London Calling to the Underground: Waste Heat in Urban Morphology is Going Down the Tube

Nicholas J. Thies

Follow this and additional works at: https://digitalcommons.wcl.american.edu/peel_alumni
London Calling to the Underground: Waste Heat in Urban Morphology is Going Down the Tube

Nicholas J. Thies
*American University Washington College of Law*

Follow this and additional works at: [http://digitalcommons.wcl.american.edu/sdlp](http://digitalcommons.wcl.american.edu/sdlp)

Part of the [Energy and Utilities Law Commons](http://digitalcommons.wcl.american.edu/sdlp)

Recommended Citation
London Calling to the Underground: Waste Heat in Urban Morphology is Going Down the Tube

by Nicholas J. Thies*

Buildings in urban areas are entirely lacking in significant energy-use developments. Energy production and distribution in urban areas are hugely inefficient, losing most of their production to waste heat.¹

Over the past 100 years, the clay surrounding London’s Underground has warmed and is no longer able to absorb the trapped waste heat, causing the Underground temperature to increase to over 30°C.² In November 2013, London’s Mayor Boris Johnson announced a new initiative to channel this waste heat from the Underground tunnels and an electrical substation to provide heat to 500 homes, thereby cutting winter energy costs.³ Excess body heat from passengers and heat generated by trains gets trapped underground,⁴ and by installing a ventilation system the waste heat can be channeled, stored, and distributed to tackle fuel poverty.⁵ This project was generated as part of Mayor Johnson’s target to produce 25% of London’s energy from local sources by 2025.⁶ Reporters who maintain that the project will be unable to supply London with enough energy to meet the impending increase in energy demand have justly criticized it.⁷ Yet, this initiative will reuse waste heat to reduce CO₂ emissions by over 500 tones each year⁸ begging the question: “What else could be done in an urban environment?”

A projection by The World Energy Outlook shows nearly three quarters of worldwide energy will be used in urban areas by 2030.¹² The growth of urban populations—which used two-thirds of the world’s energy in 2006—accounted for over 70% of global GHG emissions, while only half of the world’s population lived in cities.¹³ It is the organization of cities, more commonly known as urban morphology, which accounts for the increased use in energy and, ultimately, the resulting significant waste of energy created by urban designs.¹⁴

Made even more significant by the complex nature of urban morphology¹⁵ is the clear and significant role of buildings in urban design and, consequently, energy use.¹⁶ Throughout the world, buildings are the most substantial users of energy, averaging from 20% of all energy use in developing countries to 40% in the developed world.¹⁷ In London, the energy use of buildings accounts for nearly 70% of the city’s total energy use.¹⁸ Moreover, the majority of energy used by buildings becomes waste heat,¹⁹ which, like London’s Underground, could be redirected to be a part of the Underground’s system of insulated energy.²⁰

The difficulty with capturing waste heat is that the surrounding geology so easily absorbs it.²¹ However, in redesigning the system through which energy travels, waste heat can be protected from escaping.²² This can be accomplished through a system based on decreasing the distance between the site of energy production and the city center, insulating the underground channels through which energy travels, and directing the earth’s natural underground heat sources to this insulated channel.²³

Conclusion

Waste heat represents the largest area for improvement in energy production²⁴ and gives us insight to the future of urban morphology. To accommodate for this new system of energy conservation, cities will need to develop new forms of waste heat recovery as a foundation for urban development. New cities should be built based on the idea of capturing waste heat and utilizing the natural reserves of energy that cities have the

*J.D. Candidate 2016, American University Washington College of Law
unique advantage to obtain. This can already be seen through
the work of architects, whose designs distinguish between the
passive and active areas in buildings, where an active area uses
the design of the building to maintain its energy needs and a
passive area must find its energy elsewhere.\textsuperscript{25} For the most
part, the design for a more energy efficient future is already in
place. Because of their dense populations, tall buildings, and
infrastructure (all things which have traditionally been causes
of greenhouse emissions), cities are already built to develop
channels for waste heat and more efficient energy distribution.
In the end, it is the urban areas that will be the most energy
efficient. New styles of cities and urban development that will
incorporate the capture and distribution of waste heat in its
founding are on the horizon and will be forever intertwined
with city planning and urban morphology.

\textbf{ENDNOTES: LONDON CALLING TO THE UNDERGROUND: WASTE HEAT IN URBAN
MORPHOLOGY IS GOING DOWN THE TUBE}


\textsuperscript{2} \textit{Duncan P. Nicholson et al., The Design of Thermal Tunnel Energy Segments for Crossrail, U.K., 167 Engineering Sustainability 118, 119 (2014).}


\textsuperscript{4} \textit{See Nicholson et al., supra note 2, at 119.}

\textsuperscript{5} \textit{See Press Release, supra note 3.}

\textsuperscript{6} \textit{See id.}

\textsuperscript{7} \textit{James Woudhuysen, All this Carbon-Cutting is a Waste of Energy, Spiked (Feb. 2, 2012), http://www.spiked-online.com/newsite/article/12038#.VDxH1Lu2mQ.}

\textsuperscript{8} \textit{See Press Release, supra note 3.}

\textsuperscript{9} \textit{Edward F. Renshaw, Public Utilities and the Promotion of District Heating, 106 Public Utilities Fortnightly 26 (1980).}


\textsuperscript{11} \textit{See Renshaw, supra note 9, at 26.}


\textsuperscript{13} \textit{See id.}


\textsuperscript{15} \textit{See Kayla, supra note 12.}

\textsuperscript{16} \textit{See Rhode et al., supra note 14, at 139.}

\textsuperscript{17} \textit{See id at 138.}

\textsuperscript{18} \textit{See id.}

\textsuperscript{19} \textit{See Renshaw, supra note 9, at 26.}

\textsuperscript{20} \textit{See Rhode et al., supra note 14, at 139.}


\textsuperscript{22} \textit{Id. at 118.}

\textsuperscript{23} \textit{Id. at 118.}

\textsuperscript{24} \textit{Joan L. Pellegrino, Energy Use, Loss and Opportunities Analysis 25 (2004), available at https://www1.eere.energy.gov/manufacturing/intensiveprocesses/pdfs/energy_use_loss_opportunities_analysis.pdf.}

\textsuperscript{25} \textit{Ahmad Okeil, A Holistic Approach to Energy Efficient Building Forms, 42 Energy and Buildings 1437 (2010).}