Wispy willow makes energy winner

by Hugh Maynard

Ever wondered what could be done with that back 40 acres which hasn't been farmed since the last horse was retired? With fully one quarter of their farmland out of active production compared with 1950, so have the Swedes. Driven by the need for more domestically produced energy that won't add to environmental problems, this Scandinavian country is looking to the willow tree as one of the answers.

Sweden has committed itself to phasing out its 12 nuclear reactors by the year 2010. At the same time, it has banned any further hydro electric development and set maximum levels for emissions of carbon dioxide, nitrous oxide and sulfur dioxide from the burning of fossil fuels.

Enter big-energy, the production of energy from vegetation. Coarse grains such as corn and barley can be grown and processed to produce ethanol, a clean burning substitute for gasoline. But what to do with less productive land that won't support ethanol crops?

Alternative

Enter the willow, and similar cousins with big-energy potential such as poplar and birch. Fast growing and environmentally friendly, the willow can be cut and chipped in wintertime, then fed to a furnace to produce heat, hot water and even electricity. Recent Canadian studies also show that the willow can be used to produce ethanol.

Lars Christensson has been conducting studies at the Swedish University of Agricultural Sciences in Uppsala on what is called "Short Rotation Forestry". Even with an energy value of only one third that of oil, the willow has so far shown the best promise and estimates are that the present 2,000 hectares planted to willow will reach 300,000 ha by 2015.

``It's harvested in winter after the leaves have dropped so we believe we are leaving a better soil than when we started" says Christensson.'He adds that as the willow grows, H takes back the $C0_2$ produced when previous plant material was burned, solving the air quality problem. The willow grows sufficiently fast so that H can be harvested every 3-5 years but will grow back from the stump, reducing the need to re-plant only every 20 years. Production levels have averaged 10-15 tonnes per hectare per year, equal to 4-6 tonnes of oil.

Still problems

The winter harvest period and productive use of marginal land makes the tree an interesting prospect as an alternate crop for farmers as well as providing a 'green' transition fuel as the world moves from a carbon-based to a hydrogen-based economy during the next century.

Christensson says that current research efforts are focussed on developing better harvesting equipment and solving management problems concerning weed control, frost damage, fungal disease and insect infestation. Wild animals such as deer and rabbits can also be a problem, attracted to the willow plantations for winter-time shelter and feed from the young shoots.

He is confident that these problems can be overcome and that aside from government support programs to encourage a switch over and establishment of willow stands, big-energy is at least a break-even proposition based on 1990 oil prices. The Swedes are anticipating one-time subsidies of 9,000 Swedish Kronas (5Kr=$1 Can) per hectare for switching over to big-energy production and 10,000 Kr/ha to assist with the establishment of stands.

Using 1990 oil price equivalents, willow big-energy would bring in 120 Kr per mega watt hour (mwh) of energy produced. Costs would range from 87-123 Kr, with the lower cost resulting from the use of improved harvesting machinery and techniques.

As long as transportation of the big-energy material is limited to 50 km from the field to the utilization facility, there is a profit potential of 1 ,500-2,000 Kr per hectare. These calculations were made prior to the Gulf Crisis and subsequent oil price increases, which will add more greenery to the willows' bottom-line.

It should also be noted that Swedish oil prices are twice what the current rates are in Canada and that the cost of living is considerably higher. While the startup subsidies may seem extravagant after direct conversion into Canadian currency, the purchasing value the Swedish economy would be at least half compared to Canada.

Political effort

New systems are also needed to utilize the chips in an efficient manner, and that needs a political decision" says Christensson, referring to the other side of the new fuel equation. Some Swedish towns have central boiler systems, particularly for blocks of apartments. These supply heat through radiators as well as hot water and the expansion of such systems will be necessary to make efficient use of this type of big-energy.

Wood chipping for energy has been carried out on a limped basis in the state of Vermont and a lack of a distribution system would be the major drawback for implementation in Canada, which otherwise has big-energy potential from large areas of marginal land suitable for willow growth. Due to the bulk of wood chips relative to their energy value, they are not cost efficient when delivered to individual households for burning.

But with growing opposition to the Environmental impact of mega-hydro projects, electricity generation on a local or even regional basis from wood chips may be an alternative worth watching.