The Reichstag Energy Story

This article was written in November 1998, and first published in the German magazine Spektrum der Wissenschaft *in February 1999.*

Our work to transform the Reichstag is rooted in four major issues: a belief in the significance of the Bundestag as one of the world's great democratic forums; a determination to make the process of government more accessible; an understanding of history as a force which shapes buildings as well as the life of nations; and a passionate commitment to the low-energy, environment-friendly agenda which is fundamental to the architecture of the future.

Today Germany leads the world in the responsible attitude of its legislation concerning the environment, and the encouragement of renewable energy sources. From the outset our aim was to demonstrate in the Reichstag — a structure that represents the pinnacle of German democratic government — the potential for a wholly sustainable public building, environmentally responsible and virtually pollution-free. The design team — Foster and Partners, Kaiser Bautechnik and Kühn Bauer und Partner, in conjunction with the German Federal Government — developed the brief for an energy efficient building. The European Commission was extremely supportive and contributed financially towards this challenge to create a model for a more sustainable architecture.

In the reconstruction of the Reichstag, we proposed extensive use of natural light and ventilation, together with combined systems of cogeneration and heat recovery. Here the minimum energy achieves the maximum effect at the lowest cost-in-use. Due to its own modest energy requirements, the new Reichstag is able to perform as a local power station, supplying neighbouring buildings in the new government quarter.

The Reichstag's new cupola or 'lantern', has quickly become a Berlin landmark. Within it, two helical ramps take members of the public to a viewing platform high above the plenary chamber, raising them symbolically above the heads of their political representatives. The cupola is both a generative element in the internal workings of the building and a key component in our light and energy saving strategies, communicating externally the themes of lightness, transparency, permeability and public access that underscore the project.

At the core of the cupola is a 'light sculptor', a concave, cone-like form which works like a lighthouse in reverse, using angled mirrors to reflect horizon light into the chamber, while a moveable shield tracks the path of the sun to prevent the penetration of solar heat and glare. In winter and at the beginning and end of summer days — when the sun is lower — the shield can be moved aside to allow softer rays to dapple the chamber floor. At night, the process is reversed and artificial light in the chamber is reflected outwards making the dome glow dramatically so that Berliners will know when the Bundestag is sitting.

The cone also plays an important part in the chamber's natural ventilation system, extracting warm air at high level, while axial fans and heat exchangers recycle energy from the waste air. Fresh air from outside, drawn in above the west portico, is released through the chamber floor as low-velocity ventilation. It spreads out in the room very slowly and gently rises as it heats up. This provides maximum comfort for the occupants and minimises draughts and noise. Power to drive the chamber's exhaust air ventilation system and the shading device in the dome is generated by 100 solar panel modules with photovoltaic cells; these are located on the roof and provide a peak output of approximately 40kW.

Manually and automatically controlled windows, combined with secondary outer glazing, allow natural ventilation to most rooms. These double layered windows comprise an internal, thermally separated, glazing system and an outer layer which consists of a protective laminated glass pane with ventilation joints. Between these two layers is a void in which a solar shading device is housed. Between half to five times the air volume of a room can be exchanged per hour via this double facade depending on the weather conditions outside. The double facade also gives a high level of security so that the inner window can remain open whenever required, especially for night-time cooling.

Due to the constantly varying number of people occupying the building a flexible energy conservation strategy was adopted. Using the building's inherent thermal mass, energy can be stored to provide a comfortable base temperature from which active heating or cooling can be 'topped up'. This method reduces heat load peaks by approximately 30 per cent over conventional methods.

The fossil-fuel powered services installed in the Reichstag in the 1960s produced an alarming emission rate of 7000 tonnes of carbon dioxide annually. Heating the Reichstag today by such means would consume enough energy annually to heat the homes of 5000 people. Berlin can be very hot in summer and very cold in winter, and because of its great thermal mass the building responds only slowly to changes in temperature, which is both a problem and an opportunity, allowing passive systems of temperature control to be exploited.

We proposed a radical new energy strategy, using vegetable oil, a wholly renewable bio-fuel. Refined vegetable oil - from date palm, rape or sunflower seeds - can be considered as a form of solar energy since the sun's energy is stored in the plants (biomass). By using this renewable natural fuel carbon dioxide emissions are considerably reduced in the long term as the plant absorbs as much carbon dioxide in its lifetime as is released in its combustion. When the oil is burned in a co-generator to produce electricity it is also remarkably clean and efficient when compared to traditional sources of energy production. In the Reichstag's installation it allows a 94 per cent reduction in the emission of carbon dioxide. Heating and cooling the building will produce, we estimate, a mere 440 tonnes of carbon dioxide per annum.

Surplus heat generated by the Reichstag's power plant is diverted into a natural aquifier 300 metres below the building, where it can be stored for future use without any impact on the environment at ground level. In winter, stored warm water can be pumped up to heat the building; it is also used to drive an absorption cooling plant - rather like a giant refrigerator - which produces chilled water. This too is stored below ground and can be pumped back into the building in hot weather to provide cooling via chilled ceilings.

The Reichstag now uses precious natural resources, recycling rather than wasting, to produce a comfortable environment in all seasons. In its vision of a public architecture, which redresses the ecological balance, providing energy rather than consuming it, lies one of the Reichstag's most intrinsic expressions of optimism. It is an object lesson in sustainability.

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1999