

The Economics of Low Carbon Cities

Palembang, Indonesia

Andy Gouldson, Sarah Colenbrander,
Andrew Sudmant and Effie Papargyropoulou



Executive Summary

Introduction

What is the best way to shift a city to a more energy efficient, low carbon development path? Even where there is broad interest in such a transition, there are major obstacles that often prevent cities from acting on such a far-reaching agenda. The absence of a credible and locally appropriate evidence base makes it particularly difficult for decision makers to act.

This study aims to provide such an evidence base for Palembang, and to use this to examine whether there is an economic case that can be used to secure large-scale investments in energy efficiency and low carbon development in the city. The more specific aim is to provide prioritised lists of the most cost and carbon effective measures that could realistically be promoted across the energy, housing, commercial buildings, transport, industry and waste sectors within the city.

A continuation of business as usual trends in Palembang will see energy use rise by 129.2%, total energy bills by 155.1% and carbon emissions by 164.6% by 2025.

Our approach

We start the analysis by collecting data on levels and composition of energy use in Palembang. We do this for a range of different sectors including the electricity sectors on the supply side and the housing, commercial, transport and industry sectors on the demand side. We also evaluate the waste sector as it both generates greenhouse gas emissions and has the potential to generate energy.

For each of these sectors, and for the cities as a whole, we examine the influence of recent trends, for example in economic growth, population growth, consumer behaviour and energy efficiency, and we develop 'business as usual' baselines that continue these trends through to 2025. These baselines allow us to predict future levels and forms of energy supply and demand, as well as future energy bills and carbon emissions.

Based on extensive literature reviews and stakeholder consultations, we compile lists of the low carbon measures that could potentially be applied in each of the different sectors in the city. We assess the performance of each measure by conducting a realistic assessment of its costs and likely lifetime savings, and we consider the scope for deploying each one in Palembang in the period to 2025. These appraisals were subjected to a participatory review in expert workshops to ensure that they are as realistic as possible and to consider the key factors that shape the potential for their deployment.

We then draw together the results from our assessment and the expert review to determine the potential impact of the combined measures across the different sectors of the city as a whole. This allows us to understand the scale of the development opportunity, the associated investment needs and paybacks, as well as impacts on energy supply and demand, energy bills and carbon emissions in the different sectors in the city. These aggregations also allow us to generate league tables of the most cost and carbon effective measures that could be adopted both in each sector and across the city as a whole.

The economic case for low carbon investment

We estimate that Palembang's GDP was IDR 54.00 trillion (US\$4.59 billion) in 2014, and if recent trends continue we forecast that GDP will grow to IDR 123.21 billion (US\$10.47 billion) by 2025. We also find that the total energy bill for Palembang in 2014 was IDR 10.08 trillion (US\$857.22 million), meaning that 18.7% of all income earned in Palembang is currently spent on energy (without including government expenditure on fuel subsidies).

We predict that a continuation of business as usual trends in the period to 2025 would see total energy use in Palembang rising by 129.2% from 2014 levels to 2025 and we forecast that the total energy bill for the cities will increase by 155.1% from 2014 levels to IDR 25.73 billion (US\$2.19 billion) in 2025. We also predict that under a business as usual scenario, total carbon emissions from Palembang are forecast to increase by 164.6% from 2014 levels by 2025.

After examining the potential costs and benefits of the wide range of energy efficiency, renewable energy and other low carbon measures that could be deployed across different sectors in the city, we find that - compared to business as usual trends - Palembang could reduce its carbon emissions by 2025 by:

- 24.1% through cost effective investments that would more than pay for themselves on commercial terms over their lifetime. This would come from an investment of IDR 4.77 trillion (US\$ 405.6 million), generating annual savings by reducing energy bills by IDR 5.14 trillion (US\$ 436.80 million), paying back the investment in less than one year but generating annual savings for the lifetime of the measures.
- 26.6% if, as well as the above investments, cost effective investments in the electricity sector were made that could more than pay for themselves on commercial terms over their lifetime. This would require an investment of IDR 34.95 trillion (US\$ 2.97 billion), generating annual savings of IDR 2.29 trillion (US\$ 195.05 million), paying back the investment in 15.2 years and generating annual savings across South Sumatra for the lifetime of the measures.
- 28.3% with cost neutral measures that could be paid for by re-investing the income generated from all cost-effective measures. This would require an investment of IDR 18.17 trillion (US\$ 1.54 billion), generating annual cost savings of IDR 5.50 trillion (US\$ 467.4 million), paying back the investment in 3.3 years but generating annual savings for the lifetime of the measures.

- 32.0% with cost neutral measures in the electricity sector that could be paid for by re-investing the income generated from cost-effective measures. This would require an investment of IDR 111.42 trillion (US\$ 9.47 billion), generating annual cost savings of IDR 6.50 trillion (US\$ 552.25 million), paying back the investment in 17.2 years and generating annual savings across South Sumatra for the lifetime of the measures.
- 46.5% with the exploitation of all the realistic potential of the different measures with carbon saving potential. This would require investment of IDR 4.56 quadrillion (US\$ 387.30 billion), generating annual savings of IDR 14.53 trillion (US\$ 1.24 billion).

We find that the industry sector contains 46.1% of the total potential for cost-effective low carbon investments, with the remaining potential being distributed among the domestic sector (21.4%), commercial sector (1.2%), transport sector (7.8%), waste sector (14.1%) and the electricity supply sector (9.4%).

While the impacts of cost effective and cost neutral changes will reduce overall emissions relative to business as usual trends, they do not stop overall emissions from rising in absolute terms. With exploitation of all cost effective options, by 2025 emissions would be 88.5% above 2014 levels and, with the exploitation of all cost neutral measures, 78.0% above 2014 levels. Investment in all cost effective measures will save IDR 7.18 trillion (US\$610.94 million) in energy costs per year, thereby reducing the energy bill in 2025 from 20.9% to 15.0% of GDP. Investment in all cost neutral measures will save IDR 7.85 trillion (US\$667.12 million) in energy costs per year, thereby reducing the energy bill in 2025 to only 14.5% of GDP.

Palembang could reduce its energy bills by IDR 5.14 trillion (USD 436.80 million) and its carbon emissions by 24.1% through investments that would pay for themselves in less than one year.

Figure 1.
Indexed total CO₂-e emissions per unit of energy, per unit of GDP and per capita.

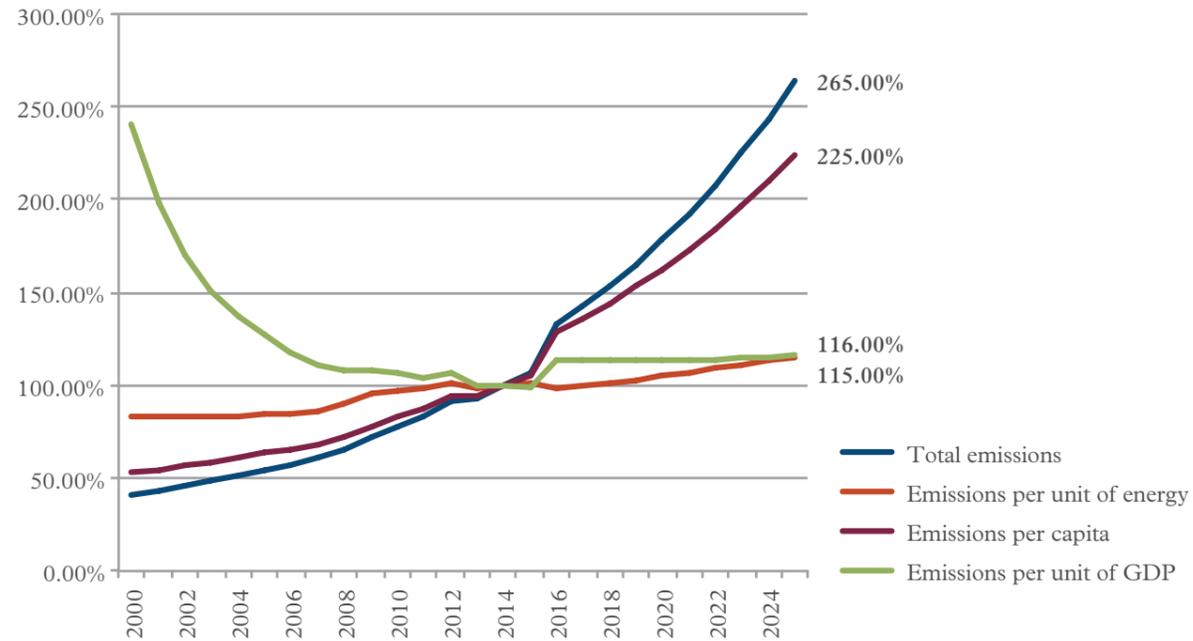
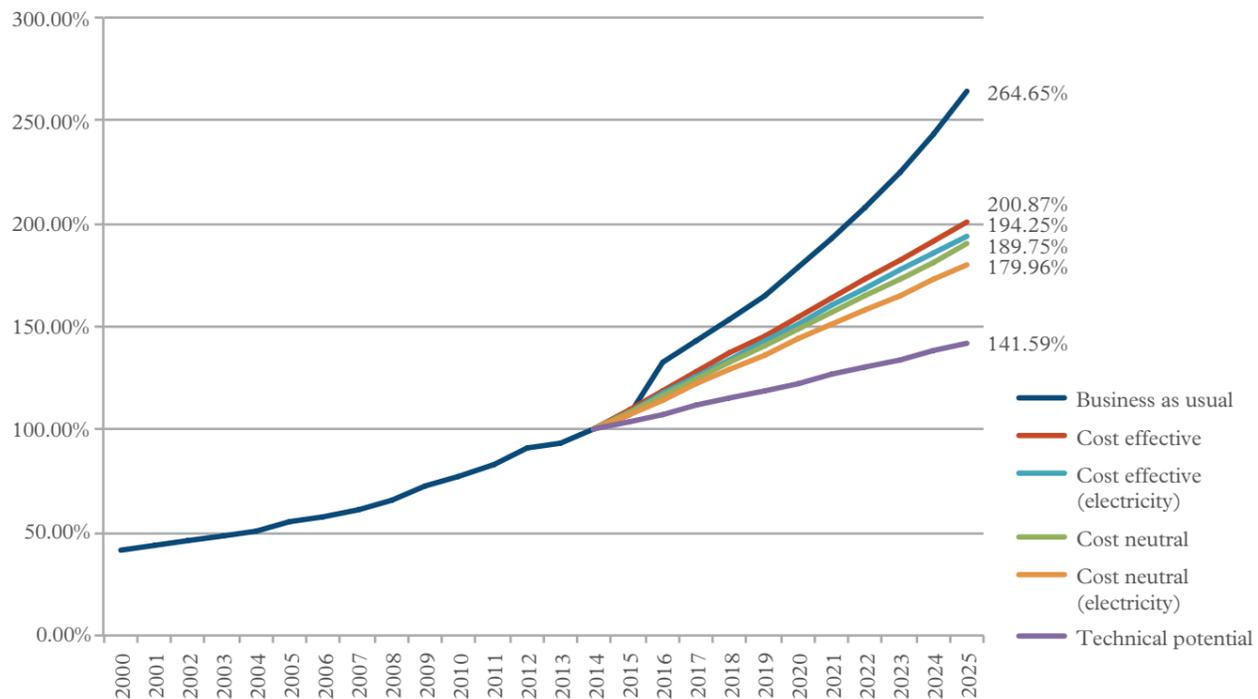


Figure 2.
CO₂-e emissions from Johor Bahru and Pasir Gudang under five different investment scenarios, as a function of 2014 emissions, between 2000 and 2025.

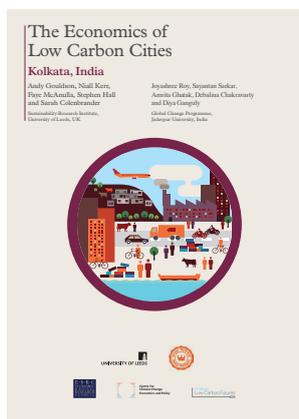


Conclusions and Recommendations

This research reveals that there are many economically attractive opportunities to increase energy efficiency and stimulate renewable energy investment, which would in turn improve the economic competitiveness, energy security and carbon intensity of Palembang. The scale of the opportunities demonstrates that accounting for climate change in the early stages of development can be attractive in commercial terms, above and beyond the immense benefits of reducing the future impacts of climate change.

The presence of such opportunities does not mean that they will necessarily be exploited. By providing evidence on the scale and composition of these opportunities, we hope that this report will help to build political commitment and institutional capacities for change. We also hope this report will help Palembang in particular and Indonesia more broadly to secure the investments and develop the delivery models needed for ambitious climate action. Some of the energy efficiency and low carbon opportunities could be commercially attractive whilst others may only be viable with public investment and/or climate finance. Many of the opportunities would benefit from the support of enabling policies from government.

We also stress that economics is not the only discipline that has something useful to say on the transition to a low carbon development model in Palembang. A wider analysis should also consider the social desirability of the different options, as well as issues relating to the equity, inclusivity and broader sustainability of the different development pathways that could be pursued in the city.



Kolkata, India



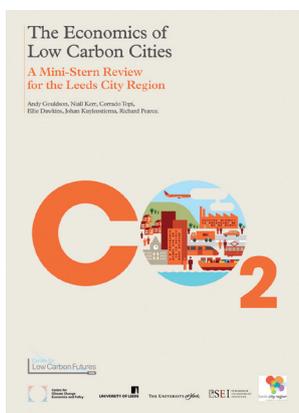
Lima-Callao, Peru



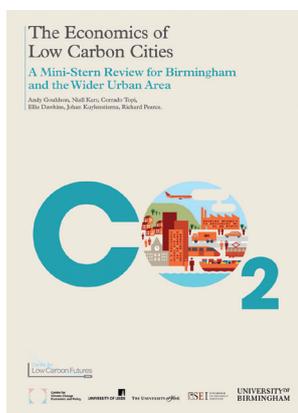
Palembang, Indonesia



Johor Bahru, Malaysia



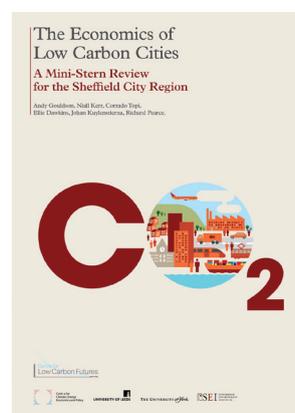
Leeds City Region



Birmingham and the Wider Urban Area



The Humber



Sheffield City Region

Project Director:

Prof Andy Gouldson
a.gouldson@leeds.ac.uk



Project Manager:

Sarah Colenbrander
s.colenbrander@leeds.ac.uk



In-country lead:

Dr Elly Sinaga
ellysinaga@yahoo.com

