Wilwater project (2004 – 2007)

100 hectares of Short Rotation Willow Coppice

SRWC (Short Rotation Willow Coppice) is a perennial crop intended for energy wood production. The crop was introduced in Sweden after the oil crisis of the 1970s with a view to replacing fossil fuels with new energy sources.

Sweden now has 16,000 ha of willow coppice. In Europe, other countries such as Denmark, the UK and Belgium have also developed this crop but to a lesser extent and with the emphasis on the purifying properties of willow coppice for tertiary treatment of waste water or land application of sewage sludge.

In Brittany, the first experiments date from 1998. Willow grown as very short rotation coppice was selected from a number of rapidly growing species because it appears to be the most attractive compromise in terms of productivity, adaptation, cost and ease of integration into the existing energy wood system.

Two experimental programmes took place in Brittany prior to the WILWATER project:

- Experimentation from 1998-2001 on 13 ha distributed over 10 sites conducted by AILE to test the technical and economic feasibility of willow cultivation in Brittany.
- 5 ha planted in the locality of Pleyber-Christ with trials of land application of liquid slurry between 2002 and 2006, in conjunction with a wood boiler project to use the wood produced.

Financial partners of the project:

Technical partners of the project:

Wilwater objectives

The aim of the WILWATER LIFE Environment project is to demonstrate the purification properties of SRWC and the economic and environmental advantages of this purification method.

The programme involved 5 main activities:

- **Planting 100 new hectares :** It is important to develop a significant acreage of plantations in western France in order to reduce the mechanisation costs significantly and develop this system under acceptable economic conditions

> 100 hectares of willow have been planted in western France

> A number of application methods have been trialled :

Fertigation with pre-treated waste water
Sewage sludge spraying
Protection of the catchment area for drinking water
Other application methods.

- **Development of specialised production methods:** SRWC requires specific machines which are specially adapted to local conditions for planting, weed control, sludge spraying and harvesting. The suitability of a harvester for local harvesting conditions is assessed before any investment is made.

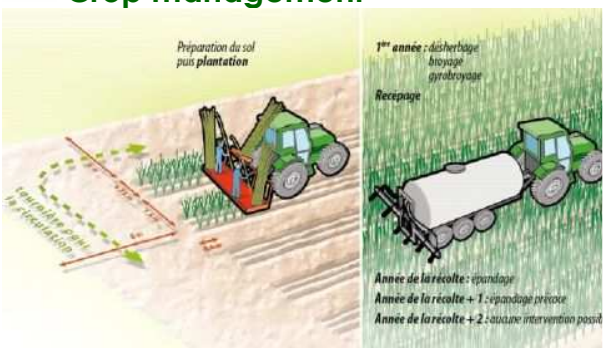
- **Monitoring the purification effect of willow:** Experimental equipment is located at each of the plantations with the aim of identifying the effect of the volume of sludge or effluent applied on biomass production and on the environment.

- **Validating the environmental and economic importance of the system**: The impact of the crop on the soil, water quality, fauna, flora, landscape and the greenhouse effect is evaluated as a function of the application level tested and the conditions at each site. The economic cost-effectiveness of SRWC is assessed for each type of application.

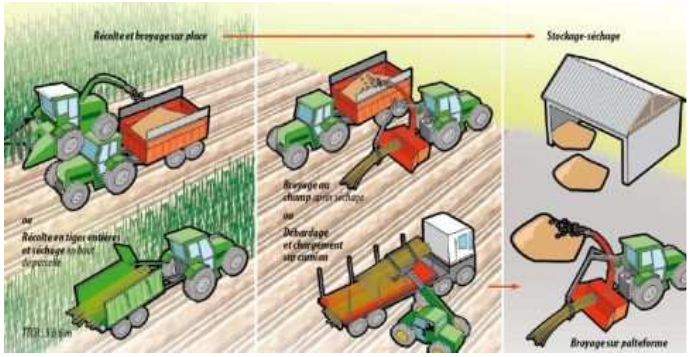
- **Experience sharing:** The results of this experimental project are disseminated so that the techniques can be transferred to other regions in Europe.

Main conclusions of WILWATER

Crop management



- Planting of specific cuttings in the spring, using equipment designed specifically for this crop.
- Maintenance operations, particularly weed control, are concentrated in the first and second years.
- Cutting the coppice back during the winter after planting



- Harvesting in the winter every 3 years using special harvesters
- Two harvesting methods (forage harvester and rod harvesting) are viable and may be selected depending on factors such as subsequent use of the wood as fuel and the type of plot (size, load-bearing capacity, etc).

Biomass valorisation

Willow wood in the form of wood chips is used in automatically stoked wood boilers: for individual, industrial and municipal installations (swimming pools, apartment blocks, hospitals, etc).

Main interests

Renewable Energy

The lack of maintenance operations after the first few years and harvesting once every three years give a satisfactory energy balance: for a yield of 8-10 t DM/ha/year, the energy produced with the harvested woodchips is equivalent to 32-34 times the energy input for the crop.

The use of willow chips as fuel avoids emissions of greenhouse gases (12 tonnes CO_2/ha/an).

Wastewater or sludge valorisation

The high evapotranspiration capacities and perennial root system of SRWC give satisfactory results for tertiary treatment and water quality protection.

Willow absorbs no more nutrients than an annual crop but with less intensive management. The amount of land required for application of sludge is not reduced through the use of willows.

Biodiversity

With its permanent soil cover and spaced cultivation operations, SRWC increases biodiversity compared to annual species.

Particular care should be taken not to establish plantations which could compete with areas of special interest or create conflicts of use.

Landscape

SRWC looks like a crop (long, vertical, aligned stems), the height of which varies over the three years of the growing cycle. In "bocage" landscapes it adds little in terms of visual impact. On the plains, it can help to recreate diversity and limit opening up of the landscape.

Main conclusions of WILWATER

SRWC key costs

	Low hypothesis	High hypothesis
Planting SRWC *Soil preparation, planting, weed control, inter-row cutting, cutback*	**2 300€ excl tax/ha** *Includes 1800€/ha planting costs (cuttings+planting)*	**2 800€ excl tax/ha** *with soil improvement, pest control, post-emergence weed control*
Effluent application (1 - 2 times in 3 years)	**180€**	**480€**
Harvesting of willow (every 3 years) (€ excl tax/ha) *Harvesting (STEMSTER), chopping, transport to barn*	**850€ excl tax/ha** *Optimised harvester utilisation over 200 hectares per year*	**1 800€ excl tax/ha** *Current situation*
Annual cost of the crop over 20 years		
with effluent application	**424€ excl tax/ha/year**	**824€ excl tax/ha/year**
without effluent application	**370€ excl tax/ha/year**	**680€ excl tax/ha/year**
Cost of wood **storage** (25% m.c.)	**6€/t**	**36€/t**
	Agricultural barn for reprocessing	*New hub without subsidy*

Further development

Harvesting costs represent a key factor in the economic balance of all the projects. To date, the increase in planted area has made it possible to acquire a harvester in accordance with the objectives of the Wilwater programme but has not yet enabled an evaluation of the harvester at full capacity. The harvesting costs therefore remain high but will decrease with SRWC development.

The diversity of the projects and uses of the willow crop makes a generalised economic assessment difficult and depends largely on the alternatives available in each specific instance. Currently, only systems which combine a number of economic benefits and/or environmental synergies are likely to develop :

- **Energy independence in agriculture :** farmers with land available and who accept municipal sludges. Home consumption of the wood for the farmhouse or livestock housing is the best use of the wood.
- **Water protection :** on a farm on the banks of a watercourse or the break of a slope. This system is only suitable for land with a high load-bearing capacity.
- **Local municipality project :** combining land application of sludges and local energy production.
- **Tertiary treatment :** industrial or municipal systems with no ability to discharge at low water periods and with land close to the treatment plant