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Building Closed Loops for Positive Regeneration

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1. Introduction

R-URBAN is an action-research project which is building on the findings from the EU 'Life+ ' programme which extends over four years until 2013. It proposes a series of temporary and permanent urban interventions to promote ecological, social, economic and cultural regeneration and well-being at the scale of the building, neighbourhood, city and region. It aims to break down barriers and provide closed loops between traditionally rural and urban activities through habitat, work, transportation and agriculture, taking account of global as well as local impacts. The work is catalysed by AAA (atelier d'architecture autogérée), a small multidisciplinary design practice, working with a variety of community agents for change. The practice includes architects, economists, sociologists, ecologists and planners.

R-URBAN is focused on three particular sites in the North West suburb of Paris known as Colombes: AGROCITÉ, RECYCLAB, and ECOHAB are all within walking distance of each other in a densely mixed community of about 84, 000 inhabitants. The aim is for each of these three interventions to mutually support each other with a series of developed closed and open loops that will form a resilient mini-urban ecosystem for the neighbourhood.

The first of these projects, Agrocité, is well under way with two thriving community allotments, one of which also houses an experimental micro-farm with pedagogical and cultural activities related to the growing cycle. Temporary new buildings are being erected on the micro-farm site in Rue Jules Michelet which will have renewable energy and water saving features as well as being constructed from re-used and recycled materials. The micro-farm has approximately 20 allotments, sitting alongside an experimental agricultural growing area, which are maintained by 30 local residents.

The second project, Recyclab, will be situated in the Boulevard Acheres, and will form a centre for the collection and redistribution of reusable and recyclable resources. It will develop transformational processes which will re-purpose local resources in an ecological way and feed these back into the local and city-region economy to help it become more resilient. The site is in a quiet side street, with a requirement that a single lane of traffic be allowed to pass down the street. This leaves a wide pavement area on each side of the street for transformational processes and buildings to be developed. A key feature of the site is the large number of trees with mature canopies.

The third project, Ecohab, will be situated in Rue Jean Jacque Rousseau, and will consist of seven housing units within an ecological co-operative structure that contains various live-work elements. The site is close to the local railway station. This project is at a very early stage of development and is not considered in this report.
AAA commissioned me to examine their R-URBAN project, to help build their capacity for undertaking resilient ecological design through lectures and discussion, and run a workshop in June 2012 to map local materials and identify new ideas for re-use and recycling in the locality of Colombes. This report reflects on these activities through my own theoretical and practice-based approach to sustainable design and offers a framework for considering R-URBAN from a holistic, systematic and environmentally auditable basis. This will hopefully help AAA in their quest to gather and evaluate environmental evidence which can help underpin their design decisions for the various projects they are undertaking.

2. Bioregional Resource Mapping

2.1. Context and boundaries

A Bioregional approach to developing resource mapping recognises that environmental, economic and cultural factors are intimately intertwined within a physical region that shares environmental, cultural and economic commonalities (Stevenson and Ball, 1998, Stevenson, Jones and Macrae, 2002). Typically there are six conceptual layers which inform a bioregion: social, economic, ecological, topographical, climatic and geological (figure 1). All these need to be considered when trying to identify suitable resource use for a closed construction loop (figure 2).

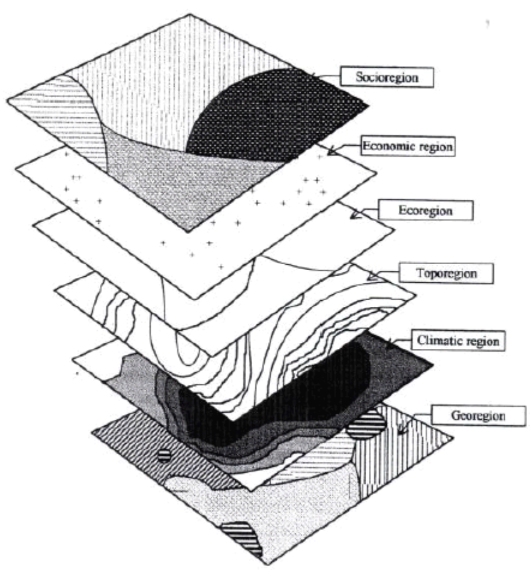

Figure 1: Bioregional Layers (Ball, 2002)

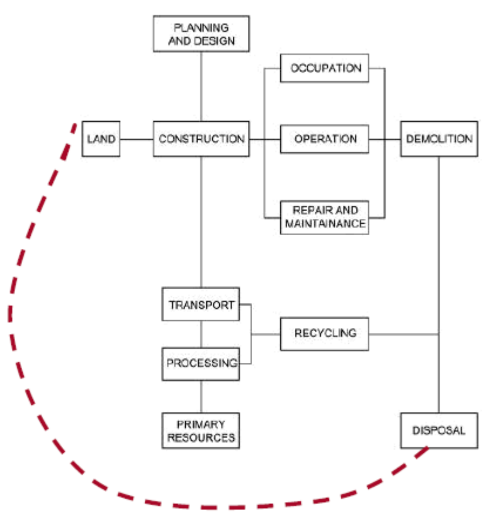

Figure 2: The Close Construction Loop

The watershed area which flows into a principal river from the highest points each side of a major valley or plain is often used as the definition of a bioregion, although in practice, a local community will often define its own bioregion according to its own perception of place.

For a city such as Paris, the issue is more complex, because although the first four layers do not change (apart from the Urban Heat Island effect related to the Climatic Region), the upper two layers of economic region and socioregion are less easy to put a common boundary around. In this respect, it is ultimately for the people of Colombes to participate and decide the physical, economic and social commonalities which can form a boundary of consideration relating to resource use within the other four layers of their self-defined bioregion (Birkland, 2008 p.210).

Fundamentally, the ecological biodiversity of an area, which any construction loops should encourage, will be determined by the first four layers and designers should have a deep knowledge of these in order to decide on the appropriateness of construction resources. For example: if the geology of a region is fundamentally limestone, then mineral recycling in construction should focus on this. On the other hand if the geology is a mixture of minerals, then the construction resource can be more heterogeneous. The aim is to reinforce the natural ecological base as much as possible, rather than to change it, with construction materials that are related to its existing ecosystems. In the case of Paris, the geology is predominantly limestone, with some clay, which suggests the mineral base for resource use which will tie into the natural ecosystem.

2.2. Ecosystems and Maximising Diversity

Within a defined Bioregion, the aim is to not simply preserve the biodiversity but to maximise it as far as practically possible, in order to increase the natural resilience of a region. The greater the number of different species interacting with each other within an area, and the greater the links between them, the more resilient the ecosystem is. If one link breaks, another can take over to do the same task. Janis Birkland (2008,p.277) refers to this as 'Net Positive Development' with the aim of using a R-URBAN approach to increase the ecological base through resource exchanges between urban and rural activities.

Biodiversity can be taken as a direct metaphor for human activities also – the greater the diversity of human activity within a given area, the greater the resilience of that community in terms of responding to change. This is also an argument for greater multiculturalism within cities rather than the segregation that can develop through ghettos.

2.3. Bioregional Resource Mapping

Once the community has fixed the boundaries of its bioregion, it is then possible to begin the resource mapping process for the area. Typically, this will include making inventories of the habits and biodiversity that is important to the native ecology as well as those which are threatened, along with inventories of local economic resources such as natural physical materials, manufacturing and recycling/re-use activities, food growing and processing, renewable energy sources and production, climate, demographics, settlement patterns and human ecology.

Ideally the R-URBAN project will help the people of Colombes to create their own 'Bioregional Directory' of resources related to a map of the area (e.g. see my 'Green Directory' for Scotland[1]) – this could be done using spreadsheets, GIS or other software. Clearly, developing these inventories takes a lot of time and they also need regular updating, but they are an invaluable resource, because globalisation tends to erode local knowledge bases.

2.4. Bioregional Industrial Ecology

Once a Bioregional Directory has been created, it becomes possible to start linking resources together in closed loops that operate within a Bioregion and which maximise diversity within the region while minimising transportation impacts. Adding a level of resource transfer analysis to the Bioregional Directory will help to identify what links can be made between resources, where one activities waste effectively becomes another activities product base or help their processes. This form of symbiosis can help minimise inefficiencies within the region and is called Industrial Ecology. It can lead to the positive regeneration of a bioregion if planned carefully.

A classic example of Industrial Ecology is the Kalundenborg[2] project which involves 20 businesses in an industrial province of Sweden linking together to form an industrial 'ecosystem'. 4,500 households are served by a Combined Heat and Power plant, which generates waste heat used by a fish farm to produce 200 tonnes of salmon daily, as well as mineral waste products used for soil remediation and road building. At a more mundane level, it is easy enough within any neighbourhood to identify Freecycling[3] opportunities which facilitates resources for one person's waste to be transformed into another person's new product.

3. Scale and Positive Regeneration

3.1. Choosing the right scale for regeneration and resource use

Bioregionality does not sit easily with neo-classical economics that excludes externalities such as environmental resource costs (pollution, reduction of biodiversity etc.). At the same time, not everything that a Bioregion needs for positive regeneration can be found with the region. Typically, high-tech construction products using natural technologies may have to be sourced from another country until a production unit is established more locally. There will need to be a careful trade-off between different environmental impacts e.g. the embodied energy of transport set against the benefits of using a natural resource from a distance.

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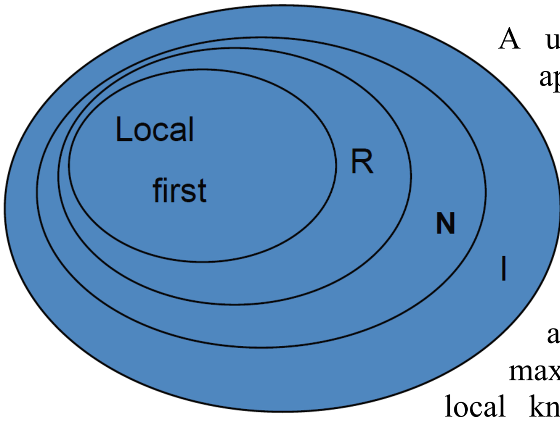
[1] http://www.sust.org/tgd/
[2] http://www.symbiosis.dk/en
[3] http://uk.freecycle.org/



A useful analogy for adopting a scalar approach to resource sourcing is to think 'Onion Layers ' (figure 3) where the first search layer is local, followed by regional (R), then national (N) and finally, if all options are exhausted, international (I). A performance specification should be used rather than a physical specification to allow for maximum choice. It is also important to use local knowledge rather than national indices when searching.

Figure 3: Scalar searching for resources

3.2. Scale, environmental technologies and autonomy

Autonomy for the sake of autonomy is rarely the best answer in terms of sustainable design from a systems point of view. A careful consideration of efficiencies of scale in relation to different locational requirements is needed to ensure any eco-retrofitting interventions in cities or rural areas are appropriate. This applies particularly when it comes to thinking about which renewable energy and resource saving technologies to deploy on buildings. Arup (USA) has produced a useful graph which illustrates the efficiencies of different energy technologies when applied at different scales (figure 4). It can be quickly seen from this that many energy technologies are more optimal at a neighbourhood (campus) level of 10,000 people rather than at the level of an individual building.

Photovoltaics are more optimal at a very large scale, which cuts down on transmission losses as well as maintenance. Equally, energy from waste is better at the scale of a city. The same applies to sewage – where there is an existing sewage treatment plant with spare capacity, this should always be used first rather than resorting to sewage treatment on site (Halliday, 2008 p.303) which will involve excessive energy use and maintenance. Even water recycling should be carefully considered – the costs of running any pumps and replacing filters may well offset the benefits of using a local reservoir system and simply allowing the water to percolate into the water table and back into the river and sea, ready for re-use through a natural precipitation cycle. These ideas may seem counter intuitive to the idea of autonomy, but they emphasise the need for scientific evidence which takes into account systems thinking at a variety of scales.

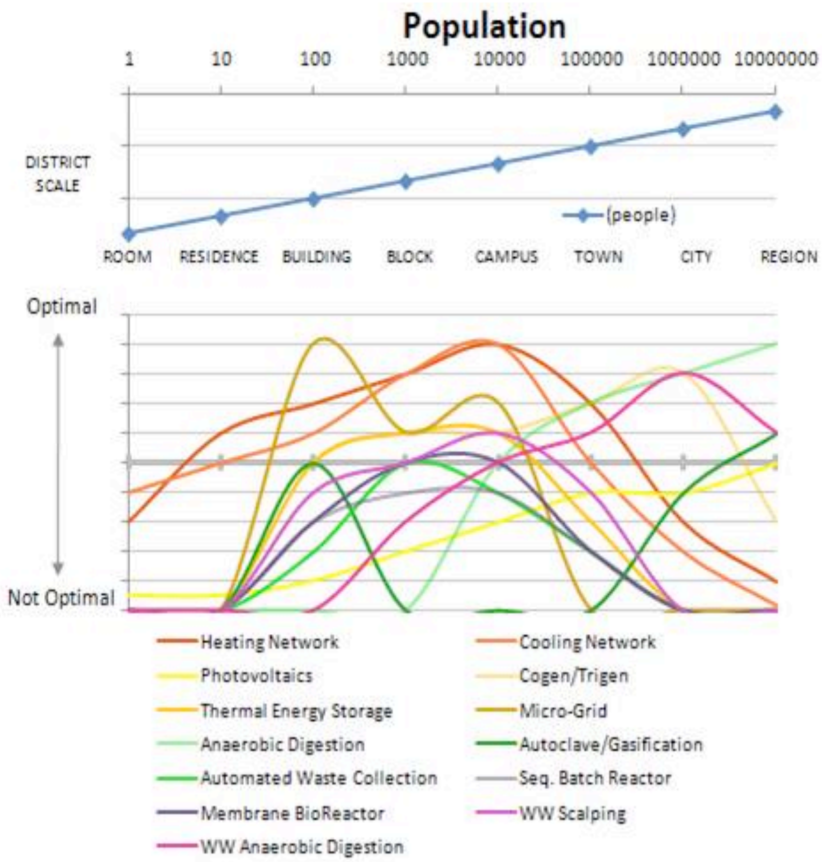


Figure 4: Optimal scale for different energy technologies (source: Arup, USA)

At the same time, there are times when the need to demonstrate a new technology at a local level for pedagogical reasons outweighs the need for efficiency (such as the demonstration of a Solar Aquatic 'reclaimed water' or sewage conversion plant in CIRS[4]).

3.3. Scaling energy and water systems in R-URBAN Buildings

AAA and the various stakeholders in the R-URBAN projects need to audit existing renewable energy and water systems in Paris and Colombes before making a decision on which renewable energy and water technologies to use autonomously.

My understanding is that most electrical energy in France is produced by nuclear power and so therefore any renewable production of electricity is to be welcomed if it can offset the various problems of using nuclear power. On the other hand, if there are already large scale renewable energy initiatives planned for Paris such as large scale wind farms or solar farms, or a city biomass plant which uses waste biomass, then it might well be more sustainable to connect to these from the R-URBAN projects than going autonomous.

Water harvesting systems are generally preferable to trying to recycle waste water because they involve less treatment and can involve less energy for pumping,

[4] http://cirs.ubc.ca/building

particular if the water harvesting is designed as a gravity fed system. However, what should be taken into account is the amount of resource needed to set up and maintain a building water harvesting system, compared to just plugging into an existing water supply system for a city, where there is spare capacity. AAA need to research the condition of water supply systems to Paris, including whether or not reservoirs are generally depleted or not and how local the nearest reservoir is. This needs to be balanced against the environmental cost of pipework and storage vessels (if these are re-used items, this is clearly more attractive) and any pumping system that may be needed.

4. Audit Tools

4.1. Lifecycle Analysis

For AAA to be able to make truly sustainable links between rural and urban activities, the infrastructure which provides the services and products needs to be carefully audited while it is being designed. Lifecycle Analysis (LCA) is one method for working out what the overall environmental impact is for any service or product. It is a complicated process and it is generally left to experts who either produce an expensive LCA for a single product, or who produce LCA guides such as the BRE Green Guide to Specification[5] which are not wholly transparent in their methodology and make some big assumptions, but are adopted wholesale by the industry because they are free.

Either way, it is difficult for designers to know what the full impact of their specification choices are without resorting to such tools. An example of this type of activity was undertaken by Bioregional.com when they were trying to establish a green specification for the construction materials used on their famous BedZed housing development in 2002. Their construction report[6] clearly spells out their approach to materials selection, which included regional sourcing and re-use of key materials, and provides some valuable learning for the R-URBAN building projects. Without funding, however, LCA is unlikely to be undertaken by small developers. An environmental impact ‘proxy’ measure can be used in the first instance which is a bit easier to work out and capture some key elements of LCA– it is known as embodied energy/carbon.

4.2. Embodied Energy (Carbon) in Buildings

To calculate the total amount of energy being used in a building over its lifecycle, designers need to take account not only of the energy used by the building in operation, but also the energy used to source, manufacture, transport, build, maintain and ultimately demolish, and re-use, recycle or dump the materials, products and assemblies which make up the building. This represents the construction lifecycle energy for the building and is known as embodied energy. Its equivalent – embodied

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5 http://www.bre.co.uk/greenguide/podpage.jsp?id=2126
6 http://www.bioregional.com/files/publications/BedZEDMaterialsReportSummary.pdf

carbon - can only be worked out once the carbon dioxide emission factors are known for the different fuel sources and related to the embodied energy calculation (figure 5).

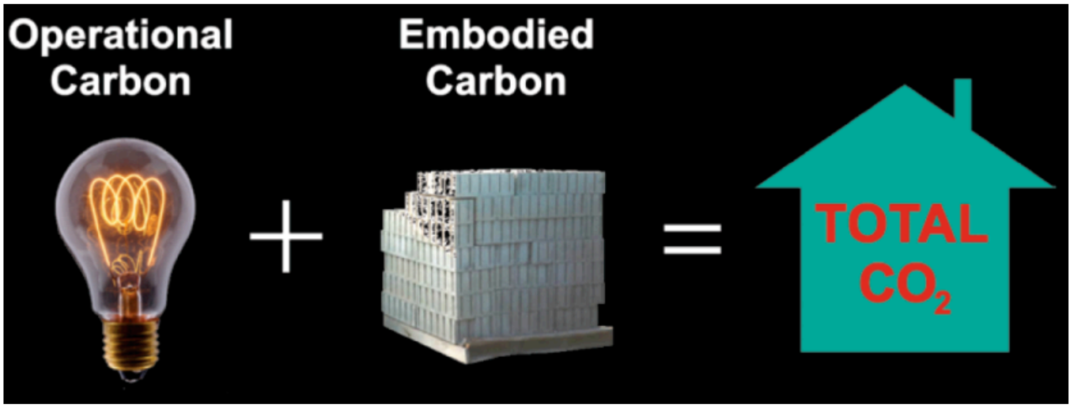

Figure 5: Total energy (carbon) needed to construct and operate a building

A typical definition for embodied energy (carbon) is:

' *The embodied energy (carbon) of a building material can be taken as total primary energy consumed (carbon released) over it's life cycle*'

ICE V1.6a Hammond and Jones, 2008

The embodied energy (carbon) of a building material can be worked out by calculating all the energy used at each stage of the material's life. There are also guides to the relative embodied energy(carbon) for construction materials, and although these can vary, the ICE V 1.6a is a good starting place for R-URBAN projects[7]. Typically in the UK, only the energy involved from sourcing the material through to its factory exit point is taken into account (this is known as 'Cradle to Gate') whereas other countries advocate calculations that take into account maintenance and demolition energy ('Cradle to Grave'). The most comprehensive calculation also includes the recycling or re-use potential for a material at the end of its first building life (Cradle-to-Cradle) but this is relatively speculative.

Calculating the embodied energy(carbon) of complex products is almost as difficult as carrying out an LCA, and it is probably best for AAA to refer to manufacturers figures for the LCA or embodied energy of products, where this exists. Caution needs to be exericised with any embodied energy(carbon) figures, as they can vary significantly from country to country depending on calculation methods and fuel sources. In general, figures should be treated in relation to orders of magnitude (1,10,100 etc) rather than finely compared.

On average, the energy(carbon) used to transport a construction material is about the same as the energy(carbon) used to manufacture it, so it is well worth AAA considering the transportation factors and whether a material has been delivered to site by ship, barge, train or lorry. The last of these is the most energy(carbon) intensive

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[7] http://web.mit.edu/2.813/www/readings/ICE.pdf

transportation mode, whereas ship or barge tends to be the least energy(carbon) intensive mode.

4.3. Energy (carbon) Profiling for buildings

Once AAA have gained an understanding of initial manufactured embodied energy(carbon) in building construction and the transportation to site, the next level to tackle is which material, products and assemblies to use in relation to a) the lifespan of the building and b) the relative lifespans of the products and materials c) the trade off in resource use between demolition and new-build when dealing with an existing building.

For a short-life new building it is vital that the construction is designed not only to be fully deconstructable, re-using materials and products as far as practical, but also in consideration of the appropriate lifespan needed for materials. A short-life building need not be made of high-energy/highly processed materials and assemblies in order to re-use it. It may well be possible to use low-energy/low-processed materials which last long enough for the life of the building. Overall, if sourced locally, the use of biodegradable low-energy materials in R-URBAN projects may well be more ecological than designing for re-use, particularly if the material can 'feed' and remineralise the local topsoil.

For all buildings, care should be taken to consider the *lifespan of components in relation to their embodied energy* (carbon). Often a high-energy component may have a shorter life-span than similar component with lower energy – typically complex cladding elements can break down more quickly than simple ones, especially in relation to joints, glues and seals (figure 6).

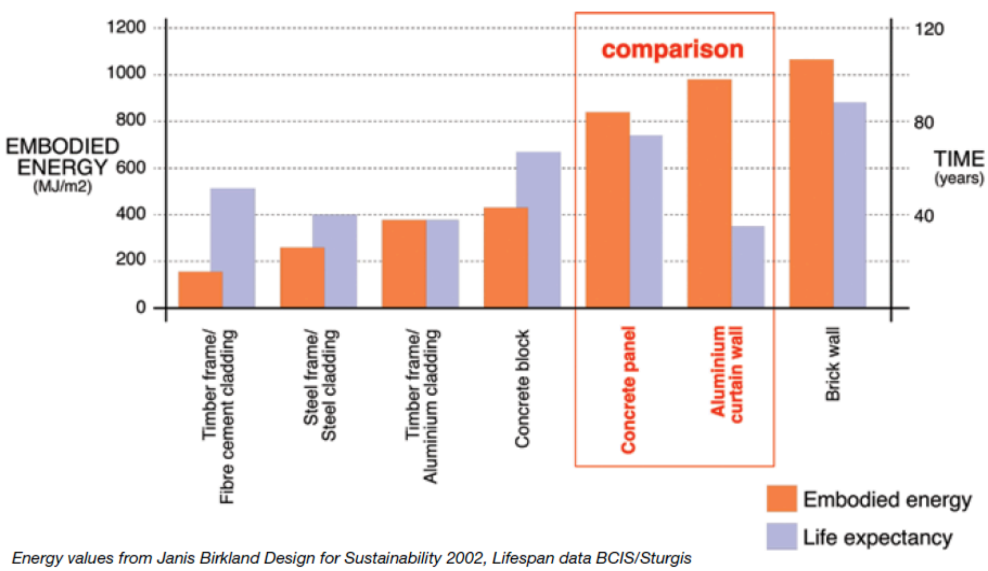

Figure 6: Comparison of cladding elements – lifespan.v. embodied energy (source: Sturgis, 2010)

4.4. Waste Hierarchy

Another useful audit tool for thinking about the sustainable use of products and materials when developing closed loops between urban and rural activities, is known as the EU Waste Hierarchy (figure 7):

Figure 7: The EU Waste Hierarchy (source: Low Carbon Scotland, 2010)

Ideally, the Waste Hierarchy should be a 'mindset' for the designer when approaching any use of materials. Very often, however, the upstream activity of reducing the creation of construction waste in the first place, is not well considered. Designing buildings and building elements for de-construction and re-use is still not a regulatory requirement and so the default position tends to be designing for recycling, which in itself tends to use more energy than appropriate re-use of products and materials. It is hard to over-emphasis the environmental consequence of society being overly focused on recycling, which tends to promote a consumerist culture where things can be 'discarded' without personal conscience, because they will be 'recycled'.

Some have argued that once human labour is taken into account, it is better to recycle high energy construction products rather than re-use them (Brown and Buranakarn, 2003) as this is more efficient in terms of overall energy use. However, this does not take into account a bioregional perspective which aims to re-use materials and products within a local economy, thus creating local jobs as well as saving on transportation. There is practical guidance on how to design for deconstruction in buildings (Morgan and Stevenson, 2005)[8] which should help AAA. This should include minimising waste construction materials by carefully designing to take account of all product dimensions in order to minimise off-cuts, and avoiding over-ordering of materials.

The current trend in the EU towards 'Energy Recovery' by producing heating, cooling and power from incinerating waste is equally concerning. This action should only come after all re-use and recycling options have been considered, but frequently the need for power generation overrules the Waste Hierarchy. Renewable energy generation for CHP should be considered instead as it is almost always preferable to burning construction waste.

[8] http://www.seda.uk.net/assets/files/guides/dfd.pdf

5. Colombes – Re-use and Recycling in Action

5.1. Ideas

In a R-URBAN workshop held in the Summer of 2012, participants were asked to each list three key ideas they had for potential resources in Colombes that could be re-used or recycled either directly in the neighbourhood or in Paris more generally. Key ideas that emerged included:

- recycling of coffee ground waste from Paris's 60,000 cafes (each cafe produces about 1 kg of waste an hour) into a compost accelerator product for redistribution in the city-region.

- encouraging workers from the local Supermarket opposite the Agro Cite site to make use of the site during their work breaks for rest, recreation, and some light gardening, generating affordable vegetable and fruit produce for them to take home.

- recycling of waste clothes, magazines, timber, green waste and earth by Recyclab project into insulation and cladding materials.

Although the workshop was based purely on 'brainstorming' with no supporting literature review, it demonstrated the power of articulating tacit local knowledge in communities when considering a bioregional approach to resource use.

5.2. Case Studies

There are numerous re-purpose, re-use and recycling initiatives in the UK which AAA could draw on when developing their Recyclab and Agrocité projects:

- **ABLE:** This social and educational project is based in Wakefield, near Sheffield. It has developed an integrated aquaculture (growing fish) and hydroponic (growing plants) system which does not use chemicals, requires only 10% of the water needed for field plant production and a fraction of the water used in traditional fish farming. Water contaminated with fish waste is used as a nutrient source for growing plants. The plant-cleaned water is then recycled back into the fish tanks. Waste plants are composted in a wormery and the worms are then fed to the fish in the aquaponic system, completing a series of 'closed loops' to form a dynamic eco-system. Aubergines, watercress, chillies, strawberries and Sturgeon,Tilapia, Koi Carp and Catfish are produced in the aquaponics greenhouse through these processes[9] alongside organic vegetable produce on a converted brown field site, and willow coppicing for fuel.

- **Seagulls Paints**: This non-profit social enterprise based in Leeds collects and

[9] http://www.theableproject.org.uk/produce/how-and-what-we-grow

receives left over or over-ordered paint, checks the stock and organises it for resale, at a much cheaper rate than new paint in a workshop open to the public[10]. It also provides a colour mixing service so that customers can get exactly the colour paint they require. On the back of this activity, it has also developed a community decorating service as well as educational activities. 90 tonnes of potentially eco-toxic paint is diverted from landfill each year.

- **Redress Ltd**: This co-operative based in Bedlington, North East England takes waste textiles and clothing and re-makes them into new clothing and fashion items[11].

- **Bioregional.com**: This organisation, based in London, has pioneered numerous bioregional resource initiatives and is currently investigating setting up a network of UK Building Material Re-use Centres[12]. The key contact in Bioregional is Jonathan Essex.

6. Building Interventions

6.1. Agrocité

The temporary community educational buildings are now largely developed on this site, and so comments will be retrospective to some degree:

Basement: This can provide an excellent degree of 'coolth' to help prevent overheating in the summer, providing some openable ventilation panels are created in the floor space to the accommodation above. The open water channel in the basement should be closed off as it will create dampness which could affect the timber structure in time. If the basement space is kept relatively dry, it can make an excellent 'cool' storage area for fruit and vegetables harvested from the allotments and farm. Dampness from the open water drain would be prevent this possibility. Good cross ventilation is essential in the basement.

Water system: Ideally rainwater from the roof should be collected in a tank at high level to provide gravity-fed water which does not rely on pumps. The embodied energy in the extra structure needed is repaid by the energy saved by not using pumps.

Plant system: It is essential that this is robust and is able to deal with periods of drought. Vertical planting systems should always be connected to a significant soil base either on the roof or ground, which can hold enough water to tide over drought periods. Pumping systems should always be avoided for growing vertical plants as they fail and plants die very quickly. A hydroponic system is questionable unless the fertilisers needed can be manufactured locally (e.g as in ABLE). Deciduous planting

[10] http://www.seagullsreuse.org.uk/Home
[11] http://www.redressltd.co.uk/redress1.htm
[12] http://www.bioregional.com/flagship-projects/bioregional-production-systems/construction/

(e.g. Virgina Creeper) should be extended over the pergola attached to South side to provide ambient shading beyond the vertical wall planting. This will create a heat buffer zone in Summer.

Energy system: Solar thermal panels should augment the PV system as they can provide 100% of hot water requirements for up to 6 months of the year. They can be connected to recycled rainwater tanks and used to heat up water for showers and the kitchen.

Material system: Materials and assemblies should be connected using fully demountable fixing systems (e.g. non-rust screws rather than nails, bolts rather than rivets, etc.). A principle of assembling materials and products in layers should be used, with the shortest-life material or product being accessible before the next longest life material or product. This is important to ensure efficient maintenance and replacement (figure 8). Large sheets of high-value materials (glass, metal) should be avoided – a single damage point can mean having to replace the whole sheet, which is expensive and wasteful. It is better to subdivide windows into smaller components for a more affordable replacement strategy. Finally, an attitude of 'cherishability' should be adopted, where materials are planned to age well (ie. it does not matter if they are scratched) and have historic/local meaning for the users (Chapman, 2005).

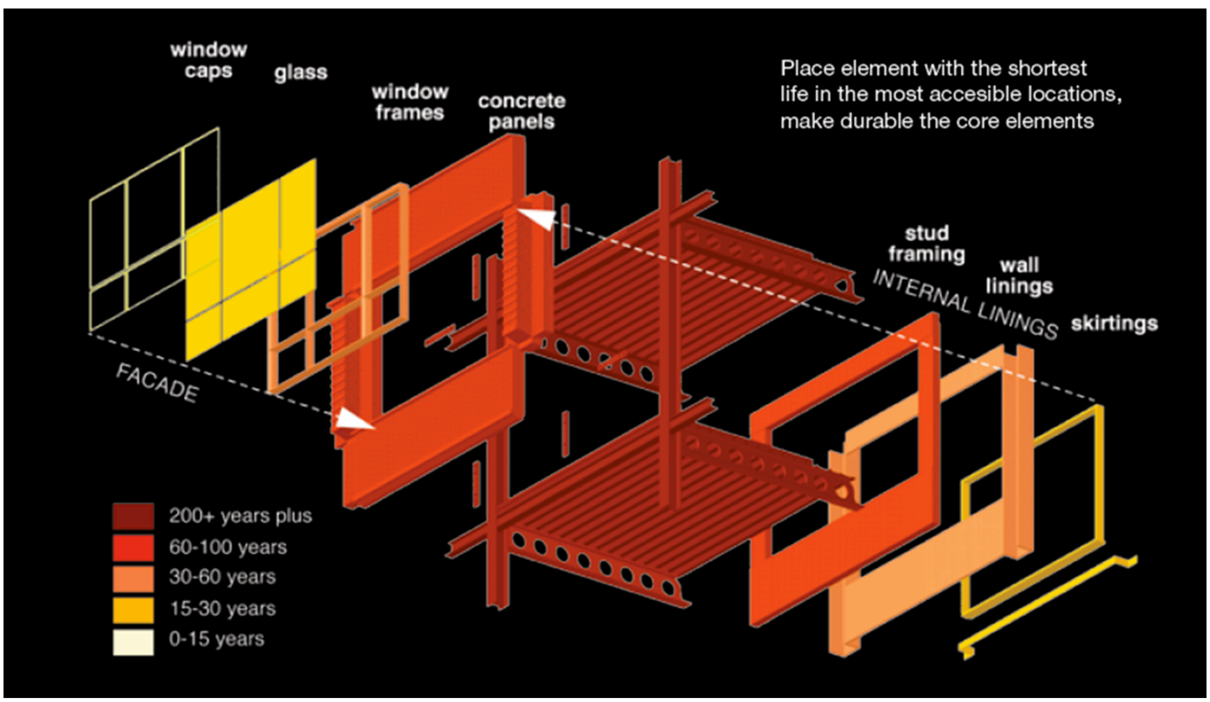

Figure 8: Diagram showing 'layered' construction approach for replacement (source:Sturgis, 2010)

6.2. Recyclab

Water system: Care will need to be taken with any rainwater collection system that leaves from the trees do not block pipes – netting or grills should be applied to all water collection points. If a toilet is placed next to the kitchen on the upper level, then it can be a composting toilet with collection point below[13].

Plant system: Existing trees provide excellent free 'air-conditioning' for the site. Consideration should be given to collecting the extensive amount of leaves that will be generated each autumn for leaf mould recycling, to generate free compost for collection. At the same time, the site should still be prepared for downpour flooding, which is increasingly frequent with Climate Change. As much as possible of the tarmac that is not directly used for business should be opened up and planted with low maintenance plants to help absorb flash flooding. Swales for sustainable urban drainage should be considered[14]. Planters could also be added to the timber terraces next to office and kitchen, so that salads and herbs could be grown here.

Energy system: The use of PV and Solar panels needs to be very carefully considered given the amount of summer shading from the extensive tree cover. Carefully modelling of tree shading on the building should be made using either Sketch-up Shading modelling, or a physical model and a lamp to simulate the position of the sun in the summer. It may not be practical to use solar energy. Biogas could potentially be collected from the composting toilet for cooking with.

Materials system: The system of placing timber 'pods' on top of the containers will require extensive insulation (U-values should be to PassivHaus standards) to prevent overheating in summer and save energy in winter. The walls look thin just now. Care must be taken to properly cross ventilate the metal storage containers to prevent dampness – these containers do not have breathing skins and so any dampness that gets in from the air or otherwise needs to be able to escape. See earlier comments on materials in Agrocité also.

7. Recommendations

To strategically progress a bioregional approach to developing positive regeneration systems for R-URBAN projects the following recommendations are made to AAA:

1. Identify a boundary for your 'Bioregion', working closely with local inhabitants.

2. Create an ongoing Bioregional Directory, by auditing local human and physical resources.

3. Aim to create Bioregional Industrial Ecology Systems (BIES) for R-URBAN projects for maximum resilience.

4. Identify existing energy and water sources and systems and plug into these where it makes sense to, recognising efficiencies of scale.

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[13] http://www.clivusmultrum.com/
[14] http://www.susdrain.org/

5. Treat Life Cycle Analysis and Embodied Energy tables of products and materials with caution, but use available independent guidance.

6. Carry out embodied energy/carbon analysis of bulk construction materials, including transportation factors for site delivery, to identify best environmental options.

7. Adopt the EU Waste Hierarchy for all actions.

8. Use a ‘layering’ approach to construction to take account of material and product lifespans in relation to maintenance and replacement sequences.

9. Consider building interventions suggested for Agrocité and Recyclab more generally for all projects.

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