Waste and resource management practices, legislation and policy encouraging and influencing ‘regeneration reuse’ of property assets

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Abstract:- Carbon taxation governance is becoming increasingly popular, further evolving the polluter pays concept already well established in the built environment as a mechanism to controlling and licensing waste generation. This paper presents an explanation of property asset ‘regeneration reuse’ principles following deconstruction, which reduce waste generation associated with the process of demolition, construction and operation. An analysis is made of strategies in Australia and the United Kingdom, comparing jurisdiction targets pertaining to construction and demolition waste that encourage ‘regeneration reuse’. From examination of applicable Australian and United Kingdom legislation, strategic, fiscal and policy that influence on the ‘regeneration reuse’ of property assets, an evaluation to the variety of issues relevant to waste and resource management practices is reached. The paper concludes that a systematic evaluation framework to selecting building components and structures suitable for reuse after deconstruction must be considered in legislation.

Key-Words:- Regeneration reuse, Deconstruction, Reuse, Adaptation, Relocation, Legislation, Sustainability

1 Introduction
The benefits of improving sustainability more recently have seen governance in the Australian and United Kingdom (UK) jurisdictions towards developing ways of reducing carbon emissions. Such as The Climate Change Act 2009 that sets to reduce the UK’s overall carbon emission by 80% by 2050 (against 1990 levels), significant given that half of the UK’s carbon emissions come from the built environment. Other recent incentives include an award of a £1bn contract for the first UK carbon capture and storage demonstration project by December 2011, with assurance to invest in future projects by May 2012. [1] Australia more recently passed carbon tax measures that are comparable in significance to polluter pays policies developed throughout the European Union in the late nineties. Further the UK has tax incentives for good environmental practices including relief on stamp duty on zero carbon homes, and tax penalties for poor environmental practices such as landfill tax. [2] This common theme to improve sustainable waste behaviour is represented to a more fundamental level by creating a culture that achieves a reduction of waste generation and responsible disposal. Built environment Construction and Demolition waste (C & D) is generated as a result of building, refurbishing, renovating or demolishing structures, building structures and infrastructure such as roads, bridges and docks, and includes material such as timber, uncontaminated soil, concrete, asphalt, plasterboard, steel, bricks, ceramic and clay tiles, and aluminium. [3]

Fig.1 Waste and resource management hierarchy [3]

The main principles when managing C & D apply in the waste and resource hierarchy shown in Fig.1 from the Queensland, Australia Waste Reduction and Recycling Strategy 2010–2020 when adapting definitions from the European Union [4], as:
‘reduce’ means measures taken before a building structure or component has become waste, that reduce: (a) the quantity of waste, including the reuse of components or the extension of the life
span of building structures, (b) the adverse impacts of the generated waste on the environment and human health, or (c) the content of harmful substances in materials and components.

‘reuse’ means any operation by which building structures or components that are not waste are used again for the same purpose for which they were conceived, or means checking, cleaning or repairing renovation, by which building structures or components that have become waste are prepared so that they can be reused without any other reprocessing or recycling back to material when considering relocation, component and adaptive reuse.

‘recycle’ means any recovery operation where waste is reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials.

‘other recovery’ means any operation the principal result of which is waste serving a useful purpose by replacing other materials that would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the building structure or in the wider economy.

‘treat’ means recovery or disposal operations, including preparation prior to recovery or disposal.

‘dispose’ means any operation which is not recoverable, including where the operation has a secondary consequence during the reclamation or reuse of a building structure or component.

Key elements of ‘material reclamation’, include: reprocessed materials or use of recycled materials, appropriate materials and dimension encompassing prefabrication, efficient ordering of materials, materials handling and storage, contractual arrangements, efficient waste management segregation, and efficient waste management auditing.

2 Context

In the context of waste, the polluter pays concept is based on the premise that those who generate waste or cause pollution from inappropriate waste and resource management practices should bear the cost of its treatment, containment, or disposal. Australia is the world's largest coal exporter and the biggest per capita greenhouse gas emitter in the developed world thanks to a booming mining industry and a reliance on coal fired power stations. Australia generates approximately double the amount of Carbon Dioxide (CO₂) emissions per person compared to the UK. [5]

“The built environment is said to account for around 47% of CO₂ emissions in the UK, with a significant proportion of this relating purely to the running and operating of existing buildings and their facilities.” [6] These statistics and recent examples of Australia’s susceptibility to acute fluctuations in climatic conditions can be accredited to climate change, which justifies government policy to react as has been witnessed in the passing of legislation. Such legislation will indirectly impact on the built environment by increasing costs of materials and require the construction industry to improve efficiency, select greener products and adopt the strategy of regeneration reuse.

2.1 Regeneration Reuse

From the main principle of reuse defined from Fig.1 a philosophy of ‘regeneration reuse’ based on the scenarios for material reclamation and regeneration reuse in the built environment is represented in Fig.2 and can be best defined as: ‘regeneration reuse’ means any building structure or component that has been reconditioned for adaptive reuse and relocation following deconstruction, which has not involved reprocessing or recycling.

![Fig.2 Scenarios for material reclamation and regeneration reuse in the built environment [7]](image-url)
The process of ‘regeneration reuse’ has recognisable environmental, social and economical benefits including: lower greenhouse emissions, reduced waste generation, retaining of historical buildings or structures, jobs creation due to labour intensive deconstruction, and increased proportional capital expenditure on refurbishment of existing property assets, as opposed to new construction. A definition of each of the ‘regeneration reuse’ scenarios and their specific environmental benefits follows.

2.1.1 Adapted Reuse
Where a property asset is no longer fit for purpose, ‘adaptive reuse’ is a desirable outcome and the more effective, rather than undertaking relocation or extracting building components during deconstruction and reconditioning when bringing it back to use. [8] The principal of ‘adaptive reuse’ is to leave the basic structure and fabric of the property asset intact and change its use, which can include construction being in part, full, upgrade or addition. [9] The scenario of ‘adaptive reuse’ saves on resources, water, disposal, and energy use during material reprocessing or recycling, as well as energy use during building structure or component deconstruction and the related transportation. [10]

2.1.2 Relocation Reuse
Rather than the retrofit or refurbishment as with the ‘adaptive reuse’ of a property asset, consider the process of ‘relocation reuse’ in the context of ‘regeneration reuse’ when a building structure is relocated in its entirety to a different location. [9]

Knowledge of the lifespan of components in a building structure are crucial to the understanding of their embodied carbon efficiency, typically embodied carbon is calculated from levels of CO$_2$ emissions generated from the formation of building structures, their refurbishment and subsequent maintenance. More detailed analysis could be used to calculate the optimum time that adaptive reuse (or ultimately replacement) is desirable when seeking to estimate a building structures finite life expectancy when taking into account embodied energy, the carbon cost of demolition and replacement, and the relative lifespan of different elements within the building structure. [11]

2.1.3 Component Reuse
Design for deconstruction and the lessons of industrial ecology provide a strategy in which the initial design of the building structure allows for ‘component reuse’ to be maximised in achieving complete ‘regeneration reuse’ of a property asset. [10] If a building structure were designed for deconstruction it can be seen that a major portion of the embodied carbon of the property asset could be recovered in the form of components that would be suitable for ‘regeneration reuse’ and that avoided the need of ‘material reclamation’. [12]

3 Legislation, Strategic, Fiscal & Policy Jurisdiction Comparisons
The UK set itself a domestic objective that went beyond the legally binding Kyoto Protocol, and set a target to reduce emissions of CO$_2$ by 20% on 1990 levels by 2010. [13] The Climate Change Act 2009 requires when compared with 1990 levels, a reduction of UK greenhouse gas emissions by 80% by 2050 with an interim reduction target of 34% by 2020. To assist in achieving these targets the UK government recently announced funding of up to £1 billion to cover the capital costs of one of the world’s first commercial scale Carbon Capture Scheme projects, and is committed to providing additional funding towards a further three projects. The overall lifetime costs for the full demonstration programme could be around £7.2 billion to £9.5 billion. [14]

More recently Australian parliament has passed a Clean Energy bill to tackle climate change with a price on carbon, which is the most ambitious carbon tax scheme outside Europe. On the 8 November 2011 the bill was passed in the Australian upper house senate allowing a carbon tax to commence from the 1 July 2012, which is expected to be applicable to 500 of Australia's biggest polluting companies. It is set to reduce carbon emissions by 159 million tonnes (mt) in 2020 commencing from mid 2012 to mid 2015 (July to June), followed by a carbon trading system. A review of legislation, strategies and policies applicable in the Australian and UK jurisdictions follows, specifically narrowed to identify those that encourage ‘regeneration reuse’ in the built environment relating to C & D.

3.1 Waste and Resource Management
Most major contractors now have waste management policies and practices in place. A major UK contractor, Wates Group reported in 2005 that contractors, clients, designers and governance were considered as having the main responsibility towards offering solutions when seeking to reduce waste in the construction and demolition processes.
This was aimed at specifically targeting contractors to set a deadline by which to segregate 90% of construction waste and raise the recycled content of projects to 25%, and that governance drive environmental reform using tax incentives in the key areas of waste. [15] Governance has much greater influence on those wishing to 'regenerate reuse' property assets, and a variety of legislative, strategic, fiscal and policies encourage reduction of waste generation including the responsible disposal of waste. Australian and UK jurisdictions have differently evolved waste and resource management practices linked to similar waste strategies, landfill tax and carbon emission levies.

### 3.1.1 Construction and Demolition Waste

Of the 43.8mt of waste generated in Australia in 2006-07, 29% came from municipal sources, 33% from the commercial and industrial sector, and 38% from the construction and demolition sector, where municipal waste includes domestic waste and council waste. [16] In 2008, the largest contributing sector in the UK was C & D at 101.0mt from a total waste generation estimated at 288.6mt or 35%. From the total C & D generation estimate, 62% was diverted and 26% was sent to landfill. [17] A comparison of the statutory requirements set out in the waste strategies of various jurisdictions in Australia and the UK follows, including achievements on set targets represented through C & D statistical analysis of each.

### 3.1.2 Waste Strategies

Waste policies can be described as a methodology by which building industry stakeholders acting in a structured manner assess C & D site activities to ensure that they are carried out to the prescribed environmentally acceptable standard. Such policies are typically concerned with the decision making processes when dealing with potential environmental impacts generated from C & D. Waste strategies in addition to environmental impact assessment take in to consideration human health risks of waste generation. An outcome of the Waste Strategy for England 2007 was to make Site Waste Management Plans (SWMP) a mandatory requirement for construction projects over a certain value increasing reuse and recycling by the construction sector. Since April 2008 SWMP’s have been a mandatory requirement for all projects over £300,000 (AUS$462,000), and projects over £500,000 require the monitoring of waste including the type and amount generated, as well as the waste management route. Further The Strategy for Sustainable Construction 2008 set a target to halve the amount of C & D going to landfill by 2012 as a result of waste reduction, reuse and recycling compared to 2008. Scotland’s Zero Waste Plan 2010 aim is to secure 70% recycling of C & D by 2020. Scotland produces large quantities of waste, almost 20.0mt in 2008 from a range of sources, with household waste accounting for 2.9mt, compared with 8.6mt from C & D, and 7.9mt from the rest of the commercial and industrial sector. Waste Management in Wales 2007 (WMW) set targets that at least 75% of C & D should be reused or recycled by 2005, and at least 85% by 2010. In 1998 to 99, 76% of C & D was reused or recycled in Wales, with the remainder landfilled. In 2003, 91% of C & D in Wales was reused or recycled, a figure that attained the 2010 target of the WMW. Towards Resource Management The Northern Ireland Waste Management Strategy 2006 to 2020 has set a target 75% of C & D to be recycled or reused by 2020. Excluding England, Australian states have a similar approach to UK jurisdiction strategies, the Australian Commonwealth’s A National Waste Policy: Managing Waste to 2020 targets to stabilise waste generation for the period 2003 to 08, and by 2014 increase the recovery of C & D from 65% to 76% when compared to 2000 levels. In Queensland a C & D recycling target of 75% by 2020 is prescribed, although this is ambitious considering 30% was achieved in 2007 and no detailed framework to make up this 45% deficiency is clearly defined. Unrealistically, Draft II Waste Strategy for Western Australia March 2010 sets a C & D recovery rate increased from its achieved 17.5% in 2007, to 50% by 2016 and 70% by 2020.

![Fig.3 C & D recycled as a percentage of total C & D generated by Australian states from 2006 to 07](image)

In contrast to the low achieving C & D recycling Australian states of Queensland and Western Australia represented in Fig.3, other states have a greater realism to achieving their targets. Victoria sustainability in action Towards Zero Waste Strategy sets a recovery rate of 80% of C & D for reuse and recycling by 2014, against a 2007
achieved 72% level following a 65% target by 2008 to 09. New South Wales (NSW) achieved a C & D recycling level in 2007 of 67%. A target is set to increase recovery and reuse of materials from a C & D level 65% in 2000 to 76% by 2014 as stipulated in the NSW Waste Avoidance and Resource Recovery Strategy 2007. Australian Capital Territory (ACT) arrangements for recycling of C & D appear to be effective having achieved 91% of recovery of C & D. The ACT Sustainable Waste Strategy 2010 to 2025 does not seek to set further targets beyond 90% by 2014 other than to explore options for temporary C & D facilities within new development areas. The Northern Territory and Tasmania generated 0.4% of all Australian C & D in 2007, albeit no targets and records were obtainable for C & D recycling.

3.1.3 Landfill Levies, Policies and Procurement

The definition from the Landfill (England and Wales) Regulations 2002 of a landfill is “a waste disposal site for the deposit of waste onto or into land”, including “any site which is used for more than a year for the temporary storage of waste; and any internal waste disposal site that is to serve a site where a producer of waste is carrying out its own waste disposal at the place of production”. The UK standard landfill tax rate from April 2011 to March 2012 is £56 (AUS$86.24) per tonne (p/t), which will increase annually by £8 until 2014. In comparison only half of Australian states have set landfill tax rates; Victoria, NSW, South Australia and Western Australia rates are from AUS$25 to AUS$70.30 p/t. NSW has the highest levy and through the Protection of the Environment Operations (Waste) Regulation 2005 sets out a landfill tax increase rate of AUS$10 (£15.40) p/t a year until 2016. The Towards Resource Management The Northern Ireland Waste Management Strategy 2006 to 2020 introduced a minimum requirement that 10% of the materials value of public sector construction projects should derive from recycled or reused content. Queensland Government, Department of Public Works has a similar policy including criteria to monitor generated C & D in the public sector. In England, Planning Policy Statements (PPS) seek to provide guidance to be reflected by local and regional bodies in setting responsible approaches to future waste management, PPS 10: Planning for Sustainable Waste Management 2011 includes the broad development strategy to recycling C & D. In England the Regional Planning Guidance for the South East 2001 encourages sustainable design to include use of waste prevention and minimisation, techniques for reducing the amount of C & D disposed in landfill, and highlights the potential for recycling and reusing C & D. After the Commonwealth of Australia’s Natural Heritage Trust of Australia Act 1997 stipulating developing or promoting waste minimisation, policies are only just emerging in some Australian States. An example is Queensland’s Waste Reduction and Recycling Strategy 2010 to 2020 that introduces a waste disposal levy to change behaviour, and targets to strengthen requirements for implementing state and local government strategic waste plans, establishes requirements for resource recovery from waste streams prior to disposal, and sets mandatory reporting requirements for the waste and resource recovery sector.

3.2 Evaluation

Australian and the UK jurisdictions have similar policies for construction fabric energy performance and efficiency applied through building regulations and codes, including specific legislation for achieving and monitoring operating levels of CO₂ emissions attributed to climate change. Both jurisdictions set targets to increase the level of recycling C & D, but not specific policies for regeneration reuse. In England alone the waste sector, including both municipal waste and commercial and industrial waste requires up to an estimated £15 billion of investment to divert waste from landfill, improve sustainable waste management and generate more energy from waste. [19] Changes in policy and investment have been rewarded, in the Australian state of Victoria by 2007 the proportion of C & D recovered against a 2002 to 03 rate of 57% had increased by 15% in the 4 years, towards a target of 80% by 2014. [20] This scenario is comparable to the Australian state of Queensland that has a 45% deficiency towards achieving its set 2020 C & D recycling target.

“It is not always the case that recycled or reclaimed product is the best use of resources. Some products contain high embodied energy as a result of remanufacturing processes or transport.” [21] To accelerate and maintain reduced C & D levels, in addition to waste reduction targets, landfill levies, procurement wastage and recycling clauses, [22] a meaningful understanding of waste and a classification of its impact based on current European legislation needs to be evolved. [23] Similarly to achievements in CO₂ emission reductions, waste strategies should be linked to policies concerning the recovery of embodied carbon throughout the lifecycle of a property asset.
4 Conclusion

The significance of embodied carbon in building components and structures of property assets must be strongly considered in the same context, as the polluter pays policies when practicing the scenarios for material reclamation and regeneration reuse in the built environment.

For both new and existing property assets it is crucial to implement policy through codes and planning to not only encourage the philosophy of regeneration reuse, but to influence it through regulation and prescribed targets. Such a philosophy leads to a systematic evaluation framework to selecting building components and structures suitable for regeneration reuse after deconstruction. This philosophy could be based on the Australian, Building Products Innovation Council life cycle inventory data, and the UK, Building Research Establishments life cycle analyses environmental profiling technique and SMARTWaste monitoring tool. Such an approach must account for site specific conditions, jurisdiction construction cultures, and seek to address the barriers of regeneration reuse that relate to increased transport costs, storage facilities and strict material specifications of different property asset building components or structures.

References:
[3] Fig. 1, Queensland Government, Queensland’s Waste Reduction and Recycling Strategy 2010 to 2020, Department of Environment and Resource, Brisbane, Australia 2010 pp. 5 & 18
[7] Fig. 2, Bleek, An assessment of timber dwellings typical of the Queenslander era, and constraints associated with their relocation, component and adaptive reuse when considering 'regeneration', Proceedings of the Engineering, Design and Development for Sustainable Wellbeing Conference, Brisbane, Australia, 2011, pp. 76-81
[18] Fig. 3, Department of the Environment, Water, Heritage and the Arts, National Waste Report, Australian Government, Canberra, Australia, 2010