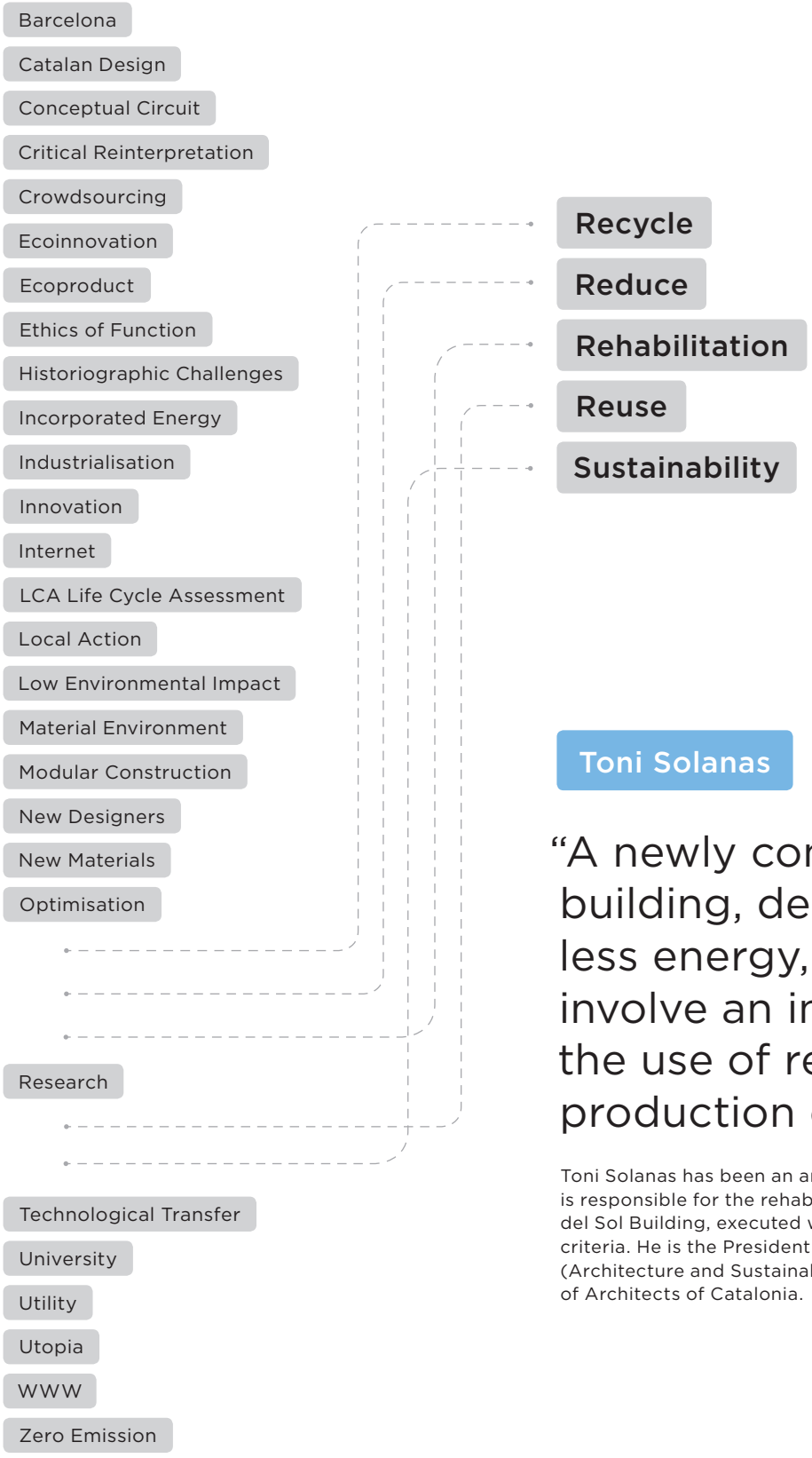


Toni Solanas

"A newly constructed building, despite consuming less energy, would always involve an increase in the use of resources and production of emissions."

Toni Solanas has been an architect since 1971 and is responsible for the rehabilitation of the Fàbrica del Sol Building, executed with sustainability criteria. He is the President of the Agrupació AuS (Architecture and Sustainability) of the Association of Architects of Catalonia.

Rehabilitation and Sustainability in D Major[1]

Parting from the premise that in view of the current situation a series of new limits must be established in the construction sector and that inspiration to define these limits is to be found in nature, duly covering – in Euclidian fashion – the many "REs" (reduce, reuse, recycle) that correspond to the attitude with which sustainability is to be confronted in the building sector.
As of this point we can undertake a historic review of the past, present and foreseeable future of rehabilitation, in which we explain the milestones that have been reached, benchmarks to be taken into account and new strategies and levels of action needed in order to face the future.

I recall recent and distant memories from my fragile memory's hard disk. First, Francisco Javier Barba Corsini's reflection in an interview that was published on *La Vanguardia's* back-page daily interview, "*La contra*": "One of the greatest pleasures we can enjoy is the profound understanding of reality." Second, the title of one of Mercè Rodoreda's best novels, *Mirall trencat* (Broken Mirror). These memories are coupled with a complex reality to be understood, a reality fragmented into a thousand fragments of reductionist views, disconnected from everything else. The tiny mirrors must be recomposed so as to see the entire mirror. And third, writing workshops at the Verge del Pilar street. Zulema Moret tells us "You can write". Do you feel the fear of the blank white page? It's hard to do without restrictions, as the lack of limits is itself limiting. To redefine the limits. Where can they be learned? According to Wagensberg,[2] "Sustainability establishes limits, rehabilitation has limits, nature teaches us limits".

The Two "REs" of Attitude: Reflect, Rethink

Rethinking an obsolete model of the "brick" sector, of the financial sector, of the production sector, of the way we live and see the world…in short: of current culture. It is only if we start with this change in view that we will be able to successfully focus on the necessary analysis that seeks to understand reality. Rethinking time and speed, the 100-metre dash or the marathon? A hundred years ago Dadaists clamoured for speed; many now champion slow food and slow cities.

Perhaps there is a prior reflection, however. Do we really want to experience deep pleasure, as claimed by Barba Corsini? In times of ephemeral pleasures within everyone's reach, do we really want to recuperate the difficult pleasures of times gone by?

Reform? Revolution? Edgar Morin, the respected philosopher, offers us an alternative: "Metamorphosis". We risk too much if we only reform, we still

1 D Major is Re Major in Romance languages, so the title in the original evokes the concepts which begin with "re" involved in rehabilitation and sustainability.

2 Wagensberg, J. *La rebelión de las formas* (The Rebellion of Forms). Barcelona: Tusquets Editores, 2004.

live far too well to undertake a revolution; perhaps the path is an unlikely yet possible transformation.[3] And again I insist that sustainability is an attitude, not a prescription.

The Five "REs" of Sustainability: Reduce, Reuse and Recycle. What? Resources and Residue

In this order of importance. Reducing takes priority over reusing/recovering and these two take priority over recycling. Why then is the most popular term the last one, the least important of the three? Simply because of its relationship with the capacity to generate business. And is business actually an inconvenience? No, the market is indeed necessary, but not a market that converts us into mere robots, turning us into compulsive consumers. A democratised market would take into account other parameters, and not just the economic benefit out-and-out, in the shortest possible period, with no determining factors or limits whatsoever.

The Three "REs" of the Building Sector: Restore, Rehabilitate, Remodel

Will the construction sector, a sector that has been hit hard, a sector that has fallen off its high horse, off the pedestal occupied by players who for years had become accustomed to raking in 100% profits from speculating with land classification, be capable of reinstating itself with "normal" margins? Is the sector willing to accept that the relationship between the offer and demand must be established in search of some sort of balance between the two pans of the scale? Is the sector capable of accepting the necessary and indispensable restructuring required in order for it to adapt to current times? And what direction is the sector to take? A study promoted by GBCe, ASA and CEIM provides us with clear-cut clues:

> The building sector must be redefined and approached – based on analysis of its sustainability –, as the set of activities aimed at producing and maintaining the necessary environment to shelter social activities. The building sector must be broadened further beyond the activity of the construction sector in order to extend itself in the direction of the use given to buildings and management of precise resources in order to ensure habitability. In short, it should be a sector aimed at efficient management of habitability.
>
> This habitability is obtained under socially acceptable conditions – and, therefore, socially defined conditions – that quite often exceed the scope of hygienic and dimensional conditions that are necessary in order to accommodate the activities, and that include access to services and facilities that are considered as basic in today's society.[4]

Rehabilitation: Past and Present

Traditionally the "culture" of the rehabilitation project postulates recuperation of a building because, as a result of its historic or artistic heritage value, regaining its use is considered worthwhile, be this for its original use or for alternative uses.

Our streets have received a positive facelift thanks to the "*Barcelona, posa't guapa*" (Let's Embellish Barcelona) campaign. Twenty-six years later the city once again boasts its most amiable face and enriches the urban landscape with a burst of colours that had been hidden under the layers of grime caused by pollution. In 1987 I was the winner of the *Ciutat de Barcelona* Awards to Façade Restoration. The award was awarded for my restoration of the Granell House façade, which was designed by

3 Morin, E. *¿Hacia el abismo? Globalización en el siglo XXI* (Towards the Abyss? Globalisation in the 21st Century). Barcelona: Paidós, 2010.

4 Cuchí, A.; Wadel, G.; Rivas, P. *Cambio global España 2020/2050. Sector Edificación* (Global Change in Spain 2020/2050. Building Sector) [online]. Madrid: Green Building Council Spain: Association for Sustainability and Architecture: University Centre for Environmental Studies and Information, 2010. Available at: http://www.sostenibilidades.org/sites/default/files/_Recursos/Publicaciones/programa_edificacion_2020_2050.pdf

▲ Rehabilitation of the Girona, 122 facade in Barcelona

architect Geroni Granell in 1901 and is located at number 122 of Girona street, where I live and work.

The various shades of green of the stucco work and the mauve-coloured window shutters, along with the red, brown and purple of the stained glass windows and ceramics reveal that the city was not grey at all, but in fact quite colourful.

The concept of rehabilitation is subsequently related with repairing pathologies. When a down pipe overflows, when there is humidity or when cracks and fissures appear in the structure, then we have to repair the element that is affected. In those years there was an abundance of bibliographies put in print by institutions[5] and publishing houses[6] that provided the necessary tools in order to take action. At this point the fundamental role held by the ITeC[7] and the Association of Architects with their datasheets is to be highlighted.

Another important milestone in the broadening of the concept is that of the French architects Lacaton & Vasal. They were the ones who managed to obtain heritage classification for a series of social housing units that they were going to rehabilitate, in such a way that remodelling ceased to be responsibility of the Ministry of Housing and was passed to the Ministry of Culture.[8]

Rehabilitation: Present and Future

A study made by the UPC (Technical University of Barcelona) and headed by Albert Cuchí, demonstrates that rehabilitation is the principal means to tackle the current crisis that the sector is going through. According to the criteria of a classification system as prestigious as the LEED System (Leadership in Energy and Environmental Design), what is the ideal housing unit like? Well, this housing unit would correspond to a rehabilitated building. A newly constructed building, despite consuming less energy than a fictitious reference building, would always involve an increase in the use of resources and production of emissions. An existing building with improvements to the foundations, structure and most windows and doors, and in which insulation of the building's shell and its features are improved,

5 Bellmunt, R. [et al.]. *Guia de tècniques i productes per a la rehabilitació*. (Guide on Techniques and Products for Rehabilitation) 2nd revised edition. Barcelona: Catalonia Institute of Construction Technology, 1988.
Gelpi, L. *Tractament de façanes i d'elements arquitectònics* (Treatment of Façades and Architectonic Elements). Barcelona: Government of Catalonia. Ministry of Territorial Policy and Public Works, Directorate General for Architecture and Housing: Official Chamber of Urban Property of Barcelona, 1988.

6 Baglioni, A.; Guarnerio, G. *La rehabilitación de edificios urbanos: tecnologías para la recuperación* (Rehabilitation of Urban Buildings: Technologies for Recuperation). Barcelona: Gustavo Gili, 1988.

7 Puiggros, C.; Canosa, J. L.; Paricio, I. *Jornades de rehabilitació d'habitatges* (Sessions on Rehabilitation of Housing). Barcelona: Catalonia Institute of Construction Technology. Government of Catalonia, Ministry of Territorial Policy and Public Works, 1983.

8 Druot, F.; Lacaton, A.; Vassal, J.P. *Plus: la vivienda colectiva, territorio de excepción* (Plus: Collective Housing, Territory of Exception). Barcelona: Gustavo Gili, 2007.

would normally produce less CO_2 than prior to its rehabilitation. In short, to this we also have to add the savings involved in land consumption.

Indeed the work carried out by the Professional Associations of Catalonia is to be recognised. This is the case with the Professional Association of Architects, with its events, such as the Conference on Bioarchitecture, organised by the Agrupació AuS, and the courses imparted at the Escola Sert, directed by the Societat Orgànica. The Professional Association of Master Builders, member of the RehabiMed[9] institution and project, and organiser of the International Conference on Rehabilitation and Sustainability. *El futur és possible* (R + S = F) (The Future is Possible), representing two activities headed by Xavier Casanova. Two of the seven points on strategies to be followed are to be highlighted from the Conference's Conclusions Document:[10]

> First: To politically assume a change in model in order to prioritise integrated urban regeneration and sustainable rehabilitation, developing an economic sector aimed at the "right to enjoy a city" and at existing buildings.
> (...)
>
> Fourth: Structuring a specific economic framework for rehabilitation, which defines a new sector of economic activity aimed at habitability for citizens. The idea is to define its viability in time and form, based on streamlining public investment capable of attracting private investment to the point that, through a diversity of channels, return on investment for the administrations from the economic activity that is generated would allow said public investment to be recovered. This economic framework is to contribute in the definition of the extension of the Agency's regulation at the very moment when it has to intervene over possible sources of resources – such as capitalisation on energy savings or generated GEG (greenhouse effect gas) emission rights – or in the mechanisms that favour return of the public investment in the most efficient manner.

The Steps Involved in Rehabilitation

The stages involve rehabilitation of buildings, revitalisation of public spaces in towns and cities and reconstruction of the territory. From the small grain to the big grain. From the current vision, in which rehabilitation means changing the kitchen furniture – another way of considering rehabilitation as a consumer fact – we have to start considering rehabilitation as an inescapable need to provide the population with cities, buildings, neighbourhoods and territories with improved quality of life. To recover the value of what is being built over and above the price involved.

The change in scale to which the current culture of rehabilitation must submit itself is put forward in the R + S = F Conference:

> The current scale of rehabilitation is a result of the scale of property development that establishes the context of independence of the construction systems. Hence, the structure or the installations are designed at the building scale, are the same for individual or collective use, although this does not mean that it is the most efficient scale. Rehabilitation "inherits" this scale of the functional context with the added problem of property distribution that is even more reduced in the case of collective buildings.

9 Casanovas, X. *Mètode RehabiMed: arquitectura tradicional mediterrània. I. Rehabilitació: ciutat i territori. II. Rehabilitació: l'edifici* (RehabiMed Method: Traditional Mediterranean Architecture. I. Rehabilitation: City and Territory. II. Rehabilitation: The Building) [online]. Barcelona: Consorci RehabiMed, 2008. Available at: http://www.rehabimed.net/

10 *Congreso Internacional Rehabilitación y Sostenibilidad. El futuro es posible. Conclusiones* (Conference on Rehabilitation and Sustainability. The Future is Possible. Conclusions) [online]. Barcelona: Professional Association of Master Builders, Technical Architects and Building Engineers of Barcelona, 2010. Available at: http://www.rsf2010.org/es/conclusiones

Is that the rehabilitation scale? Is that the optimal scale, for example, in order to obtain maximum energy efficiency by adding adequately sized demands so as to adopt the efficient energy offers that are currently available? Is the scale adequate in order to apply appropriate technologies? Is the scale adequate so that companies will have the right size to have these technologies and, likewise, qualified labour available?

The optimal elements in order to respond to each one of these questions tend to be found at a greater scale than that of the building. Both the scale of transformation and energy distributions – which currently finds its greatest efficiencies, as well as the most efficient integration of renewable energies in the climate control systems at a neighbourhood scale – such as the precise scale for development and application of effective intervention technologies or such as the scale of intervention operations that allow structuring regulatory, financial, management, labour resources, etc. that are adequate in order to ensure that the sustainable rehabilitation of the habitability sector will be economically viable, also require structuring the sector at a much greater scale of intervention than that of the building.[11]

The Catalan Administration and Sustainable Rehabilitation

There is a major step forward in the scope involved in the term *rehabilitation*. The *Pla de Barris* (Districts Plan) in Barcelona not only affects buildings but also urban space, and not only on the physical appearance of the buildings, but also on social aspects, such as the citizens that live and work in the neighbourhood.[12] The intelligent efforts within the Administration carried out by the Directorate General for Quality in Building and Rehabilitation, headed by Núria Pedrals, favours transition of the sector towards sustainable building and rehabilitation. This can be seen in government initiatives ranging from the Decree on eco-efficiency right through to the two pavilions of the Ministry of the Environment at Construmat 2007 and 2009. As a result of the Decree, "*34 kg de CO_2*" (34 k of CO_2) was published, a publication that was created along with my colleagues Coque Claret and Dani Calatayud.[13]

This policy, with Carme Trilla heading the Department of Housing, was completed with the work carried out by ADIGSA, representing examples of energy efficiency-driven rehabilitation. Apart from experimenting with these techniques, Josep Linares and Anna Mestre have put the diverse possibilities and construction techniques into practice in these projects, in particular in Can Jofresa, Terrassa,[14] which is something that the Administration should also do.

Rehabilitation and sustainability can be seen in many municipalities. Below are three representative examples. Barcelona, despite its deficiencies pertaining to the quality of the air we breathe, has turned into a European benchmark in sustainability. A campaign in the German city of Hamburg displays images of Barcelona that represent what the desirable future should be. In Sabadell, Richard Perich of VIMUSA, is a clear point of reference for

11 *Congreso Internacional Rehabilitación y Sostenibilidad. El futuro es posible. Documentos de debate* (International Conference on Rehabilitation and Sustainability. The Future is Possible. Debate Documents). Barcelona, October 4, 5 and 6 of 2010. Barcelona: Professional Association of Master Builders, Technical Architects and Building Engineers of Barcelona, 2010.

12 Nel·lo, O. [et al.] *La Llei de barris. Una aposta col·lectiva per la cohesió social* (The Law of Districts. A Collective Wager on Social Cohesion). Barcelona: Government of Catalonia, Ministry of Territorial Policy and Public Works, 2009.

13 Solanas, T.; Calatayud, D.; Claret, C. *34 kg de CO_2* (34 kg of CO_2) [online]. Barcelona: Government of Catalonia. Ministry of the Environment and Housing, 2009. Available at: http://www20.gencat.cat/docs/habitatge/Home/Secretaria dhabitatge/Publicacions/34 Kg de CO2/doc/34_Kg_CO2.pdf

14 Cerdà Institute; Department of Housing; ADIGSA. *Guia de la renovació energètica d'edificis d'habitatges: envolupant tèrmica i instal·lacions* (Guide on Energetic Renovation of Housing Buildings: Thermal Cladding and Installations). Barcelona: Government of Catalonia. Ministry of the Environment and Housing. Department of Housing, 2010.

all those who want to strictly apply sustainability. In Montcada, Marta Goñi has cleared the way for municipal policies on sustainable rehabilitation in public housing in smaller municipalities.

In the field of urban development and sustainability, we should take note of the interesting field research that is being carried out by ETSAV students, encouraged by Ivan Muñiz, Dani Calatayud and Coque Claret.[15] Surveys made in twelve neighbourhoods of differing types and income levels, or the recent work carried out in Vacarisses, give rise to a magnificent governmental programme for any political party that is competent and sensitive enough to listen and act on the demands of the 15-M Movement.

And let us not forget the necessary participation that the population is currently demanding. In this context we can indeed find inspiration in a city in an emerging country:

> Understanding a city as an elaborate scene of complex physical-spatial, socioeconomic and cultural relationships between individuals and institutions leads us to think about the structuring of a system and about a benchmark methodology for community participation that not only takes into account the dimension of the diverse relationships that take place in the territory, but also the structure in virtue of which these relationships operate. In short, systematic understanding of citizens' participation in order to formulate and build a promising future project for a city makes the need to build the foundations – technical and practical – that the community requires to effectively achieve this objective.[16]

Examples of Rehabilitation in Catalonia

There are many rehabilitation works that have gradually introduced sustainability criteria. We will now exemplify the strategies used in two specific cases: minor works executed in a housing unit and a personal commission, the Fàbrica del Sol Building.

Clara Jiménez has rehabilitated a housing unit in the Girona district of Sant Daniel:

> The intention has been to renovate the housing unit in such a way that in the future it will be as efficient as possible in relationship with the use made of the resources, in particular energy, materials and water. Hence, the need for external energy in order to achieve adequate operation, among other measures, by way of good management of rainwater and waste water and by using materials that have a minimum impact on the environment, that are easily recyclable and that do not contain toxic products. All these decisions have been made by taking into account that they will have a tremendous impact on the subsequent costs of the building's lifetime, energy consumption, quality of the interior environment and recycling and reuse of the residue resulting from demolition.
> Below are the principles guiding our application of these measures and criteria.
>
> —Efficiency in the use of energy: possibility of cross ventilation; installation of thick thermal insulation; wood carpentry with double glass panes to eliminate thermal points; ventilated roofs; solar panels for bathroom hot water; bithermal appliances with A or A+ energy rating; maximum use of natural light; low consumption equipment for artificial illumination; high performance condensation boiler; solar protection for the summer with pergolas and plants, and shaded areas in front of the façades.

15 Muñiz, I.; Calatayud, D. "Sostenibilitat, ciutat compacta i ciutat dispersa" (Sustainability, Compact City and Disperse City). A: GAUSA, M., coord. *Cap a un habitat(ge) sostenible* (In the Direction of Sustainable Housing) [computer file]. Barcelona: Government of Catalonia, Advisory Committee on Sustainable Development, 2010.

16 Rave, B. E. *La ciudad siguiente, indicios de futuro: bases para la participación de la ciudadanía en la construcción de un proyecto colectivo de desarrollo futuro para Medellín* (The next city, signs of the future: foundations for citizen participation in the construction of a future development collective project for Medellin). Medellín: Pontificia Bolivariana University, 2008.

▲ Photothermal pergola on the Fábrica del Sol deck

“According to the criteria of a classification system as prestigious as the LEED System (Leadership in Energy and Environmental Design), what is the ideal housing unit like? Well, this housing unit would correspond to a rehabilitated building.”

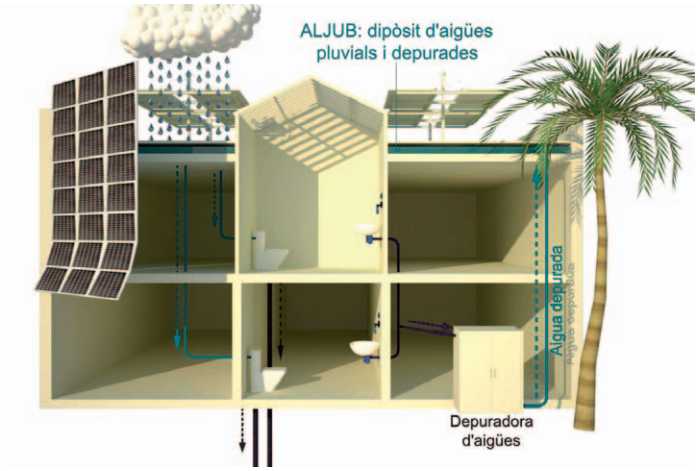
—Efficient management of rainwater and waste water: recovery of rainwater for irrigation; recycling of domestic waste water for toilet flushing and water-saving systems in flush cisterns and taps.

—Materials with minimum impact over the environment: structure made with wood panels and stone and lime walls; wood carpentry and shutters; lime mortars; lime paints; laminate wood flooring and traditional tiling; wood panelling partitions; thermal and acoustic sound insulation, cellulose and recycled wood chips.

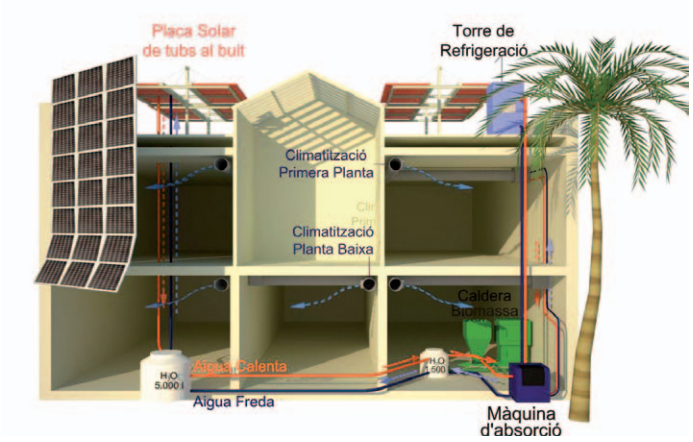
Fàbrica del Sol Building

The so-called Fàbrica del Sol Building, which was designed and built by architect Josep Domènech i Estapà in 1907, underwent a rehabilitation process that was interrupted for 10 years. In order to summarise the intervention that has taken place, we will use four elements from nature as the thread: air, fire, water and earth.

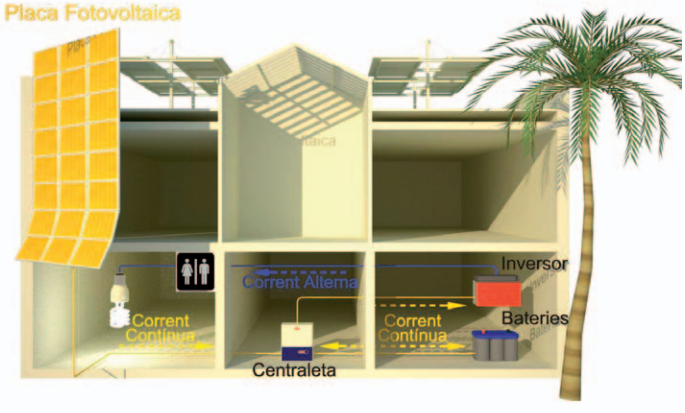
1. The quality of the air, both interior and exterior, is achieved by way of crossed ventilation and stack (chimney) effect, which ensures natural air renovation in the building. Green purchasing (off-plan) of offices avoids contamination caused by many traditional products. Creation of own cycle parking shelters, a *bicing* station (city bicycle program in Barcelona) and a station for recharging electrical vehicles all have an influence on the mobility system of building users, fostering transport systems that are less contaminating.
2. Fire is energy: light and heat. The very first step involves reducing demand. As the building's name indicates, here the sun is king. In order to take advantage of the natural light, we simply have to recuperate the building's possibilities (just as has been done with crossed ventilation). The building's original built-in wooden roller shutters have also been recovered, although the frame has been isolated with cork. With use of



▲ Water cycle in the Fábrica del Sol building



▲ Energy cycle in the Fábrica del Sol building



▲ Photovoltaic energy cycle at the Fábrica del Sol building

hollow tube panels, the sun not only provides heat, but also cooling. In order to complete the benefits obtained from our charitable star, two systems of photovoltaic panels – some of which are connected to the grid, while others are connected to batteries – provide part of the electrical energy that the building needs.

3. Rainwater is collected and stored on the roof in a service reservoir and subsequently used to water the plants on the green roof (living roof) and to fill the toilet tanks. Domestic waste water is purified. Natural purification of grey water (domestic waste water without urine or faeces), yellow water (urine and flushing water) and black water (faeces, urine and flushing water) was ruled out due to a lack of space.
4. Earth corresponds to materials selected on the basis that it they do not contain any contaminants that are harmful for health, or components derived from oil that give rise to the greenhouse effect and contribute to climate change. Amongst these materials we find OSB (Orientated Strand Board) wood for the partitions, cork as insulation, lime mortars and eco-friendly paints, as well as polypropylene piping. The green roof absorbs CO_2, isolating and contributing to the microclimate, not to mention the fact that plants are a decisive factor to our well-being. We also carried out selective separation of residue during the demolition stage.

All these measures are further complemented by applying strict austerity criteria in the finishing details, as is to be expected these days.

The building, which is open to the public, hosts an exhibition in its ground floor that reveals the sustainable rehabilitation criteria. The Department of Environmental Education of the Town Hall of Barcelona is responsible for the building's maintenance.

▲ Office building in Lleida by Pich-Aguilera Studio and J.M. Puigdemasa. © Photo: Jordi V. Pou

On a greater scale we have two fabulous examples of how to take advantage of a building, instead of demolishing it. These examples are the office building for the Pich-Aguilera Architects, located in Barcelona's district 22@, and the rehabilitation-extension of the former barracks quarters found in Turó de Gardeny (Lleida), which has been executed by the same team, along with Josep Maria Puigdemasa.

Now in a mountainous area, Josep Bunyesc is currently undertaking praiseworthy rehabilitation work on a series of cabins, which is resulting in energy consumption levels that can be compared with those of northern Europe.

Likewise to be highlighted are works being carried out by companies such as Bestraten & Hormías, Oriol Muntané, Salvadó & Tapias, López & Rivera, Bosch & Capdeferro, Toni Gironès, Harquitectes, datAE, Sergi López-Grado, Duran & Grau, Aymerich & Salvadó, Xavier Farrés, Torsten Maseck, Claudio Pirillo, AIA and many others who are too numerous to mention. In view of the current difficulties, we must be optimistic and we must do this "with hope between the teeth".[17] The changes have already arrived.

17 Berger, J. *Hold Everything Dear: Dispatches on Survival and Resistance*. London: Verso, 2007.