

# MASDAR CITY FROM AN ENERGY EFFICIENCY PERSPECTIVE

Lukas Wolz, Malek Dawi & Stefan Glutsch  
UNIVERSITAT POLITÈCNICA DE CATALUNYA  
Communication Skills 1



# Masdar City – From an energy efficiency perspective

## Contents

1. Introduction .....	2
2. Challenges .....	2
3. The city .....	2
4. Mobility .....	3
5. Energy & Water.....	3
6. Waste .....	4
7. Design and architecture .....	4
8. Conclusion.....	5
9. References .....	6

## 1. Introduction

The human mankind needs energy sources more than ever and will always need them. Due to the increasing demand, the earth is shamelessly exploited. Fuel and Oil will run out in a few decades and if we haven't solved our energy problem till then, we'll have a disaster. But even if humanity manages to change their energy supply to green energy, we are still not saved. Another big problem is already waiting for us. The biggest cities are enticing more and more people and with the enlarged number of inhabitants it is getting more difficult to remove the waste, keep the air fresh and organize the traffic. As everybody can see, smog and dirt is a serious problem in many big metropolis.

## 2. Challenges

To sum everything up there are three major problems, which have to be solved. These are the „dirty“ energy supply, the enormous amount of waste and carbon dioxide produced or emitted and the overcrowded streets, which are always causing huge traffic jams costing millions of dollars. Masdar city is a planned city project in Abu Dhabi, which may be able to solve all of these issues. The concept city is designed by the architectural firm „Foster and Partner“ and is the host of the headquarters of the „International Renewable Energy Agency) or short IRENA.



*Design of Masdar City*

## 3. The city

It was already initiated ten years ago in 2006. As designed, the city would be home to 45,000 to 50,000 people. Its aim is to be independent from „old“ energy supplies like fuels, oil or nuclear energy. This is only possibly with a huge amount of solar panels and a good combination between solar and wind power and of course a reliable dealing with energy sources. Furthermore money is needed to finance this ambitious project. It is estimated that it will cost around US \$18-22 billion and their goal was to complete it in 8 years. Due to the impact of the financial crisis the final completion of the city was pushed back twice. The new date is approximately around 2030. In 2016 only 300 000 square meters have been developed, which is only 6% of the final area. In addition fewer than 2000 people are employed in Masdar at the moment. Despite the setbacks many big companies are taking part in that project like BASF or Siemens but also big universities like the MIT or the RWTH Aachen. Beyond that the project is financed and supported by the local government. As the city should be an example to the world how to efficiently use your given resources, it will also have an university called „Masdar Institute of Science and Technology“, which only topics will be alternative energies, environmental sustainability and clean technology. In spite of the numerous amount of applicants only around 300 students are enrolled at the university in the moment. Plans are to enroll about 800 students, which are supplied with scholarships, travel expenses, and everything they need to facilitate their studies. The students are engaged in over 300 projects with focus on renewable energy, smart grid and smart buildings, energy policy and planning. The building of the Masdar Institute was developed in cooperation with the MIT and uses 51% less electricity and 54% less potable water than traditional buildings in the Middle East.

## 4. Mobility

Masdar City wants to be a city which states an example for future cities in many aspects. One of them is the public transport and therefore the mobility of the cities inhabitants.

First of all there are no motor vehicles powered by fossil fuels allowed in the city. The transport system of the city is a combination of the “personal rapid transit (PRT)”, “the freight rapid transit (FRT)” and the “METRO”. In total it will be the first large scale zero emission transport system.



*Personal rapid transport*

The PRT is especially for the transport in the city. Driverless electrical vehicles are carrying people underground to different stops in the city. The difference to existing trams is that every ride is personalised. There are no additional stops than the ones needed. Another fact is that the cars are small compared to trams. That means just as many PRT’s are moving as it is needed. There will be no more empty wagons of trams. The FRT is driving on ground level. Together with the underground, high-speed Metro system they are connecting Masdar city with other cities and important infrastructures airports and harbours. The inhabitants of Masdar city will never be further away than 250 meters from the public transport. That means that the city itself will not have the need for streets like we are used to having them in nowadays cities. There will be literally no cars in the street, just pedestrians between the narrow alleys between the buildings.

## 5. Energy & Water

The design of the city aims to minimize water and electricity demand as much as possible. Beside the design there are also other ways to lower the energy demand. All the buildings will be smart buildings. That means that they will be monitored and also their usage of electricity. The goal is to establish individual power-usage-systems for the different buildings to decrease the demand even more. Another point is that there will be no light switchers or water taps. This will be done by movement sensors. So there will be no running taps or lights on where it is not needed. In total this will decrease the water and electricity consumption up to 60%.



*Solar Panels*



*Desalination Plant*

However, as the city will host around 50.000 people, different businesses and a university, of course there will be still a lot of energy needed. The city will draw 100 percent of its electricity from renewable sources. That means that the latest technique in generating green energy will be used. The highest percentage will be made out of solar energy. Beside that electricity will be gained out of geothermal, wind and burning waste. Most of the cities roofs will be covered by solar panels and additionally there will be solar power plants next to Masdar city to satisfy the demand of electricity. To guarantee power at all time, energy storage is a very important topic too. Latest knowledge in saving energy and the best battery systems will be used to store electricity with the aim of minimizing the losses. If the actual production of electricity is higher as the demand the power can be exported to regional power grids and provide green energy for the surrounding cities.

Water will be produced by a seawater desalination plant. As Masdar is located next to the Persian Gulf more than enough seawater is available. The plant itself will use solar panels to satisfy its electricity demands. Latest technology allows to produces around 5 to 20 litres per day and square meter solar panel. The used water in the city will be treated and reused as many times as possible. The aim is to recycle around 80% of the used water. This can be for example by irrigating the cities landscapes or to water crops.

## 6. Waste

Masdar city has a zero waste policy. That means that it will be a city without emissions and also without producing any garbage for landfills. All the generated garbage will be either recycled or burned and so on turned into energy.

As there will be no cars and generally no engines driven by fossil fuels there will be no emissions. All the electricity needed will be made out of renewable sources.

## 7. Design and architecture

The buildings inside Masdar City represent models of sustainably architecture and the style of future constructions. Siemens HQ is a clear example of the adopted urban sustainability, in addition of being designed with sustainable materials, the building is optimized to consume 64% less energy than typical office buildings in the region. The Knowledge Centre also sits as an icon of the efficient building, it has an innovative roof that was designed in a way to optimize the performance of its photovoltaic array, and also it has the ability to controls the amount of sunlight.



*Siemens Middle East HQ*



*The Knowledge Center*

In UAE, about 60 per cent of the used energy goes to air conditioning, so when it comes to architecture and urban planning, developers of Masdar city had to come up with innovative designs to overcome the desert heat and stay committed to sustainable urbanism. Inspired by the traditional Arabic technique, the city is planned with narrowed streets that have a specific angle in order to maximize the shade, and the site was elevated above the surrounding area. Another interesting technique was the introduction of wind towers, designer had developed a 45 meter towers which higher than the surrounding buildings, in order to catch the wind and create an air current that tend to decrease the temperature of the streets. It is said that. The temperature in the streets is about 15 to 20 °C cooler than the surrounding desert. With such measurements developers are seeking to create friendly environment for cyclist and pedestrians.



*A modern interpretation of the Arabian wind tower is used to cool the plaza areas at the Masdar Institute of Science and Technology*

## 8. Conclusion

Masdar city can be seen as a real initiative on how future city should be without carbon footprint, since many involved institutions are established inside the city, it can be considered as study case for intensive research in eco-cities both technologically and socially. On the other hand, despite the project is still funded by exporting fossil fuel, research efforts and financial resources should focus more on how today cities can be transformed to be more friendly to the environment instead of building a new isolated one from scratch, especially since UAE have one of the highest energy consumption per capita. Creating a community with zero carbon and zero waste depend not only on technological innovation but also on the behaviour of its inhabitants.

## 9. References

[https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ\\_AUIBigB#tbn=isch&q=uae+map](https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ_AUIBigB#tbn=isch&q=uae+map)

[https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ\\_AUIBigB#tbn=isch&q=masdar+city+logo&imgrc=SN5NXTUuvtqPdM%3A](https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ_AUIBigB#tbn=isch&q=masdar+city+logo&imgrc=SN5NXTUuvtqPdM%3A)

[https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ\\_AUIBigB#tbn=isch&q=emission](https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ_AUIBigB#tbn=isch&q=emission)

[https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ\\_AUIBigB#tbn=isch&q=waste&imgrc=Sx9emheG4zHgMM%3A](https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ_AUIBigB#tbn=isch&q=waste&imgrc=Sx9emheG4zHgMM%3A)

[https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ\\_AUIBigB#tbn=isch&q=co2+neutral&imgrc=VmxFVBLAczlwM%3A](https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ_AUIBigB#tbn=isch&q=co2+neutral&imgrc=VmxFVBLAczlwM%3A)

[https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ\\_AUIBigB#tbn=isch&q=desalination+plant+dubai](https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ_AUIBigB#tbn=isch&q=desalination+plant+dubai)

[https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ\\_AUIBigB#tbn=isch&q=masdar+city](https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ_AUIBigB#tbn=isch&q=masdar+city)

[https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ\\_AUIBigB#tbn=isch&q=renewable+energy](https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ_AUIBigB#tbn=isch&q=renewable+energy)

[https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ\\_AUIBigB#tbn=isch&q=masdar+university&imgrc=RRU8jE1tGVosrM%3A](https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ_AUIBigB#tbn=isch&q=masdar+university&imgrc=RRU8jE1tGVosrM%3A)

[https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ\\_AUIBigB#tbn=isch&q=irena+masdar&imgrc=xV2cV1ZGFikaxM%3A](https://www.google.es/search?q=uae+topographic+map&espv=2&biw=1280&bih=615&source=lnms&tbm=isch&sa=X&ved=0ahUKEwintNy-yLDQAhVBvRoKHQ67AAYQ_AUIBigB#tbn=isch&q=irena+masdar&imgrc=xV2cV1ZGFikaxM%3A)

[http://www.masdar.ae/assets/downloads/content/270/masdar\\_city\\_fact\\_sheet.pdf](http://www.masdar.ae/assets/downloads/content/270/masdar_city_fact_sheet.pdf)

[https://en.wikipedia.org/wiki/Masdar\\_City](https://en.wikipedia.org/wiki/Masdar_City)

<http://www.nytimes.com/2010/09/26/arts/design/26masdar.html>