

# Steaming into the Future

## The Case for Reopening the Canals

- by Andy Wilson

In the first issue of Sustainability, energy strategist Michael Layden wrote of the strategic importance of water-based transport in a fossil fuel depleted future. Until now, however, the history of Ireland's inland waterways has been tainted with the memory of failure. This contrasts strongly with the experience of many other European countries, where canals continue to play an important role in freight transport.

Some of Europe's earliest purpose-built inland waterways were in England, where the rapid expansion of the canal network in the 18th century was spurred on by the industrial revolution and the growing need to move goods and raw materials.

In Ireland, industrialisation did not occur in anything like the same extent, and the piecemeal building of canals that occurred from the mid 18th century onwards was done more in the hope of creating trade rather than as a consequence of it.



### Canals in Ireland

Although the Shannon, Bann and some other tidal rivers had been used sporadically by trading vessels since the Middle Ages, and the potential advantages of an inland waterway network in Ireland were acknowledged by the Irish parliament as far back as 1729, very little was done towards realising this aim until the building of the Newry canal in the 1740s.

This canal linked the port of Newry with Lough Neagh, from where there was access to the coalfields of East Tyrone. However, the poor quality Tyrone coal did not generate much trade. Instead, the Newry canal was used mainly for moving agricultural merchandise and imports. The creation of another canal to Lough Neagh in 1794, this time from the rapidly growing port of Belfast, took away much trade way from the rival canal to the south, and contributed to its eventual demise.

Meanwhile, new canals were being built to link Dublin with the Shannon. First came the Grand Canal, which was com-

pleted in 1804 and ran from the south side of Dublin to the Shannon near Banagher, Co. Offaly. Some 13 years later, the Royal Canal was built. Its path travelled through West Meath and Longford, reaching the Shannon near Tarmonbarry. Various side branches were added to both canals, including a link from the Grand Canal to Athy in Co. Kildare, where southward travelling boats could access the navigable part of the river Barrow and from there reach the port of Waterford.

On the Shannon itself, a number of un-navigable shallows and rapids were bypassed with short sections of canal, which allowed for the passage of boats all the way from Limerick to Lough Allen in Leitrim. Soon, ambitious plans to link Belfast with Limerick via the Shannon were being aired, and engineers were commissioned to survey the first section from Lough Neagh to Lough Erne. Construction work began around 1830.

Unfortunately, the project was a disaster from the start. The poor standard of works meant that the canal was dry for four months of the year. In addition, to cut costs, the locks had been built to narrower dimensions than locks on other canals, effectively ending the prospect of through traffic. Beset by financial difficulties, the canal opened in 1841 and functioned intermittently for about 20 years before being closed for almost a decade while extensive repair and reconstruction works were

carried out.

In 1846, work commenced on the Ballinamore and Ballyconnell Canal – a waterway joining the Erne and Shannon which would provide the final link between Belfast and Limerick. The canal was finished around 12 years later. Unfortunately, the Ulster Canal was to close only three years later, and by the time it eventually reopened in 1869, the Ballinamore and Ballyconnell Canal itself was falling into disrepair.

The canal network soon came under competitive pressure from the railways. Rail enjoyed many advantages, including a higher speed of conveyance and greater reliability. Canal passengers transferred allegiance to the railways, and a war of attrition began over the movement of freight. The railway companies, with their larger network, shorter journey times and larger capability for the movement of goods, held all the ace cards. Some railway companies even bought up canals with a view to removing competition from the market. Effectively, the canal era was over.

Although the inland waterways continued to be used for freight for another three quarters of a century, tonnage continued to decline. Apart from a slight resurgence of traffic during the two world wars, the canals served only a very minor role in the movement of goods across Ireland. By the late 1950s, almost all of Ireland's canals had fallen



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into disuse. Were it not for the heroic campaigning and restoration work on the part of the Inland Waterways Association of Ireland (IWAI), it is likely Ireland's canals would have disappeared for good (1).

## Reopening the Canals

One of the IWAI's first successes was the saving of the Dublin end of the Grand Canal from being incorporated into the drainage infrastructure of Dublin City Council. During the 1970s, work began to restore the Royal Canal. By 2007, almost all of the Royal Canal was open to traffic, and work is currently in progress on the final section linking the canal with the Shannon.

The passing of the Canals Act in 1986 transferred the ownership and responsibility of the canals from CIE to the Office of Public Works, heralding a new phase of activity on Ireland's inland waterways. A report on the future of the Royal and Grand Canals and the Barrow led to significant improvements in all three navigations. At the same time, a number of improvements were made to the Shannon waterway, with old locks and navigation channels being upgraded and the Lough Allen canal being reopened.

Meanwhile, a cross-border initiative led to the reopening of the Ballinamore to Ballyconnell Canal in 1994 under the new name of the Shannon Erne Waterway. The old canal was rebuilt to a very high standard and is now able to accommodate larger traffic than the Royal or Grand canals. The minimum width of 4.5 meters, depth of 1.2 meters and lock length of 24 meters would permit freight barges of up to about 100 tonnes in capacity. Although the canal is currently used exclusively by pleasure craft – mainly motor cruisers – the existence of a canal built to modern standards is undoubtedly a huge incentive for further restoration work and more canal building.

Reorganisation of the bodies responsible for canals on both sides of the border led to the formation in 2000 of an all Ireland administrative body, Waterways Ireland. In late 2007, the Irish State approved funding for the reopening of the western end of the old Ulster Canal from the River Erne to Clones. Surveys and feasibility studies have been also carried out on the rest of the canal. While there are some difficulties to overcome before the whole canal can be reopened to traffic, they are minor

compared to the original task of digging the canal out by hand in the 1830s.

## Future Inland Waterways

Many plans have been put forward at different times to extend the existing network of inland waterways. In 2000, waterways campaigner Fred Share suggested the building of a link between the Grand and Royal Canals west of Dublin between Sallins and Kilcock.

He also proposed a new route between the Royal Canal and Lough Erne, and the construction of a canal linking the Suir with the Shannon. His envisaged route from the Suir took an ambitious line through a gap in the Tipperary hills east of the Silvermines mountains, reaching 120 metres above sea level close to the town of Borrisoleigh. An alternative but lower level route that would require far less locks can be found north of Tipperary town via Golden, and would connect with the Shannon on the outskirts of Limerick city.

Share also favoured the building of a line extending west of the Shannon towards Galway city and the towns of east Mayo and although all of his proposals were framed principally with leisure craft in mind, they make perfect sense for freight too. The aim of any expanded waterways network should be to include as many of Ireland's principal centres of population as possible.

The addition of a number of link canals connecting the main routes would add hugely to the overall usefulness of an enlarged canal system, by reducing distances, eliminating bottlenecks and permitting individual sections of canals to be temporarily closed for repairs without shutting down the whole network (2).

## Cork

Unfortunately, the hills that surround Cork do not make for ideal canal building country, and any route connecting the city to Limerick would involve crossing the psychological barrier of 100 meters above sea level. Given that the lift on a typical canal lock is around 2-3 meters, the large number of locks required would make such a route expensive to build and slow to traverse.

However, the hilly country directly north of Cork could be circumvented by building a low level canal from Middleton to the Blackwater estuary near

# TRANSSPORT

Youghal and then improving the Blackwater navigation upstream as far as Fermoy. This would have the advantage of taking in a number of extra towns and increasing the potential for trade. From Fermoy, the obvious line follows the Awbeg valley as far as Buttevant, crossing the watershed southeast of Charleville.

Interestingly, plans to extend Blackwater navigation up from the tidal reaches near Cappoquin to Mallow were first mooted as far back as the 1750s, and in the early 1800s, a short stretch of canal was built on the Devonshire estate near Lismore.

## Containerisation

Michael Layden has proposed a novel solution to the problem of multiple locks on canals. Instead of – or possibly in addition to – staircases of locks, a support railway could be built to allow transfer for goods to rail where necessary. In the past, the logistics of unloading barges by hand would have killed this proposal, but containerisation has changed that.

The use of standard-sized containers in road, rail and shipping means that goods can be easily transferred from one mode of transport to another by crane. Accordingly, the envisaged future waterways network would include purpose-built docks and freight terminals interfacing with rail, road and key ports.

Viable inland-waterway networks are valuable assets in an energy-scarce future. Although canals may need rail support in order to negotiate specific geographical obstacles, barges can be run on a wide variety of fuels and energy sources, including steam (from biomass or coal), diesel, ethanol, electricity and even horse power. The choice of energy source could be made on a case-by-case basis (3).

## Direct Energy Requirements of Transport

Much research has been carried out on the energy requirements of different forms of freight transport. The unit of measurement used is MJ/Tonne-km (energy in Mega-joules required to move one metric ton one kilometre). Calculations take into account a number of variables, including the assumed ratio between average payload (weight carried) per vehicle compared to its



maximum capacity, the size of vehicle and the speed of travel.

Where barges travelling on inland waterways are concerned, the energy required for propulsion is roughly proportional to the cube of the speed of travel. At very low speeds, the amount of energy required per Tonne-km might be as little as 0.018 MJ. This figure is based on a horse pulling a 30 Tonne barge a distance of 36 kilometres in one day – not an exceptional feat in the days of horse-drawn barges. A slow-moving barge powered by an electric motor would require a comparably low amount of energy (Table 1).

The main obstacle to very-slow-moving transport at present is economic. A journey of 300 kilometres might take ten days or more, and even with a

200 Tonne train of barges operated by a crew of three, this works out at 30 person-days. This compares very unfavourably with the five person-days required to move five fully laden 40 Tonne trucks the same distance in one day. At present, because labour is much more expensive than fuel, there is little incentive to move goods by canal even were the infrastructure in place. Fuel-wise however, the trucks might require twenty times more energy than a slow moving barge train (Table 2).

Thanks to cheap and abundant fossil fuel energy, one *person-day* has a current value equivalent to approximately 3000-7000 MJ (1000-2000 kWh) of energy. As fossil fuels become more scarce, however, the labour-energy exchange rate will change and the canal will become the more viable option –

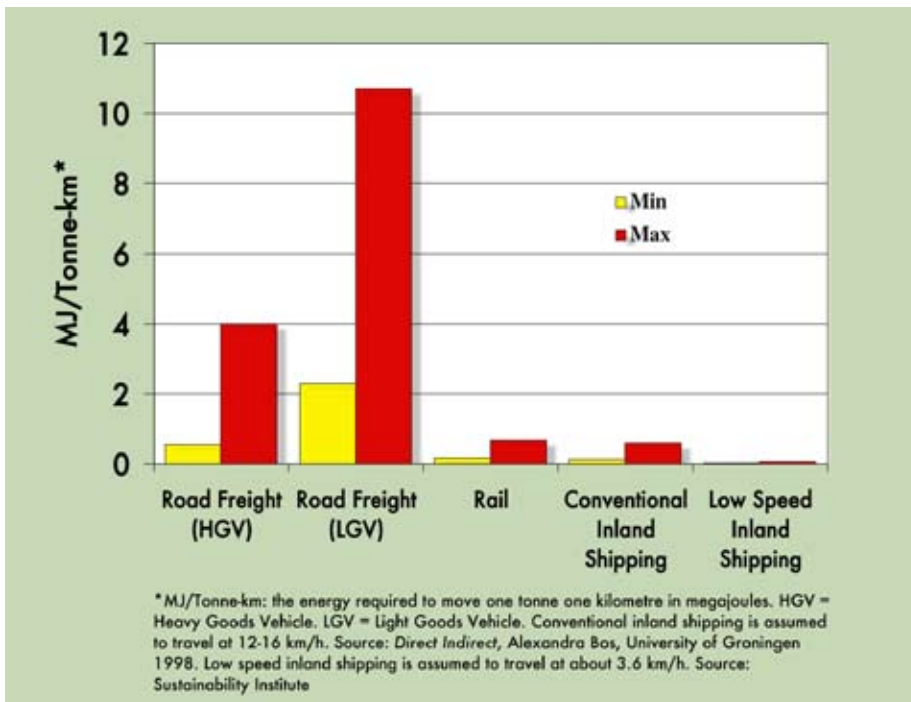


Table 1 - Direct Energy Requirements of Freight Transport

providing of course the energy investment in waterway infrastructure is made now while oil is still available.

### Fuel

Although most shipping on Europe's inland waterways relies on diesel engines, barges of the type suitable for Irish canals might be more viable if powered by electricity. A slow moving barge train of 200 Tonnes fitted with a battery bank just six times larger than ones used in a modern electric car would be able to travel the full length of Ireland, provided the batteries could be recharged each day.

The beauty of electricity is that the range of possible sources is very great, and barges could avail of off-peak energy surpluses or small, independent energy-storage facilities charged from local wind farms or biogas sources.

### Battery-powered Boats

The history of battery powered boats can be traced back to the mid 19th century. The real breakthrough, however, came in 1880, when Parisian engineer Gustave Trouve patented a 5-kilogram electric motor and adapted it for use on tricycles and boats.

Development of the technology was rapid: In 1882, an engine made by Siemens was installed in a craft built by the newly formed Electric Power Storage Company for use on the River Thames, and by the end of the decade,

many electric pleasure craft were operating along the river. Dedicated recharging stations were set up at strategic locations. The largest passenger craft built was almost 30 meters long and licensed to carry over 300 passengers (4).

Although the arrival of cheap oil in the early 20th century effectively killed off further development, in recent times, Solomon Technologies of the US has developed a 4 kilowatt high-torque electric marine motor called the Wheel. It will reputedly deliver as much instantaneous power as a much bigger 18hp diesel engine. While designed primarily to manoeuvre yachts into harbour, similar motors could have many applications on inland waterways.



### Energy

A study on the embodied energy of developing and maintaining various transport infrastructures by energy researcher Alexandra Bos reveals that for the same volume of freight carried, 45 percent less energy is required to maintain the Dutch waterway infrastructure than the road network.

Although the Dutch waterways include huge shipping lanes plied by steel-hulled ships carrying enormous tonnages, there is no reason to suspect the embodied energy of building and maintaining small Irish canals, per Tonne-km, would be significantly different. Certainly, the energy required to build a fleet of low-speed barges constructed from indigenous timber would be negligible (Table 3).

### External Costs

According to Inland Navigation Europe, the externalised costs of inland shipping are only one-third of rail and one-sixth of road transport. The costs referred to included greenhouse gas emissions, infrastructural impact, noise, accidents, pollutants and congestion. These figures are based on the European norm of large shipping vessels on major waterways and are likely to be even lower for low-speed barges on small canals (5).

### Employment

If the embodied energy of different transport infrastructures is any indicator, the building of new canals building would employ about one fifth of the number of the people required to build a similar distance of motorway. However, extra jobs could be created

	Energy per Tonne-km	Total Energy	Person Days	Current Costs <sub>2</sub>	Future Costs @ energy x 3 <sub>3</sub>
200 Tonne Barge -Train	0.036MJ	2160MJ	30 <sub>1</sub>	€4700	€5200
5 x 40 Tonne HGVs	0.8MJ	48000MJ	5	€2700	€6000

1 10 day voyage for captain and two younger crew on half captains wage  
 2 Transport based on diesel @ €1.20 litre and assumes such a journey is possible by barge  
 3 Assumes relative value of labour and energy change by a factor of 3:1

Table 2

through the building of tow paths and cycle-ways along the canals and the development of other strategic infrastructure such as solar photovoltaic panels on south facing embankments for the generation of electricity. Canal embankments could also be used for growing cob nuts, fruit or even vegetables.

As Ireland faces rising unemployment and a possibly prolonged and severe economic downturn, infrastructural projects that create employment and whilst simultaneously developing long term strategic assets are surely the priority.

## Leisure

Though many in the waterways leisure industry may have concerns about the development of Ireland's waterways for freight, the canal network can support both leisure and industrial use. Most of the waterways are currently closed at night, providing a readily available time slot for freight transport. Also, leisure use is mostly confined to the summer months, while freight transportation would occur year-round, and possibly mostly in winter. Issues of congestion along busy routes and at locks could be resolved by a strong communications system along the canals and by providing additional passing places and holding areas. Dedicated freight terminals could deal with freight craft.

## Two-Way Trade

In order for the waterways network to function most efficiently, freight transport should be fully loaded where possible. Michael Layden suggests barges could be used to transport processed sewage from the towns and cities for deployment on the land, as well as for moving food in the other direction.

The use of human sewage for fertilizer dates back to the earliest civilisations and is still widely practised in a number of African and Asian countries from which Ireland currently imports food. In many European countries, methane gas from municipal sewage sludge is used in power generation. The final solid product is sterile and completely safe from a pathogenic point of view. Processed sewage sludge is almost odourless and could easily be transported by canal (3).

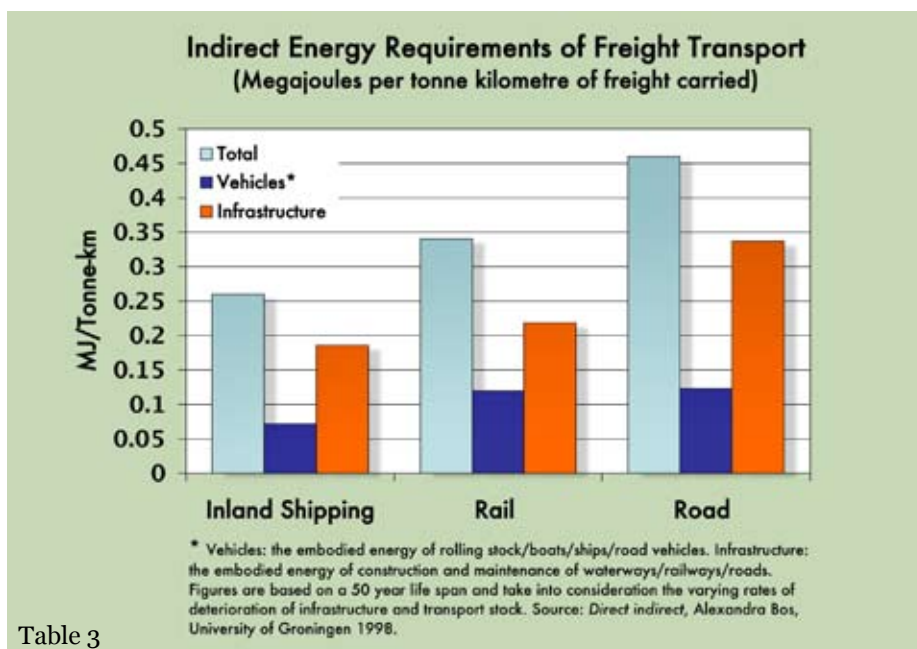


Table 3

## The Way Ahead

While the benefits of an enlarged and upgraded canal system in Ireland are self evident, the development of such an infrastructure still presents an enormous challenge. Vested interest groups involved in road haulage or that derive revenue from motorway tolls represent just some of the many barriers that must be overcome. Equally, the building of new canals should not be a green light for profiteers with political connections and insider knowledge to buy up land along proposed routes as occurred with Ireland's motorways.

Our inland waterway system is a wonderful resource that can and should be developed for the benefit of all. It is vital, therefore, that this development be systematic, transparent and environmentally sound.

The Sustainability Institute proposes to host a conference aimed at debating this issue in far greater depth later this year.

### Notes

- 1 Ireland's inland waterways: Ruth Delany Appletree Press
- 2 Irish Waterways Association of Ireland Newsletter Vol 27 No 2.
- 3 Michael Layden personal communication 2007/8. I wish to thank Michael for his many insights into water transport
- 4 For more on the fascinating history of electric barges, see [www.electric-boat-association.org.uk/history.htm](http://www.electric-boat-association.org.uk/history.htm)
- 5 [www.inlandnavigation.org/documents/Waternews/Publications/Brochures/INE\\_Environment.pdf](http://www.inlandnavigation.org/documents/Waternews/Publications/Brochures/INE_Environment.pdf)



## Infrastructural Requirements

These are just some of the infrastructural requirements needed in a viable inland water infrastructure:

Enlarged network with guaranteed minimum draught (depth) and lock dimensions based on the Shannon-Erne waterway specifications or better

The commissioning of strategic canal docks with road and rail links and appropriate lifting equipment for efficient transfer of containers

The building of dedicated facilities for the production and repair of barges

Indigenous production of electric motors and deep cycling batteries

Long term plantations of indigenous hardwoods for raw materials for barge construction

Development of new industries – especially those in need of bulk materials - on spurs of main canal network