Advancing Net Zero Ideas Competition

Stage One Submission

Applicant Code **151624**

This submission addresses core competition net zero objectives, disrupting conventional commercial accommodation specifications. It challenges locality zonal permissives – why shouldn't workspace encourage overnight accommodation if preferred by single workers, reducing carbon impact of commuting travel and avoid duplication of home / work energy use? Furthermore, why shouldn't it be possible to transmit zero carbon electricity via public utilities or public rail infrastructure?

A fundamental goal of this submission is to truly achieve a net-zero carbon lifecycle result without `greenwash', via practical plans to reduce embodied carbon through a combination of selective salvage, use of low carbon materials and improved design construction techniques applicable to structure, architecture and MEP services. There is intent also to contractually unite owner, design team, contractor, project manager, building occupants and building operator as stakeholders to minimise embedded and operational carbon content, with liability and payment incentives to attain net zero status within a 20-year period after completion.

The building is envisaged as new-build, to maximise opportunity to optimise day-one and `future-proofing' performance. It is however intended for the site concerned, to re-use existing sub-ground level structural content, on the basis this should disrupt traditional total demolition, total structural redesign and full re-build approach, when perfectly salvageable building elements can be re-purposed, gaining an extended lifecycle and avoid replicating embodied carbon content of serviceable elements already `written off'. Why should buildings in Hong Kong have a typical lifecycle of perhaps 40 years, when the rest of the world expects 100+ years from building stock?

This strategy makes a major assumption to provide a source of zero-carbon energy to both power the building and to offset of sub-500 kg Co2/m2 accumulated embodied carbon in 20 years – including an allowance for end-of-life demolition and disposal - by annual export of electricity at the stated 0.6kg/kWh. Locality issues preclude PV array site space to achieve this objective (a small-scale nuclear reactor scheme is unlikely to be accepted in an urban area); hence off-site generation and a `use-of system' transmission tariff deal with the incumbent utility supplier should be feasible in an advanced society truly committed to sustainability. This would transmit either real-time generated or stored electricity most effectively to site. Alternatively, the MTR Corporation might be expected to provide this facility, acting as a conduit to receive and notionally transmit electricity from less populated locations suitable for large scale PV arrays. Solutions such as floating PV arrays, integrated installation above highway noise barrier shields etc. could be readily adopted to provide large areas of PV, without societal disruption or loss of public amenity space.

As a contingency, this remote generation concept will assume scope to further alternatively either deliver remotely produced electricity by a fleet of battery trucks – the most desirable next option – or (anticipated to be much less efficient and convenient), delivery via a combination of (i) off-site ice or eutectic phase change media, (ii) hydrogen or synthetic natural gas for use in cogeneration plant or fuel cells within the building, with adsorption chillers using waste heat or even direct gas firing. Prior to rigorous analysis, it is intuitively clear that the very best solution must be direct transmission of zero-carbon electricity to site. Export of zero carbon electricity from the boundary of the project - displacing present-day carbon-dependent electricity - remains the only conceivable method to negate its cumulative embodied carbon. It is conceded that this method does not work if ALL society's electricity is from a zero-carbon source, but this is unlikely within the 20 year `carbon payback' plan adopted. It is further noted that a truly zero-carbon fuel from, for example, Jatropha beans farmed and processed responsibly, could be used for an on-site co-gen scheme; local bio-Diesel fuel sources reliant presently on palm oil are not proposed, because of the dubious ecological and socio-economic impact of this feedstock source. Urban wind energy is also not proposed, due to generally poor yield.

In terms of usage in the building, traditional area cooling allocations - beyond likely non-negotiable central IT loads will be disrupted downwards, by an approach spanning reducing operational heat gains via DC charging sources to displace inefficient plug-in computer or device charging, optimising the balance of natural fenestration, area and personal task lighting, accepting in this process Covid-disrupted norms for reduced occupation, `hot-desking' even for senior staff and elevating the importance of accurately controlled per-capita fresh air allocation. Accepting Hong Kong's climate reality, free cooling in restricted seasonal periods is envisaged, but overall a comfort-centric approach to air conditioning is proposed taking regard to P O Fanger's historical work. For general space treatment, a combination of low relative humidity, high dry-bulb temperatures (reducing fabric gains and promoting use of warmer and wider chilled water differential temperature) will also include radiant cooling; proven locally to our satisfaction to achieve acceptable `condensation margin'. Supplementary comfort will be achieved by innovative `in-desk' micro-air conditioning units for personal adjustment, scope to use plug-in cooling matrix jackets and extensive use of freely breathing mesh-type furniture. The in-desk cooling appears not available as a standard product beyond simple evaporative fan units; a zero-leakage chilled water bayonet connector is planned for both micro fan-coil type units and the (already available) cooling jacket concept.

Brevity constraint precludes expanding here other concepts issues, such as low-loss pipework, optimising chiller plant and heat rejection, maximising gravity value of water and waste water for distribution and dynamic lift counterweights, use of demand-controlled fan-less naturally driven washroom ventilation aligned with constrained surplus air-conditioned exhaust air etc as well as many other feasible spatial layout concepts, or expansive details on commitment to enhanced commissioning, continuous in-service performance tuning and adjustment (RCx) to suit evolving needs of the facility.

In summary, we aim to re-purpose elements of an existing structure, minimise embodied carbon in developing an optimised model solution to be progressively driven by committed stakeholders to zero net carbon, via low energy demand plus export of zero carbon electricity to displace conventional carbon-dependent electricity within an acceptable timescale significantly less than the lifecycle of the building.

(1,000 words excluding this and title page)

151624