Rotating Tower Dubai

Dr. Arch. David H. Fisher

Chairman, Dynamic Architecture Group, Rotating Tower Technology International Limited (UK)
Florence Office: Via Mannelli 5, 50136 Florence, Italy
Tel: + 39 055 6266337, Fax: + 39 055 6241423, E-mail: d.fisher@dynamicarchitecture.net

Biography
Dr. David Fisher started his career in Florence. After graduating with Honours at the Faculty of Architecture in Florence (the emblem of Italian Renaissance), Dr. Fisher taught Architecture in the same university and at the School of Structural Engineering.

On account of his academic achievements and research activities, Dr. Fisher was awarded a PhD honoris causa by the Pro-deo Institute at the Columbia University (New York).

In the last three decades he has been passionately working on redefining the technical and technological extremes of buildings, especially in urban centres like New York, Moscow, Hong Kong, Paris and Dubai.
At the same time, Dr. Fisher has also been involved in the restoration of ancient monuments and in the design of public buildings. Through the New York office of Fiteco Ltd, which he launched in the mid-eighties, Dr. Fisher got involved in the business of prefabrication and construction technologies as well as in the building and development of hotel projects.

Dr. Fisher’s professional activity has always been focused on two concepts: an industrial approach, which involves the use of prefab units, and Dynamic Architecture, according to which the traditional 3D design meets a fourth dimension: time.

According to Dr. Fisher, time is the most powerful dimension of life because it is tightly linked with relativity. His new skyscraper, the Rotating Tower, is “shaped by life, designed by time”.

Keywords: Sustainability, Rotating Skyscraper, Prefabricated, Dynamic Architecture, Time
Abstract
The Dynamic Architecture project is innovative in design and building sustainability, therefore the project recognizes environmental care and industrial production process as key points in the buildings of the future.

In particular, the project is based on three fundamental concepts: it is DYNAMIC because each floor can rotate independently from the others allowing the building to change its' shape continuously, it is GREEN because it produces its own energy from the wind and from the sun; it is INDUSTRIALLY PRODUCED being made of prefabricated modules, then assembled on site.

These green buildings based on the sustainability concept will change the skyline of cities not only due to their Dynamic Shape but mainly as they may finally help us to enjoy nature.

Keywords: Sustainability, Rotating Skyscraper, Prefabricated, Dynamic Architecture, Time

Introduction Architecture = Sustainability

The Idea of Dynamic Architecture was born with the desire to have buildings that adjust themselves to life, that are part of nature.

In fact, our buildings, in which each floor rotates separately, change their shape continuously and never look the same.

I call them “Buildings designed by time, shaped by life”.

Imagine a skyscraper that can revolve according to tenants’ needs and whims, allowing them to decide their own light exposition and view.

In fact, these buildings are part of nature, inserted in the environment.

During the first phases of design I understood therefore that they are by nature sustainable buildings.

In fact, they become part of environment, they are made of natural materials green as they save energy, but not only as they produce wind energy and what can be more important today then saving our planet?

Architecture seems today as an expression of artistic imagination as most architects are competing in designing buildings that can become iconic due to their particular shapes.

Design is of course an important value in our society, it takes care of a part of our life style… but above all we should really care for our quality of life and quality of life has different values.

In fact, architects could at the end of the planning process take care also for the harmony of the shapes. But only after they satisfy the previous task, the first commands…

Today, instead, most architects exchange their trade concept with sculptures as they make sculptures in the wrong scale.

Buildings are different things as they are the shell around our space and should be therefore satisfying our needs, therefore they should make sense being designed and built, according to a specific list of preferences.

I believe that the six commands of Architecture are ranking in importance as follows:

1. Economical Feasibility
2. Functionality
3. Environmentally sound
4. Quality & Engineering
5. Maintenance
6. Design

The above are the principals of sustainability.

If we follow this formula, if we design according to this order of importance then we have sustainable buildings.

In fact Architecture should be equal to Sustainability, let’s forget about the design, this is a massage of a Florentine architect, city of art and Renaissance, but also the city of Science and quality of life.

Leonardo and Amerigo Vespucci, Michelangelo and Galileo were born in Florence…

Let’s put aside the design for a while, let think of sustainability the art of living is more beautiful then any other….living in a clean and green environment.

What are the six commands?

Above all a building has to be economically feasible. If our homes are not feasible they do not have the basis to be our shelter, we cannot afford them, we cannot maintain them. As a consequence, how can we
have a good quality of life if they are not economically sound?
Before an architect starts planning a building he should look at its’ economic and only when he finds the right “formula” or combination that guarantees the feasibility of the building he should be in a position to face the other aspects.
The second command in my list is the functionality. Again, has to do with quality of life. Buildings should offer us the best possible benefits and, in order to have the most convenient space to live in, we should consider all practical aspects of life.
The third command is the environmental aspects of our homes… they should be made of natural materials, they should be pure of transmission of electrical waves, they should be inserted in nature, relate to the view and as much as possible save energy… this is sustainability.

Engineering and quality are the forth most important elements in planning buildings. Engineering means the feasibility of the physical aspects of the building, of the hardware, the shell around our space, the structural aspects, good quality product, the method of construction and therefore also the human conditions of the construction worker, the cost and time of construction. So again, our engineers should help us in making the buildings have sense and being sustainable.

The fifth most important thing in a building is its capability for maintenance. Today buildings are done as by the ancient Egyptians, when something goes wrong with the hydraulic system and has to be fixed, we have first to break the walls, to look for the lick, to adjust the pipes and then to plaster the wall and paint it. If it is in the bathroom we may also face the problem of not finding the same tiles. It is about time that buildings will be able to have easy maintenance and service and offering, again, a proper quality of life to people.

Sustainable buildings…

Last... if they are of a nice shape it will make our apartments attractive and our cities nice, so why not?
A sustainable building, in fact, has to be economically feasible, functional, environmentally sound, engineering sound and allow easy maintenance.

The combinations of the above issues – all of them, but strictly according to the rank, create sustainable buildings.

We should consider the sustainability impact of our home to the environment and the influence of nature on our space of life (“homes”). If environment is ignored our life is in danger. This is exactly what is happening today on our planet, so buildings should be environmentally friendly, they should be built in an ecological method to prevent the cities suffering during the construction time.

Buildings should consume as little energy as possible and should be made of clean natural materials, green as possible and can create energy as well.

Sustainable buildings will become the symbol of a new philosophy that will change the look of our cities and the concept of living.

Dynamic Architecture:

My Dynamic Buildings are known as Rotating Skyscrapers.
The rotation of these buildings indeed could be seen as a gimmick, but not so!
It all started with the desire to see the view around us, of adjusting our self to the season, to follow the sun, of having a house part of nature.
I consider our Dynamic Architecture towers to give also sense of time, of movement to life, rotating apartments may give a different sense to our life and create a different space around us.
Above all, these buildings are sustainable, as will be hereby described.
Dynamic Architecture buildings keep modifying their shape. As each floor rotates separately, the form of the building changes constantly; you may not see the same building twice.
Dynamic architecture marks a new era in architecture. This new approach, based on motion dynamics, is in fact a challenge to traditional architecture that until now was based on rigid buildings…joking, I call the not-moving buildings tombstones… buildings should start being part of the universe… and therefore moving…dynamic….

How could one think that homes in digital area will be immobile as our grandmother house?...
Dynamic Architecture buildings will become the symbol of a new philosophy that will change the look of our cities and the concept of living. From now on, buildings will have a fourth new dimension TIME. Buildings will not be confined to rigid shapes; construction will have a new approach and flexibility. Cities will change faster than we ever imagined.
This fourth dimension has been the essence of my work so far. The concept has already generated considerable interest internationally, from political leaders and city councils.
The homes we live in and the way we live are also set to change drastically with this innovative architecture.
Our buildings will no more remain the ‘fossilized imagination’ of the architect; they will change, constantly bringing new views and experiences to us with time; nor can the architect's pencil impose an environment on us. Each building will have its own future and will gain freedom.

Let’s go to the first command: the Economical Feasibility.

The Prefabrication:

The construction method and therefore also the economical feasibility of these buildings make them sustainable.
These buildings are made of prefabricated units, custom-made in a workshop, to fit very high quality standards. Such a process itself can guarantee cost savings of up to 20%, a factor that will have a huge impact on the global real estate industry. Compared to traditional buildings, Dynamic Architecture requires
fewer people on site, which means less risk of human casualties; construction is faster and cost is significantly lower.

Today, everything is produced in an industrial facility. How could we afford a computer that would have been produced manually? They are produced in a facility that allows low cost of local labour, efficient assembly system, easy quality control, easy monitoring of time.

Doing buildings on site, as we do since the pyramids, is as if we were producing cars in the parking lot or an aircraft on the runway…

Our building in fact are made of preassembled units, that arrive to the site completed of all finishing, equipment, plumbing and air conditioning, ready for a fast and easy installation process.

So these buildings are feasible.

I mentioned functionality – well, also the interior partition will be flexible if they will ever exist... look how flexible is our digital part of life... why should we still live in a medieval castle where the wall do not let us any freedom and we can modify them when our way of life get changed.

The prefabrication offer also environmental advantages, bringing several “Green” benefits:

Instead of having over 2,000 workers on a regular skyscraper of 60 floors, we will have 70 people.

The industrialization of buildings gives also environmental benefits:

We can better control that materials used are properly ecological.

The construction workers are in a much better working environment.

The construction site is ecologically sound for the benefit of the city, it is clean, quite, there is no waste, minimal traffic, no use of inflammable materials.

**The rotation**

I think we all are aware that construction technology hardly changed in the course of the years. It was clear to me on the other hand that we can use for this building, that I tend to call “a machine for living”, many other technologies that exist in other fields.

The phases of design got me and our engineers, taking part in the design of the Rotating Tower, very much involved with our “partners” industries such as Bosch.

We tried to apply technology existing in different fields such as air space, trains, massive machines and tools, the large telescopes, bridges, off shore platforms and cranes.

The rotation of the floors is done with steel bearings and combination of air-cushion, allowing the floors to rotate smoothly and with no vibrations.

There is limited power of about 4 KW required to rotate a floor. The drive system is situated in the base of each floor so it can not be seen and in the same time it allows easy maintenance when required.

The structure is based on a reinforced concrete core of about 22mt diameter that carries all the vertical loads.

The floors will be all made of steel structure, becoming a monolithic platform, with a cantilever up to about 15 meters.

The floors will be connected to the core in a way that will allow a continuous rotation to either direction, with no vibrations or noise.

This architecture is revolutionary even in the way it's built. It is in fact the first building produced in a factory, apart from the concrete core. It's produced of complete luxury units in a factory, including all plumbing, electrical, air conditioning and installed on the concrete core right on location.

This ready made implementation offers high quality finishing, high quality control and the use of a very few workers on site, with a real cost, life risks and time savings. Besides, this architecture, made of single separated floors offer higher seismic resistance than any other normal building. Dynamic Architecture is designed for better living even before it's finished.

The ready made technology allows a revolutionary implementation which is the quickest way to build a tower: building time is reduced from 30 to 18 months.

The revolutionary ready made technology, plus the fact that it moves to the wind, allows the building to be 1.3 times more resistant to earthquakes.

**The Rotating Tower, the first industrial skyscraper:**

Man has always built his homes in the same way: brick after brick, right where he would then live.

The art of construction has actually changed very little over centuries. Until today, there have only been three major steps forward:

3,800 B.C. – Ancient Egyptians built the pyramids and buildings until now are based on gravity: stones/bricks/blocks are positioned one on top of the other.

1436 - Brunelleschi designed the dome of the Cathedral of Florence. The biggest dome ever built, challenging horizontal forces.

1889 - The first iron structure, the Eiffel Tower , was built in Paris. Many skyscrapers are built of bolted steel traces, based on the same technology.

1905 - Reinforced concrete was created by combining cement with iron bars; most structures until now are made of reinforced concrete.

Today, the Rotating Tower of Dubai marks the first real innovation in construction in a century.

In fact, the Rotating Tower will be the first industrial skyscraper ever constructed: 90 percent of the building will be prefabricated and assembled on a central core, the only part that will be built with traditional reinforced concrete poured on the site.

This new way of building, based on rationalizing the construction process, provides significant savings in terms of both time and money. With fewer people on the
job site and part of the production totally industrialized, the tower is expected to cost about 23% less than a traditional building. The Rotating Tower will be constructed in two main phases. The central core will take just six months to be constructed, using slip forms that allow the erection of a floor every two days. This structural solution of a massive single concrete core will increase the building's seismic resistance compared to a traditional skyscraper. Two months after the start of works, the first residential units will reach the job site, complete with all their plumbing, electric and air-conditioning systems. The units will be “hooked” to the core with a sequence of one floor a week, allowing a 60 stories building to be built in a record time, saving about 30% over a construction time of a similar skyscraper. Once attached to the load-bearing structure, an operation that would require...few days. These pre-assembled units that make a complete finished floor will be made of a combination of steel, aluminium and fiber carbon. The industrial assembly process will mean high quality of finishing that can never be achieved on a construction site, faster construction time and cost savings. The prefabrication of the prefab “units” will be done based on the following principals: Light weight Steel structure Aluminum cladding All part arrive ready to the assembly facility and then put together. The units leave the plant complete of all parts such as: Structural MEP Partitions Bathrooms and kitchens All finishing items Size to be of easy transportation We do believe that in future days, most buildings around the world will be produced within an industrial facility, offering all the above benefits. (see Figure 1) Engineering: Based on the structure and construction features of the Rotating Tower, it will be the first skyscraper “produced” according to an industrial process. Apart from the central concrete core (built “on-site” using traditional techniques), 90% of the building consists in prefab modules, assembled in an industrial park and transported to the building site to be connected to the central core. This process will revolutionise the traditional building techniques (see Figure 2). Considering that each floor of the tower consists of factory-made modules that will arrive at the building site with electrical, plumbing, air-conditioning systems ready for use, the “Fisher Method” will provide a long series of advantages: Advantage 1: costs and construction time It has been calculated that in addition to the cost savings of up to 20% compared to those of traditional building methods, the construction time will be reduced of 30%. The Method will allow the completion of a 70-floor skyscraper within 18 months (nowadays it would take around 30 working months). Furthermore, the “assemblage” of the Rotating Tower would require the presence of approximately 90 people (specialized workers, technicians and engineers) in the building site, instead of over 2 000 people in the traditional ones. The Method will turn the site into a place where the modules are only assembled because the structural work has already been completed in the factory. The structural concept of the building is very simple – in fact, the only structural element is a single centre core made of concrete. It is faster, less expensive then hundred of beams, columns and joints and also more sound as it is quite a homogeneous structure with no wick connections.
Advantage 2: customization
In addition, it will be possible to customise individual apartments according to owners’ needs and style. Due to the industrial process, the apartments will offer excellent design and an endless variety of customizations (see Figure 3). I wish to underline that modules, as a new industrial structure, can easily offer luxury standards of living and excellent structure quality.

Figure 3. An illustration of how a whole floor of the Rotating Tower can become a villa (Infinity Studio, 2007).

Advantage 3: quality control
The quality standards, from the structural parts to the fittings and finishing, can easily be guaranteed since the modules are manufactured in an industrialized structure, and not in a building site where monitoring can be difficult (see Figure 4).

Figure 4. An illustration of how a floor of the Rotating Tower can be turned into various apartments (Infinity Studio, 2007).

Advantage 4: safety in the working place
Another strong point of the “Fisher Method” is safety in the working place. Building site workers will be able to operate in comfortable and functional environmental conditions because the various assemblage (rather than construction) phases will follow smart, time-saving, well-organized sequences. The industrialization of house-building in fact is based on the optimization of the manufacturing cycle and will turn house-building technique into an industrial model.

Advantage 5: environmental advantages
Thanks to this new Method, the Rotating Tower building site will definitely offer outstanding environmental advantages to the cities: traditionally huge, polluted, unsafe building sites will become Smart Sites, comparatively smaller, ecological and safer. Considering that the modules have been pre-assembled in the factory, all the negative factors linked to traditional sites will disappear: big space around the building, endless loading and unloading, debris, waste material, noise and traffic. The modules for the Rotating Tower will be assembled in dedicated industrial parks where manufacturers of high standard building materials will gather to work on the common project. The first industrial park will be created in Italy, and it is easy to foresee that the most important Italian manufacturers of interior design furniture and accessories will be the official suppliers of the Rotating Tower apartments and hotels, giving a new impulse to “Made in Italy” brands.
In the future these dedicated industrial parks will become possible in any country where a Rotating Tower will be built.

A Green Environmental Tower – Dubai:
The Dynamic Architecture building, which will be constantly in motion changing its shape, will be able to generate electric energy for itself as well as for other buildings. Seventy wind turbines fitted between each rotating floors as well as the solar panels positioned on the roof of the building will produce energy from wind and the sunlight, with no risk of pollution. The total energy produced by this inbuilt ‘powerhouse’ every year will be worth approximately seven million dollars. The turbines, situated in the space between the floors, have nothing to do with the rotation of the floors. While the floors will rotate by electric power, the turbines will rotate by the wind power and will be connected to a single generator, one in each floor. The vertical axes turbine that we are presently developing in Italy, are based on mini-wings that according to our calculations will give about 200KW each. Wind in Dubai at the heights of the turbine should be 16mt/sec. Considering per year 2,300 Hr of 16mt/sec of wind in Dubai, we expect to have 460,000KwH of energy produced by one turbine in one year. As each family consume about 24,000KwH in a year, therefore one turbine should supply energy for 19 apartments. Until our Mock up wind turbine, to be soon build in Italy, will give its proves we are considering to supply wind energy only to 12 apartments. In our tower we will have about 420 apartments and therefore 35 turbines will supply the energy required for the entire tower. If we will have 70 turbines, situated in the 78 floors tower, we will have the remaining 35 turbines supplying energy to another tower of the same size.
The modern design of the building, the carbon fibre special shape of the wings and the “active sound waves” will take care of the acoustics issues. Producing that much electric energy without any implication on the aesthetic aspect of the building is quite a step in tapping alternative energy sources. Furthermore, this energy will have a positive impact on the environment and economy.

![Image of horizontal wind turbines](Figure 5. An illustration of the horizontal wind turbines, placed between the Tower’s floors (Infinity Studio, 2007).)

The horizontal turbines (see Figure 5) can handle wind power exactly as the traditional ones; the only difference is that their axe is horizontal instead of vertical. Horizontal turbines are simply inserted between the floors (from the 10th floor upwards) and are virtually invisible since neither needs a pole nor a concrete foundation.

Their maintenance is also easy: there will be a dedicated elevator for all of them. The surplus of clean energy produced by the Tower can thus light up the neighbourhood of the building.

As far as the photovoltaic panels are concerned (see Figure 6), they will be placed on the roof of each rotating floor. Even though the panels will cover only a 20% of its surface, the roof of each floor is exposed to sunlight thanks to the rotating system. My Rotating Tower can be considered the first real “green” building. (see Figure 7) Never before has a building been designed to produce much more energy than it can use.

![Image of photovoltaic panels](Figure 6. An illustration of the photovoltaic panels, placed between the Tower’s floors (Infinity Studio, 2007).)

These buildings will be a green power plant, and will therefore change the skyline of cities not only due to their Dynamic Shape…but mainly as they may finally help us to enjoy nature, and to see the sun through clean air, appreciating the right colours of the sun set slowly going down into the ocean…

![Image of Dr. Fisher’s Rotating Tower](Figure 7. An illustration of Dr. Fisher’s Rotating Tower endless shapes (Infinity Studio, 2007))