UNE SEMAINE COP21 À ENSE^3

Les enjeux du changement climatique

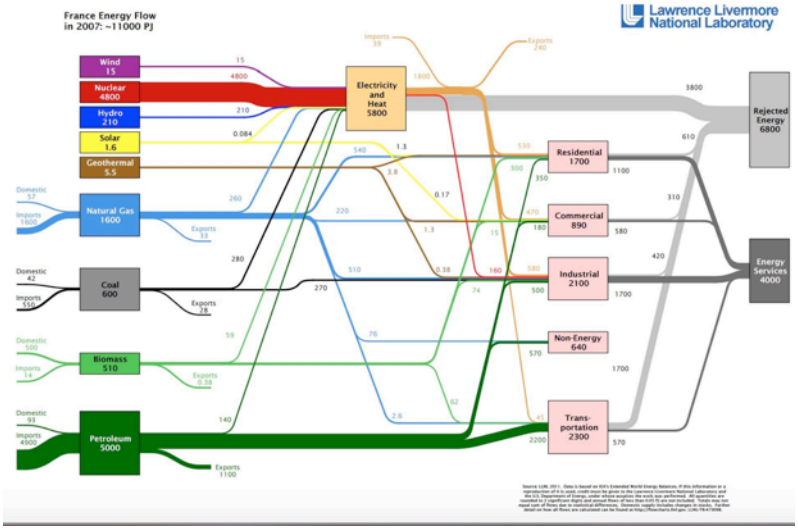
#climatechange
#COP21

Grenoble INP, ENSE^3, France, 5 October 2015

The Primary Engineering Requirement is to achieve the RCP2.6 Emissions Pathway

102 undergraduate Engineering students registered for seminars and a laboratory on Transition Engineering. The laboratory was a guided brainstorm exercise where teams focused their problem-solving creativity on ways to achieve the primary engineering requirement. The workshop started with a review of climate change and resource constraints. The population of France was relatively stable around 40 million for nearly a century, but has increased since the mid 1950's to 66 million today. The number of cars registered in France in 1960 was 5 million. By 2005 that number had grown to around 30 million, but then stopped growing over the past decade. Some data was presented showing that the biggest fossil carbon fuel use in France by far is oil, all of which is imported, and most of which is used in cars and trucks. France has a world-leading electric rail and public transportation system throughout the country. However, the rail system has been made private as in most countries, and the outcomes have been the same as in other countries – higher prices and reduced services. The massive programme of motorway building of the past decade has led to an increase in driving and the number of trucks hauling freight. Is using oil to drive cars and trucks a productive use of carbon? The current electric train and tram systems use 45 PJ of energy, while vehicle transport blows through 2300 PJ of energy from imported oil. France exports anywhere from $40-50 billion each year in cash for oil.

The French citizens enjoy riding cycles and much of urban landscape is walkable. In fact, most of the university students in the workshops did not own a car, and many did not have a drivers licence. Most felt that the congestion of cars on the roads and in the city was a detriment to the quality of life and to health.



The energy and climate change discussion in France has become focused on solar PV, Nuclear, Smart Grids and small hydro. While the long-term issues of nuclear power remain a

major inter-generational and economic challenge, the current climate crisis requires immediate reduction of oil use and a transition of the country's transportation system.

Case Study – No Parking: An interesting case-study was presented in the recent move of the ENSE[3] school from the main campus to the west side of Grenoble. In the main campus, 60% of the 2000 staff drove to work. At the new, state-of-the-art green building, there would be only 8 parking spaces. The staff were concerned about the change. A transition team worked with each staff member to explore their journey to the new building and help them to plan out how they would get to work using the tram, bus or cycle. In fact – all of the staff managed the transition with no issues. This case study illustrates the important roles of fact-finding, transition planning for change, and then applying hard constraints in order to achieve the required elimination of fossil fuels. It also illustrates the importance of *adaptive capacity* – having alternatives and the ability to continue to engage in essential activities without using a car.

Tram B stops in front of the ENSE[3]

Anne-Catherine Favre-Pugin and Susan Krumdieck

The students who participated in the workshop were most interested in food systems. Several of the brainstorm subjects involved food production, food processing, packaging, and closing the loop on the food waste and composting.

Transition le Supermarket:

Could a supermarket transition to using no fossil fuel? The project proposes to carry out an inventory, logistics, and modelling project to design a supermarket transition. The team imagined that the new supermarket would require a new type of sourcing and stocking system. It might be more like the open-air market on the weekends. The appeal of the supermarket system is the uniformity and predictability of products, and the variety that allows all the shopping to be one in one place at any time. These seem to be more likely to be conveniences afforded by the use of low cost energy than essential elements of a food supply system. In fact, for Europeans, the weekend market featuring local fresh foods still has great appeal. The oil-free transport for agricultural produce into the cities is the missing link that would have to be developed. It would all depend on where the agriculture was located. There are market gardens in the river valley around Grenoble that are actually cycle distance from the markets. The no-oil supermarket would probably drive agriculture toward more diversity rather than the monoculture that best suits the current consolidated chain model. The no-oil supermarket would actually need to be a whole new enterprise, with new relationships with consumers and producers. The team thought that it would be a good and challenging engineering project to design the no-oil supermarket from the ground up.

Food Without the Factory or the Fossil Fuel:

A study in the USA showed that as much as 10 calories of hydrocarbon energy is used to process and package every calorie of food. The team felt that the amount of factory manufacturing and packaging which is currently used is not essential, and is in fact reducing the nutrition and quality of many foods. The team proposed to study the factory processing, and the essentiality of consumer food products. The project brief is to design fossil-fuel-free supply chains for essential foods and suggest the retirement of non-nutritious, non-essential food products. In particular, design, organization and cost optimization of new ways to transfer the foods from the market to the home were envisioned. The team was not clear on all of the implications of the elimination of fossil carbon from the food chain, but it appeared from the brainstorm that many currently familiar product lines such as beverages in cans and plastic bottles, factory-made instant meals and many frozen convenience foods would be retired.

Transition the University Cafeteria Le Crous:

The school cafeteria is the main source of lunch for most of the students at the school, as there are few other cafes or shops in the vicinity. The project involved auditing and measuring the supply chain, menus, and the food waste from the cafeteria.

Low-Carbon Menu: Look at the menu of the cafeteria. Develop a new menu with local, seasonal ingredients, little or no disposable packaging, low energy cooking and clean-up. Would it be possible to have a solar kitchen facility where rice, lentils, chick peas, potatoes and other such slow-cooking dishes could be prepared on sunny days? It would be interesting to develop a modelling programme that allowed optimization of nutrition and minimization of supply chain and preparation energy, and to compare that to traditional foods.

Closing the loop for the student cafeteria: The team wanted to have a research project to explore on-site food production as a way to close the loop on the nutrient cycle. They envisioned that the food scraps would be collected and composted via a worm farm. A vegetable growing facility would be built on the roof, and the vegetables could be used in the cafeteria. The project would need to research the nutrients and growing requirements of vegetables, and the menus would need to be coordinated with the cafeteria. It would be interesting to compare a hydroponic system, understand the heat required for growing through the winter and if pollination is likely on the roof of a building, do bees look that high for flowers?

Too Much Consumption? – Look in the Closet:

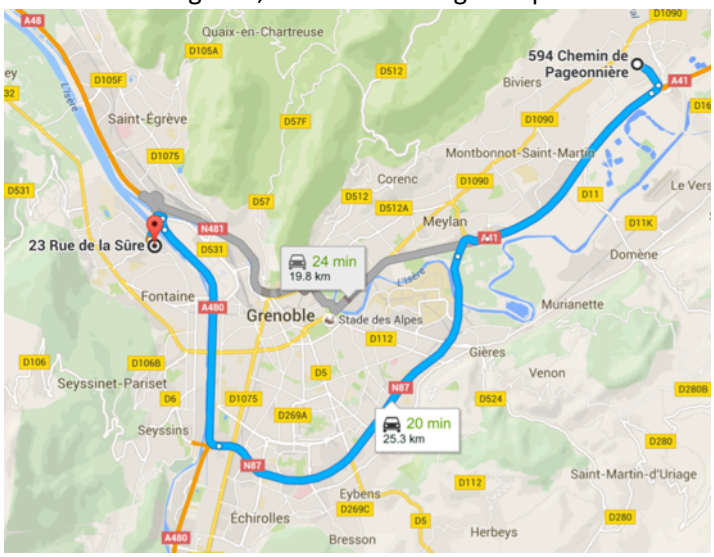
The current lifestyle is too fossil fuel intensive. Most of the manufactured goods in France are produced in Asia. The project brief considered looking at clothing as a transition project. There is currently a high popularity for Bio organic and humanely produced foods. The project seeks to look at a similar product line for clothes. First, the supply chain for clothes would need to be examined. Agriculture is known to be nearly as big a GHG contributor as fossil fuel. How much of this agriculture is involved in clothes, for example cotton? How much of our clothing is made from petroleum? What is the footprint of dies, printing, and textile bleaching? How humane is the garment industry? What

would a locally sourced and locally produced garment industry with no toxic waste and no packaging look like? People are very much used to the current low cost and low quality clothing system, sold in shops with a huge amount of branding and continuous change in variety. What kind of branding or marketing would be needed to make eco-clothing attractive? How can people who really enjoy clothes shopping and dressing in nice clothes express themselves in a low-impact way? Can we close the loop on clothes? Is there a way to design clothes that makes them recyclable? It would be an innovative engineering project to try to design a line of clothes and shops for Eco-Clothes in the same way that the Bio brand has for food.

Transportation – Retro Auto Numbers:

The project brief would explore ways to get the number of cars in Grenoble to the same levels as in 1960, or basically 80% lower than today. Thinking about what the city would be like with 80% fewer cars, the students could see that it would be a very bikeable and walkable city. Since the number of cycles would likely increase by 8 to 9 times, the streets, crossings, and signals would have to be re-designed and re-optimized for cycle travel. Automobiles might need to be either restricted to certain streets only, or the automobiles would have to be recognized as being intruders on the travel space and move accordingly – basically at the top speed of cycles at 15 km/hr.

The population of Grenoble is 155,000, and there are about 89,000 vehicles in the city. If that number declined to under 20,000, parking areas could be developed for parks or housing. The average vehicle travel per year in France is 6,500 km per person, so at 1.1 €/Lit and average efficiency of 6 L/100km, Grenoble's economy would retain € 53,196,000/yr not spent on imported fuel. The savings in accidents, not purchasing and maintaining cars, and not needing to repair roads would be significant, and could provide the driver for new markets in custom and high performance cycles, cycle innovations and more trams. The project idea was to start with analysis of the vehicle use in the city, and geographic study of where people live and travel. Then development of a plan for policies to restrict the number of cars while also building up the required tram and cycle infrastructure as well as looking at where property developments may be needed. One example is the area of the city in the east where there are a lot of houses and apartments but almost no shops, meaning that most people require a car to do any shopping, so they drive to work and pick up the shopping on the way home.



Student Eco-Village:

The area around the new building is nearly all science labs and industrial land use. The students proposed an interesting project of designing and building a student eco-village within walking distance of the campus. It would be interesting to model the land use, costs of building, the different types of housing, and to see if the eco-village could be a viable part of the larger urban fabric when it is focused on a particular community like the university students and graduate students with young children. Could it be a living laboratory for urban re-development of automobile dominated land? Could it be an on-going research center for green architecture and low-impact, low-waste, closed-loop lifestyles?