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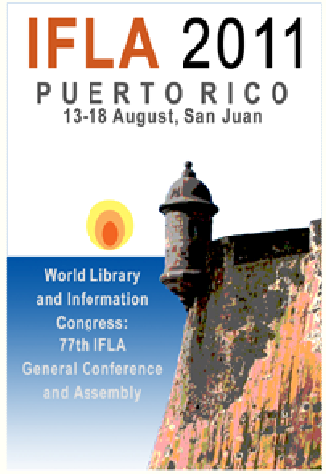

Cultural heritage preservation planning against economic and environmental challenges

IFLA 2011 World Library and Information Congress – Puerto Rico

Between cultural heritage preservation, financial restrictions and sustainable development :
- Climate rules advancement in the French National Library storage rooms
- Climate trends in the french National Archives new building in Pierrefitte-sur-Seine

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I – the Bibliothèque nationale de France François-Mitterrand building

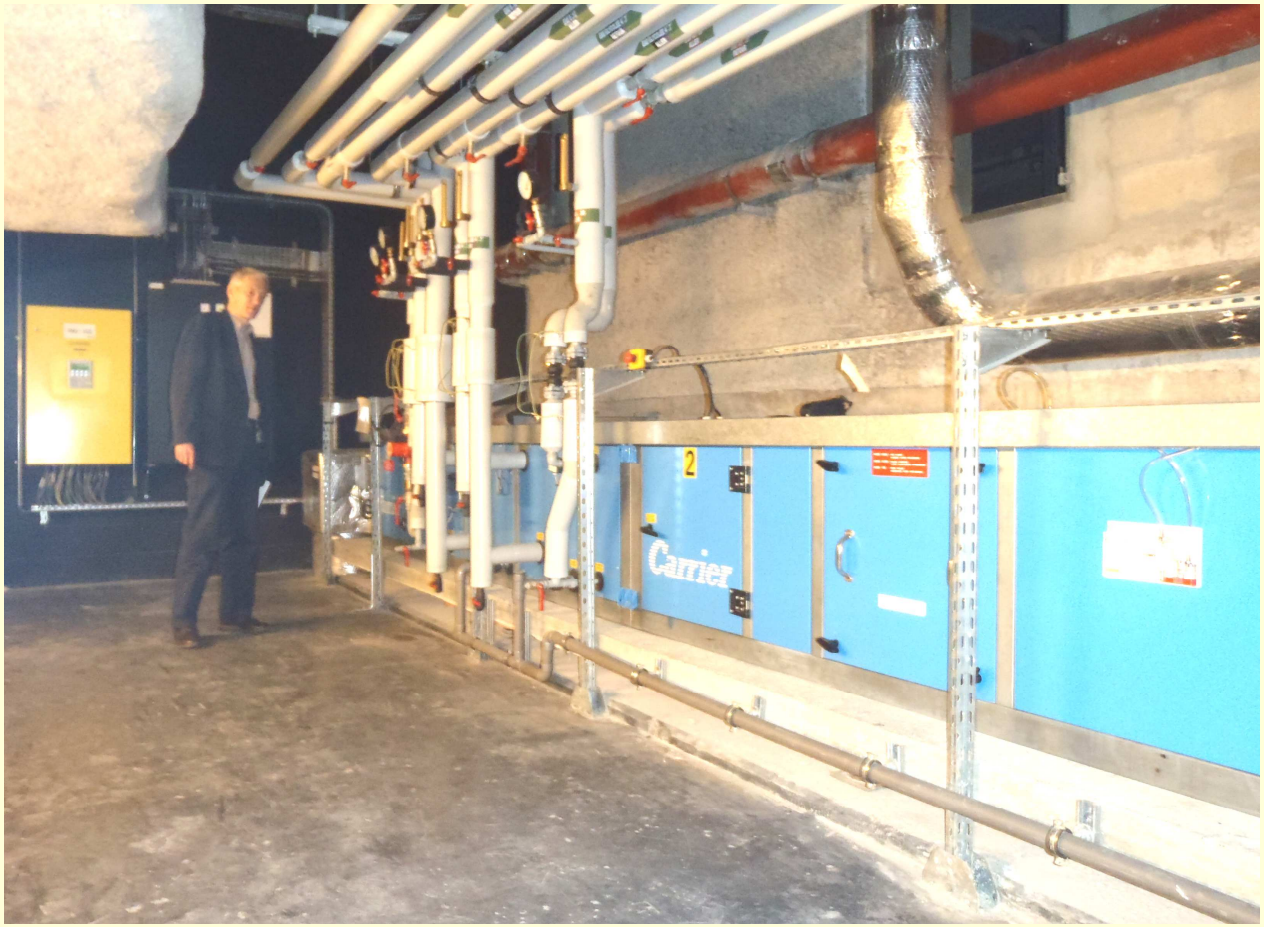
A huge building for huge collections

- A quite recent building : built 1992 – 1995
- Very large size : basement 375 m long, towers 80 m high, usable surface area 160 000 square metres
- 182 storage rooms in basement and towers (57 000 sq.m.)
- Storage rooms nearly full, containing almost 400 linear km of collections
- Very huge reading rooms and other public or professional spaces

The air conditioning system

- a centralized system (GTC) managed by the Building Department/DMT
- 12 air treatment plants to manage relative humidity/RH and external air supply (0, 3 vol./ hour)
- One air-conditioning plant in each storage room to manage temperature /T
- Possibility of local or remote control
- Up to 2008 usual climate rules respected : 18°C(+/- 1°) , 55% RH(+/- 5%), except for audiovisual documents
- Overall good results despite too much VOC
- The air conditioning of storage rooms uses very few energy in comparison with the one of public and professional spaces

An air conditioning plant in the basement



The rise of sustainable development concern

- A globally very energy-consuming building (as much as a city of 23 000 inhabitants)
- From 2005-2006, rise of the concern to save energy, for economic and ecological purposes
- Heating and air conditioning are very expensive for the library
- From the beginning, the storage rooms air conditioning is part of the thought

- ↳ **From 2007, the climate and conservation engineers of Building and Conservation departments are asked by the Library Head to propose solutions to reduce energy consumption in the storage rooms.**

2008 : first thought, first tests

- **January 2008 : in a technical note the DSC laboratory synthetises the elements of the debate and suggests possibilities of change :**
  - A strict compromise is essential because of BnF collections diversity
  - But stability (i.e. slowness of fluctuations) is as important as the values of T and RH by themselves
  - Provided that requirement, the range of authorized values can be broaded (up to 22°C T in summer), and the desirable average level of RH is reduced down to 50%RH

. The Building Department makes use of the note to successfully test new more energy saving climate values : 20℃ et 50 % RH

- Because these values are closer to external climate, energy needs for cooling and air-drying are lower
- For the first time, different values for summer and for winter are envisaged

2009 : proposal of new global climate values

- An **energy audit** of the building is performed, which reveals the distribution of energy consumption and some tracks to save energy.

- **February 2009 : Collections, Conservation and Building Departments meet together to debate climate rules changes from tests results :**
- - **The Building Department wishes that wider fluctuations would be authorized** (17-21℃, 40-65% RH), which would allow a 30% energy spare.
- **- But the long-term conservation of collections remains the first priority** : It is decided to use the *Dew Point Calculator* software from the Image Preservation Institute to determine with the « preservation index » which are the more convenient values (of T, HR, water content) to guarantee a long « life expectancy » to the documents.
- - **Two new points of climate values are proposed** from the preservation index :

  - 19℃+/- 1℃ and 50% RH+/-3% in summer
  - 19℃+/- 1℃ and 45% RH+/-3% in winter

(no change in climate rule for the storage of audiovisual holdings)

- These new points should allow to save energy too, because they are closer to the external climate

2010 : new values are adopted as climate rules

- As much tests of the new points of climate value as work to reform the ISO 11799 standard conclude that wider fluctuations of climate levels are acceptable

- **June 2010 : in a tripartite meeting the new values are adopded as climate rules** with slight change **:**

- 19℃+/-1°and 50%RH+/- 5% in summer (15th April – 15 October)

- 19℃+/-1°and 45%RH+/- 5% in winter

For the Audiovisual Department :

- 19℃+/-1°and 40%RH+/- 5% in summer

- 18℃+/-1°and 40%RH+/- 5% in winter

- Maximal authorized speed for fluctuations : 1℃ and 5% per 24 hours
- A progressive change of values is allowed to go from summer to winter and vice versa
- The Rare Books Department keeps its former fixed values (18℃, 50% RH)

Current results and tracks

- As a supplementary measure, **the air treatment plants are stopped during the night** (from 22 p.m to 6 a.m)

- **Significant savings estimated** : -15% on air conditioning of the storage rooms, - 5 % on air conditioning of the whole building
- **tests are currently performed to reduce still more energy consumption** :
  - longer air treatment cuts during the night (from18 or 20 p.m. to 6 a.m)
  - no air treatment cuts in the towers when the weather is very cold
  - improved air treatment plants for more accurate and automated control
  - improvement of the smoke shafts thermal insulation
  - automatic doors for storage rooms in the basement ?

- some projects for the other BnF storage buildings
- climate policies of foreign libraries and archives are carefully observed
- Thought and debates improve relationship between librarians and engineers

II- Climate trends in the french National Archives new building in Pierrefitte-sur-Seine

A huge building devoted to holdings storage

- Built to store the contemporary collections of the french National Archives
- On the way to completion (scheduled to open in 2012 - 2013)
- Very large size: 160 m long, 40 m high, 220 storage rooms (43 000 sq.m)
- Storage capacity 320 linear km of holdings
- Reading rooms and public spaces far smaller than in the BnF building
- More compact building than the BnF's one, with few windows opening onto outside
- Very careful external insulation
- Air conditioning system designed by the former climate chief engineer of the BnF

The new building in completion

New climate rules for an energy-saving preservation –1/2

- The climate engineer took advantage of the design features and of the purposes of the building, and of the recent changes in the French National Archives doctrine for environmental rules

Thermohygrometric levels: a much widened range of authorized levels (T = from 16 to 24°C, RH = from 40 to 57%) …

- …but only with very slow changes (0,5℃ and 1% RH per d ay, 2℃ and 5% RH per week)
- More possibilities to manage air conditioning according to the fluctuations of external climate
- Within the limits of the authorized range, the stability of the values is more important than the values themselves
- Risks of exceeding the range limits are low because of the building extensive inertia, and inner climate changes could be much quicker than the authorized limits without producing any damages for the collections

Ventilation levels : The rate of external air introduction is very slow (0,1 volume per hour); air introduction is restricted to 300 hours per month, and stopped as soon as the outer conditions are too much unfavourable

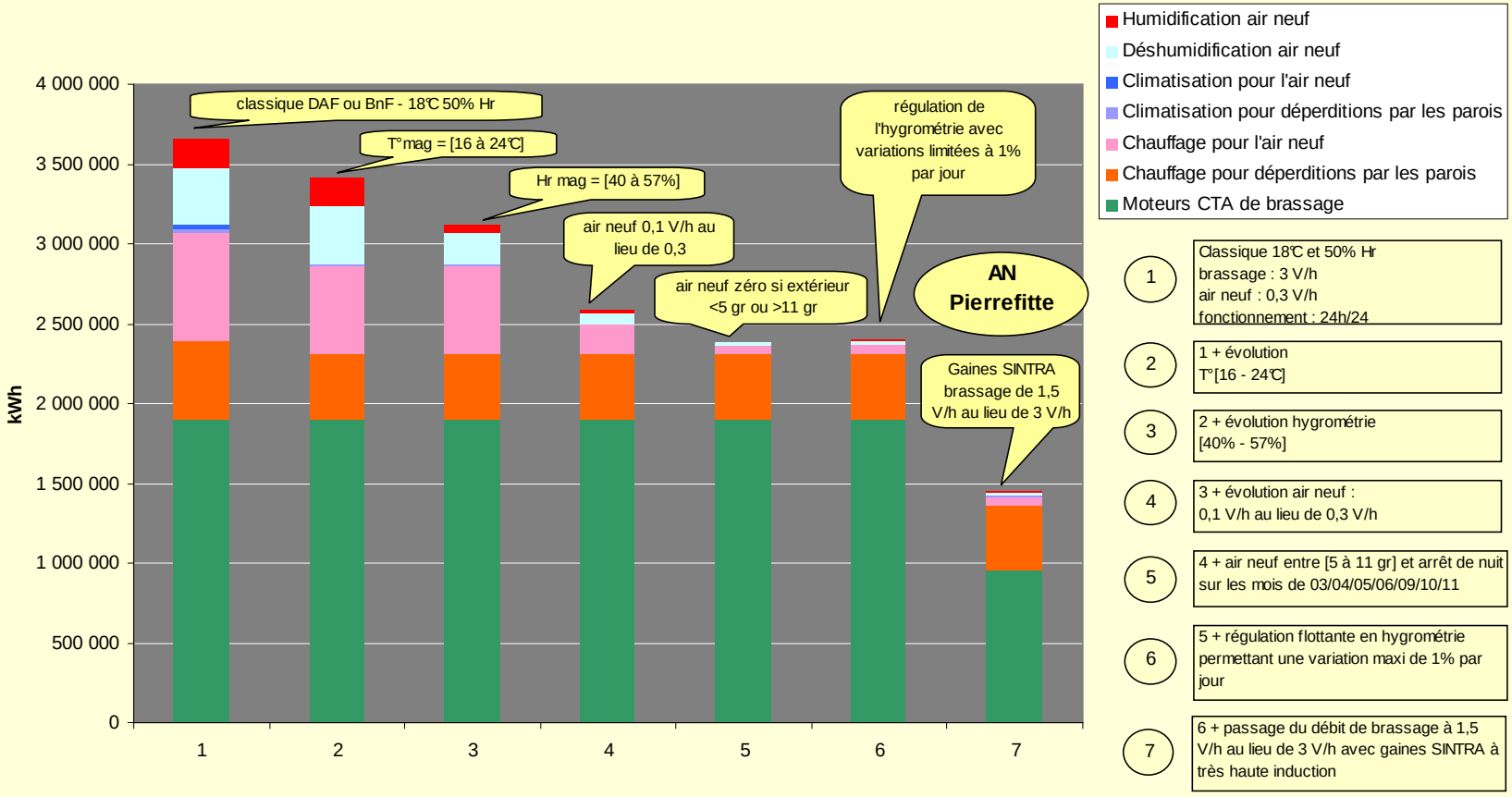
New climate rules for an energy-saving preservation –2/2

- **The air mixing rate (1,5 volumes per hour) is reduced to the half of the rate used in the BnF** whereas the expected efficiency will remain equal (thanks to very high induction shafts)
- **A air conditioning system far less powerful than the BnF's one** , even if a reserve of power will be available as a precaution
- **The expected energy-consumption savings are significant** :

  - 30% for hygrometry and temperature
  - 40 % for ventilation
  - as much for air mixing as for hygrometry/temperature and ventilation put together

… but they will have to be confirmed with use !

Changes in the energy consumptions caused by heating, air conditioning and ventilation according to climate rules and air flow



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