Diversitec Ltd

# WILLOW FARMING AND BIOMASS HEATING

***BIOMASS*** **is any plant material, vegetation, or agricultural waste used as a fuel or energy source.** ***WILLOW*** **as a biomass is an excellent source of renewable energy (unlike our ever-decreasing supply of fossil fuels) and, when burning, releases much lower sulphur emissions, which contribute to acid rain. Fewer greenhouse gases are emitted, slowing down the effect of global warming.**

## SOURCE OF SUSTAINABLE DEVELOPMENT

**Producing willow as an energy crop contributes to sustainable development, as it results in the land and the farmers' skills and equipment, to be put to good use; protects jobs in rural areas; helping rural communities to remain viable.**

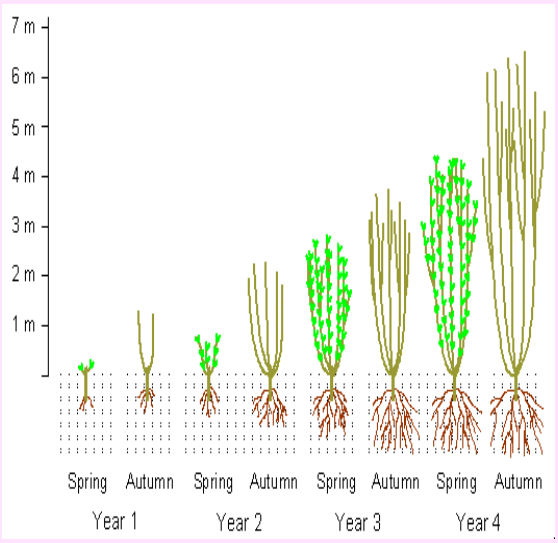
**Many rural areas are growing and experiencing increasing energy demand. However, building large power plants is not as desirable as the smaller facilities that have fewer environmental impacts and can operate with locally produced biomass fuel.**

## WHY WILLOW?

**Many types of biomass can be used as a source of fuel. However willow is almost certainly the easiest to produce:**

- **It is one of the fastest growing woody fuels in Northern Europe**
- **Can be grown with low inputs of agro-chemicals**
- **Is easily established from un-rooted cuttings;**
- **Re-sprouts vigorously after each harvest;**
- **Offers large potential for genetic improvement;**
- **Has an energy balance in the region of 20:1 (e.g. the energy obtained can be 20 times as much as the energy used to grow the crop);**
- **Can be used as a vegetation filter during "bio-remediation" of waste water or contaminated land.**

## HOW QUICKLY DOES IT GROW?

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# WILLOW FARMING PROCESSES

1. Land to be prepared as for a cereal seed bed, but cultivated more deeply.
2. Willow planted in spring using cuttings from one year old plants, usually around 20cm long.
3. New plants are cut back to ground level at the end of their first year to encourage the plant to produce multiple stems.
4. Harvesting occurs before February, prior to leaves developing, as they cause mould. Willow usually harvested on a three-year cycle.
5. Chipped willow is the most common form, however after harvesting it contains around 50% moisture, which needs to be reduced to 8% before it can be used to produce energy.
6. Wet chips quickly heat up and start to decompose. Much of the energy value may be lost, and mould spores are a health hazard, so good drying measures are important.
7. Ventilated floor driers are the most effective drying method. Drying takes up to four weeks using the ventilated floor method.

Planting

## ISSUES

- Rabbits can be a problem in particular areas and suitable fences may need to be erected
- Willow needs a moist site, but not too wet as this can make harvesting difficult
- 'Leatherjackets' are a common pest and insecticide is needed, however, moderate numbers of other insects have little effect on yield.
- Willow occasionally gets a disease called 'rust'. A strategy of planting several different varieties of willow per site helps to overcome this.

Harvesting

Growing

Gasification

# CONVERSION TO ENERGY

**The chipped willow can be supplied to a power station or biomass fuel trader or it can be processed for the farmer to produce power for himself or to sell as a value-added product, such as heat. This conversion to energy can be achieved through the methods of *combustion* or *gasification*.**

**COMBUSTION is a well established and most economical way of producing energy out of biomass. Heat emitted can be used directly, i.e. to produce hot water in a central heating system. Equipment ranges from small wood stoves used for domestic heating to large burners that can power whole communities such as hospitals, industrial estates and prisons.**

**GASIFICATION (heating with restricted air supply) converts solid organic material into a combustible gas that is generally used in a diesel engine or gas turbine. It is not economically viable to transport or store the gas, because it has a low calorific value in relation to its volume. The gas is normally used immediately, to generate electricity. This electricity can then be consumed by the farmer and any excess can be transported to the grid, where the electricity provider will pay per unit provided.**

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