermal power plants.
- ✓ Cement Industry
- ✓ Iron and Steel Industry
- ✓ Textile Industry
- ✓ Pharma Industry
- ✓ Hospitality Industry
- ✓ And all such industries using Boilers for steam needs



## **DOMESTIC SECTOR (RESIDENTIAL)**

In Pakistan, Natural Gas is most commonly used in Homes for their heat requirements. In remote areas where gas connections are not available wood, LPG and kerosene oil are used as alternate fuels. With the introduction of Biomass Pellets as an alternate source, the depleting reservoirs of Natural Gas can be reserved while a good amount of Foreign Exchange can be saved by reducing RLNG use.

### **Domestic Uses of Natural Gas that can be replaced by biomass pellets are as follows:**

- ✓ Gas/Electric Stoves Can be replaced with Biomass Stove
- ✓ Gas/Electric Geysers Can be replaced with Biomass Geysers
- ✓ Gas/Electric Heater Can be replaced with Biomass Heaters

## INVESTMENT, ROI AND REQUIREMENTS

- ✓ 1.5 tons/h Biomass pelleting plant costs around 75 Thousand dollars
- ✓ Space Requirement: 1 Acre for two 1.5 ton/h production Lines - 0.3 Acre plant Space and
- ✓ 0.7 Acre Storage Area
- ✓ Electricity Requirement: 250 KW
- ✓ Per Month Production: 900 Tons/month
- ✓ Monthly Steam Generation: 4500 Tons
- ✓ Diff per ton of steam from imported Coal: PKR 3000
- ✓ Monthly Return: PKR 1.6 Mill @ avg 200 tons/day
- ✓ ROI on plant cost - 2 Months to replace 10% of fossil
- ✓ From this 1.5 – 2 ton/ hr plant, Direct Jobs Created: 29+ and Indirect Jobs Created: 10+

# CONCLUSION

## Milestones

- ✓ 1 Plant successfully running In Utopia Facility in Karachi for 1 month

## Testimonials

- ✓ Using these pellets in our boiler that is saving 0.45 million Rs per Day

## What's next/Way Forward?

- ✓ We need to setup 100s of such plants all over Pakistan



## Contact Us

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