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**Bryncynon Strategy Community Biodiesel Report**

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Client: The Fuel Factory (Arts Factory, Bryncynon Strategy)

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## **Bryncynon Strategy Community Biodiesel Report**

### **Executive Summary**

Fuel Factory is a social enterprise set up in 2008 by a consortium of development trusts in the south Wales valleys region. Its purpose was to develop a network of community biodiesel pumps hosted by development trusts in order to:

- Produce biodiesel sourced from waste vegetable oil to supply community pumps
- Use profits to underpin core social aims
- Raise awareness of man made climate change and peak oil

One of the consortium members, Bryncynon Strategy, began to host Wales' second community biodiesel group in February 2008 following the installation of an 1,500 litre capacity armoured pump on its premises. Both technical difficulties and severe fluctuations in demand were experienced, as were some difficulties with sourcing reliable supplies of fuel.

It was found that in order to cover costs of fuel delivery and fuel filter purchase, it is necessary to add a minimum of 5p per litre of fuel sold. This was found to be a significant issue, as a higher price for biodiesel than mineral diesel acts as a major barrier to people purchasing it, leading to far lower volumes of biodiesel being sold than initially envisaged. As high prices for biodiesel look set to continue, it is difficult to envisage any community pump succeeding, let alone paying for itself in the long term. This suggests that the most viable model for the foreseeable future is a member run and operated scheme which allows members to purchase fuel without duty being paid. As the small margins gained from buying wholesale biodiesel for distribution are swallowed up by maintenance and delivery costs, currently the only viable means of financing a community pump is through grant funding.

These negatives notwithstanding, the pump has brought benefits to both the organisation, and those members who have stuck with the project out of an ethical commitment to reducing their environmental impacts. With global oil reserves peaking, the prices of forecourt diesel may once again rise to historical highs, perhaps leading to an increase of interest in biodiesel. While interested groups should think carefully before making a commitment to developing a community distribution outlet, it may indeed be the most cost-effective and sustainable solution currently available as it requires relatively small capital outlay and infrastructure.

## **Introduction**

This report was prepared for Science Shops Wales and the Fuel Factory Consortium by Ben Dineen, Sustainable Development Coordinator at the Bryncynon Strategy, in May 2009.

## **Background**

Fuel Factory is a social enterprise set up in 2008 by a consortium of development trusts in the south Wales valleys region. The purpose of the new social enterprise was to develop a network of community biodiesel pumps hosted by development trusts whose aims were broadly to:

- Develop a network of community pumps in the valleys region
- Produce biodiesel sourced from waste vegetable oil to supply community pumps
- Use profits to underpin core social aims
- Raise awareness of man made climate change and peak oil

The purpose of this report is to explore the experiences of Fuel Factory in developing its community pump, to evaluate the experience and to outline recommendations and lessons learned that will be useful for other community organisations or interest groups intending to do the same.

## **Biodiesel**

Biodiesel is essentially a non-fossil alternative fuel that is compatible with conventional diesel engines. It is produced with a process known as transesterification from a number of sources including virgin vegetable oils such as rapeseed or sunflower, or from waste cooking oil. Biodiesel is often described as being 'carbon neutral', due to the fact that it gives out the same quantity of CO<sub>2</sub> upon combustion as it absorbs during the life cycle of the plant from which it is produced. This interpretation is, however, flawed, as it fails to take into account the carbon cost of the fertiliser used to grow the crops in the first place, and the energy inputs required for its production and transportation. It is estimated, though, that even when taking into account the carbon cost of production, biodiesel can lead to a 90% reduction in emissions when produced from waste vegetable oil. Furthermore, biodiesel has significantly lower emissions of carbon monoxide, particulates, unburned hydrocarbons and sulphur dioxide than its petroleum equivalent.

Controversy still rages over biodiesel, particularly in relation to the growing of crops specifically for its production. These continue to have a deleterious effect on the proportion of land given over to food production, especially in the global south, the overall cost of staple crops, the increased landlessness of subsistence farmers working marginal lands, the depletion of aquifers and the ongoing destruction of virgin forests in places such as Indonesia to clear space for the planting of oil-bearing crops.

Nevertheless, there remains a space for the production and usage of biodiesel made from waste vegetable oil. This is a 100% recycled resource derived from crops originally grown for the food industry. As well as the obvious advantages of recycling energy, it also prevents oil entering the waste stream through landfill or through illegal dumping into drains or water sources. Fuel Factory made a decision from its inception to only source its fuel from recycled sources, and can thus satisfy itself and its members that the product they are using is both green and ethical.

## **Community Biodiesel**

The potential for community biodiesel pumps is strongly evidenced by the lack of distribution outlets in Wales. According to the website [www.biodieselfillingstations.co.uk](http://www.biodieselfillingstations.co.uk) there are currently only four operational distributors serving the whole of Wales. It is evident that, even were an individual to wish to reduce their emissions by switching to biodiesel, it would be almost impossible to do so unless they lived within reasonable driving distance of an established outlet. Community pumps provide a cost-effective means of supplying biodiesel that can also potentially afford a modest income to the host group.

Community biodiesel groups can, furthermore, create an opportunity to raise awareness of the impacts of climate change and peak oil and to support individuals and groups to take practical and achievable steps that contribute towards reducing emissions. They can also potentially contribute to more traditional community development goals of developing and strengthening local networks, and increasing social capital by promoting community participation and involvement.

The Fuel Factory pump in Bryncynon was the second community pump to be set up in Wales, the first being the pump established in St Davids in 2005.

Community Biodiesel pumps can be run using a number of models for operation. These include:

- ***Member run and operated***

A fully member run and operated pump, such as that in St Davids, functions through members paying in advance for the fuel they will require over the next period, in this case one month. Once an amount has been agreed and paid for, members, who hold individual keys to the pump are able to visit when required to fill their vehicles. A small margin is added to each litre of fuel sold in order to cover the costs of pump maintenance and delivery.

The group is collectively responsible for purchasing fuel, organising delivery, tracking sales and maintaining the pump.

Because of the fixed location of a pump, the group will need to find land with suitable access on which to site it. This may be more problematic in urban areas, especially where the security of the site is easily compromised.

- ***Hosted by parent organisation***

The model favoured by Fuel Factory at its Ferndale and Bryncynon sites; each pump is hosted on the premises of a community anchor organisation. The organisation takes on the responsibility of sourcing fuel, tank maintenance and repairs, managing the membership database and making sales. Again, the host organisation adds a small margin – 5p in the case of Fuel Factory – to the per litre price in order to cover overheads for operation.

Members are able to visit the pump during office hours only and fill their vehicles on a self-service basis having paid prior to filling. This model does not require pre-ordering by members – they are able to take the quantity they require when they require it.

A hosted pump is a better model for an urban area with a larger potential membership base. Its location on the premises of an organisation gives added security, and the ability of organisational staff to manage membership, organise fuel delivery and publicise the group is an advantage.

- **Distribution only**

A less high-profile model, but nonetheless one that operates in a number of locations: small, unincorporated groups of individuals collectively purchase biodiesel in large quantities (companies will only usually deliver 1000 litres or more), which are delivered to an individual's private address, and distributed among purchasers there. This model is naturally low-cost and requires little organisation, though there are issues around individuals' ability to store larger quantities of biodiesel in their homes.

### **Public Perceptions**

Biodiesel is still a relative unknown in many circles outside those with a strong affinity with environmental issues. Press exposure has in many cases been critical of the fuel, both from an ethical perspective (due to points raised above) and from a practical one. Many producers have set up illegally and have sold untested, badly formulated biodiesel to an unsuspecting public. This has resulted in a number of relatively high-profile headlines reporting on badly produced fuel gelling in users' engines and causing hundreds – and in some cases thousands – of pounds worth of damage.

The suspicion of biodiesel is further exacerbated by the intransigence of the majority of vehicle manufacturers, many of whom will not endorse the use of the fuel beyond 5% in any of their engines. While it is the case that most vehicles made between 1990 and 2004 can run perfectly well on 100% biodiesel in the summer months, this is not reflected in manufacturers literature, or on the advice of their call centres when contacted. This creates something of a vicious circle, as the legal, default position of a biodiesel supplier when questioned by a potential user as to the suitability of their fuel for a particular vehicle is to advise that the individual consult the manufacturer to seek clarification.

Furthermore, the vast majority of manufacturers state that the use of non-petroleum fuels in the vehicle invalidates that vehicle's warranty, which in turn acts as a disincentive to potential users with more modern vehicles.

Garage mechanics, both main dealers and independents, can represent another source of misinformation or suspicion regarding biodiesel, which can be damaging due to their perceived knowledge of vehicle mechanics.

Against this background it is essential that would-be distributors carefully consider a number of factors. These include:

- **Price**

It is highly unlikely that a potential new user will be tempted to try out a potentially risky fuel in their vehicle if there is not another incentive to purchase additional to that of lowering their personal carbon footprint. Fuel Factory determined from a very early stage that it would try to peg the price of its biodiesel at least at the level of forecourt diesel and, where possible, below it. As evidenced in the case study, price was the single, major incentive for users to purchase fuel from the Fuel Factory pump, and the volume of units sold was in direct correlation, both on the upwards and downwards curve, to the price relative to forecourt diesel.

- **Quality**

The perceived quality of the fuel is essential to both attract and retain users. People need to be reassured from the outset that the product they are putting into their cars

will not cause damage to the vehicle. In order to ensure the highest standards possible in its fuel, Fuel Factory has a policy of purchasing only from established suppliers who produce their biodiesel to the EN14214 European Standard for biofuels. This standard determines the purity of the product, as well as maximum limits for impurities, water content, cetane rating, etc. While it is reassuring to source fuel that claims this standard, it is also pertinent to note that the type of medium scale manufacturers who claim to produce fuel to EN14214 simply do not have the resources to test each batch due to the high costs of independent laboratory verification. They will instead produce one or two batches to the standard and then attempt to replicate it in subsequent batches. This in itself does not guarantee that all fuel produced is of the claimed quality, and caution should be exercised. Fuel Factory, for example, purchased a batch from a struggling manufacturer that turned out to have been far below the required quality, in spite of their claims to the contrary.

Obviously, one single bad batch is enough to damage engines and ensure that users switch back to fossil diesel on a permanent basis. Fuel Factory tries to mitigate against this eventuality by using the fuel in company vehicles prior to distribution to the general public.

- **Information**

Potential customers will naturally seek further information and reassurance from a distributor about the fuel. It is essential not to misinform people about potential problems with biodiesel, as such claims could spectacularly backfire. Fuel Factory will give informal advice on the types of vehicle for which biodiesel is suitable, but will stop short of informing people that their vehicles are fine with the fuel. Instead, people are directed to do their own research on the internet, where a Google search of *biodiesel + vehicle make and model* can often throw up useful anecdotal information from individuals who have used the fuel in such a vehicle for significant periods or over substantial distances. Potential users will always be advised to contact their manufacturer as a last resort, even when this could lead to that user taking the decision to avoid switching to biodiesel.

### **Case Study: Bryncynon Strategy**

Bryncynon Strategy began to host Wales' second community biodiesel group in February 2008 following the installation of an 1,500 litre capacity armoured pump on its premises. The group started with free membership open to all, and customers were served by Bryncynon Strategy staff members.

Price per litre was set at 91 pence, 5 pence of which was built in to cover the additional costs and overheads of running the pump. The pump also served the dual purpose of supplying Bryncynon Strategy's fleet of vehicles with biodiesel, which created a small income stream and allowed the organisation to report a significant drop in its CO<sub>2</sub> emissions as outlined in its Environmental Management System.

The time that the group came online was particularly critical, with forecourt diesel already costing £1.10 per litre and newspaper reports warning of exponential rises in the costs of fuel for the foreseeable future. By its peak in August of that year – when forecourt diesel in the local area cost £1.42 per litre – membership had grown to 50 individuals, with the pump supplying between 750 and 1,000 litres every week.

The volume of custom during this period forced Bryncynon Strategy into a rethink of how members were served. This was due to the additional demands made on the time of staff members whose contractual obligations did not stretch to filling cars with biodiesel. The organisation decided to switch to a self-service model with members required to pre-pay prior to filling their vehicles, at which point they were provided with the keys to access the pump.

The onset of a recessionary environment brought about by the credit crunch was to have rapid and negative effects on the group within a short space of time. As global financial speculators disinvested in oil in favour of safer havens such as the dollar, the price per barrel of crude started to drop as rapidly as it had risen, falling back to under \$100 per barrel within six months. The prices on the forecourt mirrored this peak, and a litre of diesel rapidly fell below £1.00.

While the price of biodiesel remained lower than that of fossil diesel throughout the majority of this period, the differential between the two gradually narrowed. Although the reasons for this are complex, one of the major contributory factors was the near monopoly held on waste oil collection and distribution by one multinational company. They had essentially pegged the price of waste vegetable oil to track the rising price of diesel, and so as one rose, so did the other, albeit with a lag. It appears that they also took the opportunity to decrease the margin on biodiesel at the same time, so as the prices rose the gap closed. When forecourt diesel reached its peak of £1.42 per litre in August 2008, the price of biodiesel, including the 5p margin built in, at Bryncynon's pump was £1.36.

As a result of the narrowing of the price differential the number of users decreased quickly. This was further exacerbated by the price of forecourt diesel dropping more rapidly than that of biodiesel, a situation that was made worse by the inability of a small pump with diminishing sales to sell old stock sufficiently rapidly to be able to buy new stock at lower prices. The group quickly found that for the first time the cost of its biodiesel was greater than that of fossil diesel from garage forecourts. As a result the number of members fuelling weekly from the pump dropped from C.50 to 10 - an 80% fall – with sales dropping to between 100 and 200 litres per week. It quickly became clear that the majority of users had switched to biodiesel for purely economic reasons rather than environmental ones.

The group took a further blow in the late autumn of 2008, when freezing temperatures coincided with a poorly-produced batch of biodiesel from the supplier to cause gelling of the fuel in the tank. Bryncynon's pump was not the only one to suffer this fate, with both Ferndale and St. Davids suffering the same problem. Indeed, the Bryncynon group was lucky that the fuel had gelled in the pump rather than in the vehicle of a member. As a result of this situation, the pump was out of action for a number of months, which naturally negatively impacted on both turnover and retention of members.

At the time of writing the pump is now fully functional, having swapped suppliers, and continues to supply both Bryncynon Strategy's vehicles and around 10 regular members with fuel. It currently retails at 98 pence per litre.

### **Publicity**

As well as advertising locally, through stalls at green events and through green networks such as Friends of the Earth, Fuel Factory also advertised its pump through two websites,

- [www.biodieselfillingstations.co.uk](http://www.biodieselfillingstations.co.uk) has an area-by-area search facility and is free to

- advertise on [www.petrolprices.com/biodiesel-companies.html](http://www.petrolprices.com/biodiesel-companies.html) also contains lists of local filling stations open to the general public.

Fuel Factory found that the majority of new customers signing up during the growth phase of its operations had found the pump through web searches leading to these two sites.

## **Economics**

Setup costs for a typical biodiesel pump start at around £1500 for a 1500 litre, lockable armoured pump, to £2600 for a 2700 litre version. This cost is exclusive of VAT and delivery, which usually costs around £300 for hire of a Hi-Ab truck, but includes the tank, outer casing pump, meter, gauge and delivery nozzle. Prices for reinforced plastic pumps are significantly cheaper, though potential groups should consider the security of the unit before they opt for this.

It will cost up to £500 to have an external pump unit wired in to appropriate safety standards by qualified electricians.

Delivery per 1000 litres of biodiesel costs around £30 from local suppliers, though these costs can be significantly reduced if the group is able to make collection themselves. A suitable van and reinforced plastic IBC container, plus submersible pump, will be sufficient to do this.

Ongoing costs include regular particulate filter changes. The filters, which prevent suspended solids from entering into the vehicle's fuel tank, cost between £10 and £15, and need to be changed every 1000 - 2000 litres depending on the quality of the fuel stored.

In order to cover costs of fuel delivery and fuel filter purchase, it is necessary to add a minimum of 5p per litre of fuel sold. This is a significant issue if the price of biodiesel is close to the price of fossil diesel, as a higher price for the former would act as a major barrier to people purchasing it.

## **Legal issues**

### **Storage**

There is currently no legislation in Wales that controls the storage of oil above ground, though it may be of use for groups considering setting up a pump to consider the Environment Agency's PPG2 Pollution Prevention Guidelines for above ground storage tanks.

The guidelines state that the tank:

- Should not be situated within 10m of a water course
- Should not be situated above roof level
- Should be sited on an impermeable surface that will not allow spilled oil to leach into the ground, and that is isolated from surface water drainage systems
- Should be double skinned to provide secondary containment of a potential leak
- Are protected against corrosion in the case of steel tanks, and contain drain valves to prevent frost damage

It is advisable to have a risk assessment for the tank in the event of spillage, and to store sand close to the unit to help with a cleanup should the need arise.

### **Taxes**

HMRC require biodiesel to be sold with reduced rate fuel duty and VAT paid if used as vehicle fuel, and as such it is necessary for a user group selling from the pump to pay the supplier at source. At the point of sale it is required to provide the customer with a receipt stating that fuel duty and VAT have been paid.

A legal loophole exists that allows a user to use up to 2500 litres per year of an alternative fuel without paying fuel duty if he or she is converting the fuel for use in a vehicle. So in practice that user is able to buy biodiesel for heating oil without paying duty, and then 'converting' the fuel by putting the biodiesel heating oil into their vehicle. This is only possible if the supplier does not knowingly sell the heating oil to a buyer in the knowledge that it is to be used as vehicle fuel. This frequently sees people filling containers directly from pumps in order to then pour the fuel from the container into the vehicle, as by doing so absolves the seller from any potential accusations of knowingly selling heating fuel as vehicle fuel. A community pump system operated through the host organisation model needs to pay VAT and fuel duty at source, so would not be able to sell at the lower price. A member run group, however, could quite legitimately purchase diesel for heating oil and then convert it as individuals.

### **Sales**

All pumps are required to prominently display a sign on the pump stating,

*“Not suitable for all vehicles. Please consult manufacturer”*

### **Technical Issues**

#### **Biodiesel**

- Due to its solvent properties biodiesel tends to break down carbon deposits in the fuel lines of a vehicle that has used petro-diesel up to that point. It is therefore necessary to replace the fuel filters soon after switching to biodiesel. Fuel Factory recommend a change after 300 miles
- Biodiesel produced from waste vegetable oil begins to gel at around 0-5 degrees celsius. Fuel Factory therefore recommends that its users blend their biodiesel at a 50/50 ratio with fossil diesel during the colder months. This blending can be done directly into the tank, and premixing is not required.
- A number of manufacturers will not warranty new vehicles for biodiesel use. Equally, some breakdown companies will not provide recovery services for vehicles that have broken down as a result of biodiesel use. Fuel Factory seeks to inform new members of this fact, and recommends that if in doubt members contact company representatives to discuss this issue before switching to biodiesel.
- Some vehicles made before 1990 used rubber fuel lines, which are corroded by biodiesel. It is recommended to check older vehicles to ensure that they are using plastic lines prior to biodiesel use.
- More modern vehicles, specifically those manufactured after 2004 contain high pressure fuel pumps such as the in-line or *pumpe deuse* models. Little is known about biodiesel being used at such pressures, and manufacturers are cautious about biodiesel being used in such engines lest it causes damage. They would not

recommend a blend of more than 5%, though a 50% blend is more realistic.

- The only vehicles to have been manufacturer approved for 100% biodiesel use are those of the Volkswagen group (Seat, VW, Audi, Skoda) made between 1990 and 2004.

### **Pumps**

- When ordering pumps it is essential to ensure that they are biodiesel compatible. Biodiesel's solvent properties and higher viscosity at low temperatures require the entire unit to contain specific components that will not be damaged or compromised by biodiesel use
- Pumps should have an universal filling valve rather than one of a specific gauge or bore. Biodiesel suppliers tend to deliver biodiesel through 1 1/4" rubber pipes, though this is by no means exclusive.
- Pumps should have a means of manually clearing sludgy deposits from the bottom of the tank
- Storage tanks should be double-skinned.
- Armoured units should have all components such as nozzles and metres stored behind a lockable door. For ease of use it is preferable that the pump nozzle and fuel delivery pipe is mounted on a retractable cylinder. The tank should also have a window gauge to assess levels of fuel rather than an electronic 'Watchman' system, as the aperture for the latter, and the ease of removing it, make it an easy access point for would-be thieves.

### **Conclusions**

As of the time of writing the cost of forecourt diesel is around £1.01 per litre. The cost of biodiesel from Sundance Renewables, one of Wales' two suppliers, was over £1.20 including VAT and fuel duty. This reflects the continued high prices of waste vegetable oil feedstock. These high prices look set to continue, and the introduction of the government's RTFO scheme will further mitigate against falls in the price due to the ending of the fuel duty relaxation on biodiesel.

In this climate it is difficult to envisage any community pump succeeding, let alone paying for itself in the long term. The high costs mean that the only viable model for the foreseeable future will be member run and operated, as this will allow members to purchase fuel without duty being paid. Indeed Fuel Factory intends to switch to this means of operation in the very near future.

The small margins to be gained from buying wholesale biodiesel for distribution mean that any excess generated above the cost of purchase will be swallowed up by tank maintenance, delivery, electric bills and the costs of new fuel filters. This in essence makes it impossible to recoup the original outlay on the tank and equipment, and thus ensures that the only viable means of financing a community pump is through grant funding.

The unfavourable price differential also means that it is impossible to incentivise potential users by offering prices lower than those on the forecourt. The effect this has had on the Bryncynon pump has led to very few new members signing up, and far lower volumes of biodiesel being sold.

These negatives notwithstanding, the pump has brought benefits to both the organisation, which has drastically been able to lower its emissions, and has been able to publicise these reductions as evidence of its commitment to sustainable development, and to those

members who have stuck with the project out of an ethical commitment to reducing their environmental impacts. It is also certain that with global oil reserves peaking, the prices of forecourt diesel will once again rise to historical highs, leading in turn to an increase of interest in a fuel which may again have become cheaper than its fossil equivalent.

The establishment of a community pump is an expensive and time-consuming process that will undoubtedly require grant funding to achieve. The volatility of the cost of biodiesel will also make growing a user group difficult in the current climate, and interested groups should think carefully before making a commitment to developing a distribution outlet. Currently it may indeed be the most cost-effective and sustainable solution for interested parties in communities to club together to buy biodiesel in bulk in a distribution only model. This will allow fuel to be bought cheaply, will not require the purchase or maintenance of capital assets, and will not require land.