

BIPV Situation in France

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- **CSTB presentation (2)**
- **Economical subsidies (3)**
 - **Market growth (1)**
- **Quality of PV as building material (4)**
- **French thermal regulation and PV (2)**
- **Some BIPV technical issues (6)**
 - **Conclusion (1)**

CSTB : one of Europe's leading research and assessment centers :

- **800 p, 4 locations (Sophia Antipolis Nice)**
- **Global approach to improve well-being and safety in buildings**
- **Four trades : research, advanced engineering, quality assessment and the dissemination of knowledge**
- **Under the administrative supervision of the French Ministry of Housing**

Focus PV : 2 trades

- **Technical assessment : located at Sophia : celine.melh@cstb.fr**
 - **R&D : PV labs located at Sophia: thierry.guiot@cstb.fr**



Photobatt , Performance BIPV,
Hybrid PV Th, Durée

COMSOL, Fluent, TRNSYS,
MATLAB...

Dwelling house on grid installation

- **National : feed in tariff 2008 :**
 - **Base (up to 1500 h . Wc) : 31.193 c€ / kWh BIPV : 57.187 c€/kWh (grid electricity about 11c€/kWh in France).**
 - **20 years contract**
 - **Yearly actualization : 60% of tariff is inflation protected**
 - **Subjected to income tax : 29% of feed in incomes**
 - **Yearly Meter charge 50 €**

- Regional subsidy :

Ex : PACA (Nice), 2008 : 1kWc < 1500€ < 2kWc 3000€ > 2kWc + 1000 € on labor

- Lowered VAT:

5.5% (not 19.36%) for dwelling house > 2 years old if Pc < 3kWc

- Tax credit:

*50% of hardware in the limitation of 6 000 € (**competition with solar thermal**)*

BIPV Economical subsidies 3/3

At present the qualification BIPV is ambiguous
⇒ **under discussion (C.S.T.B. deeply involved).**

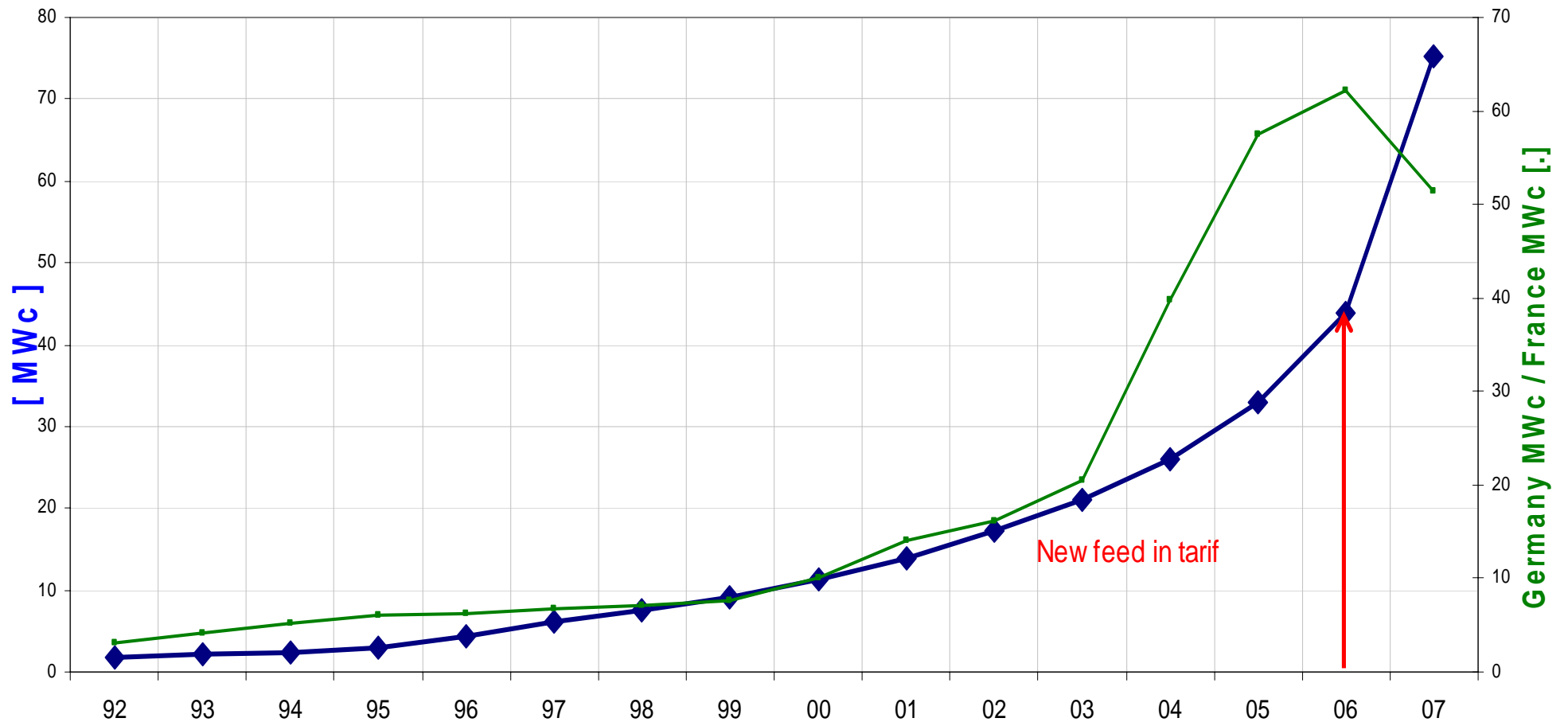
Example :



**Tiles had been removed
but modules are not
Watertightness.**

**“true” BIPV are far to
dominate the market.**

Cumulated MWc France and Germany / France (IEA PVPS)



Quality of PV as building material 1/4

- Buildings are subjected to decennial guaranty.

If a sinister occurs 2 cases:

Case 1 : Traditional material conformity to building code named D.T.U. is examined.

Case 2 : Innovative material conformity to technical assessment called ATEC is examined.

⇒ **no ATEC no technical referential stated by a college of independent expert in term of implementation, quality, security.**

⇒ **Guaranty allowance is higher (eventually no guaranty at all the project is stopped...)**

CSTB is responsible for ATEC instruction.

■ **Only one ATEC for PV material at that time (many more this year)**

ATEC is Stated by a college of multidisciplinary experts from PV and building industry .

Some PV ATEC content (2008) :

- attached to the caller + 2 to 7 years duration
- applicable to a well defined product (modules + BOS at the exclusion of inverter)
- with a well defined implementation onto building
- this product should have a stable characteristic

=> module + cell manufacturer identified and stable

Quality of PV as building material 4/4

- CEI 61215 or CEI 61646 as a prerequisite
- Reference to good practice / norm : electrical security, mechanical stability, natural ventilation non perturbed...
- Wc is mentioned but no energy rating allegation

Evolution on this last point is in focus : internal and external RD support

=> CSTB insertion at least in SP6 would make sense

- New building from 2005 are subjected to thermal code : « RT 2005 » => minimum of energetic performance :

$$C = \text{kWh}_{\text{ep}}/\text{m}^2/\text{ans} \text{ (be careful of what is counted or not)}$$

- RT 2005 : PV systems are pure sink :

$$\Delta C_{\text{pv}} = - \text{kWh}_{\text{pv}} * 2.58 \Rightarrow \text{PV} = \text{grid electricity avoided.}$$

(2.58 = primary / final energy conversion for French energy mix)

In addition, usage of Renewable Energy (PV) can lead to an increased of building land (+20%)

- Next thermal regulation « RT 2012 » in progress.
C.S.T.B. deeply involved on this work (and so on attached PV calculation)

2012 all new building : 50 kWh/year/m².
(consequence of **GRENELLE of Environment**)

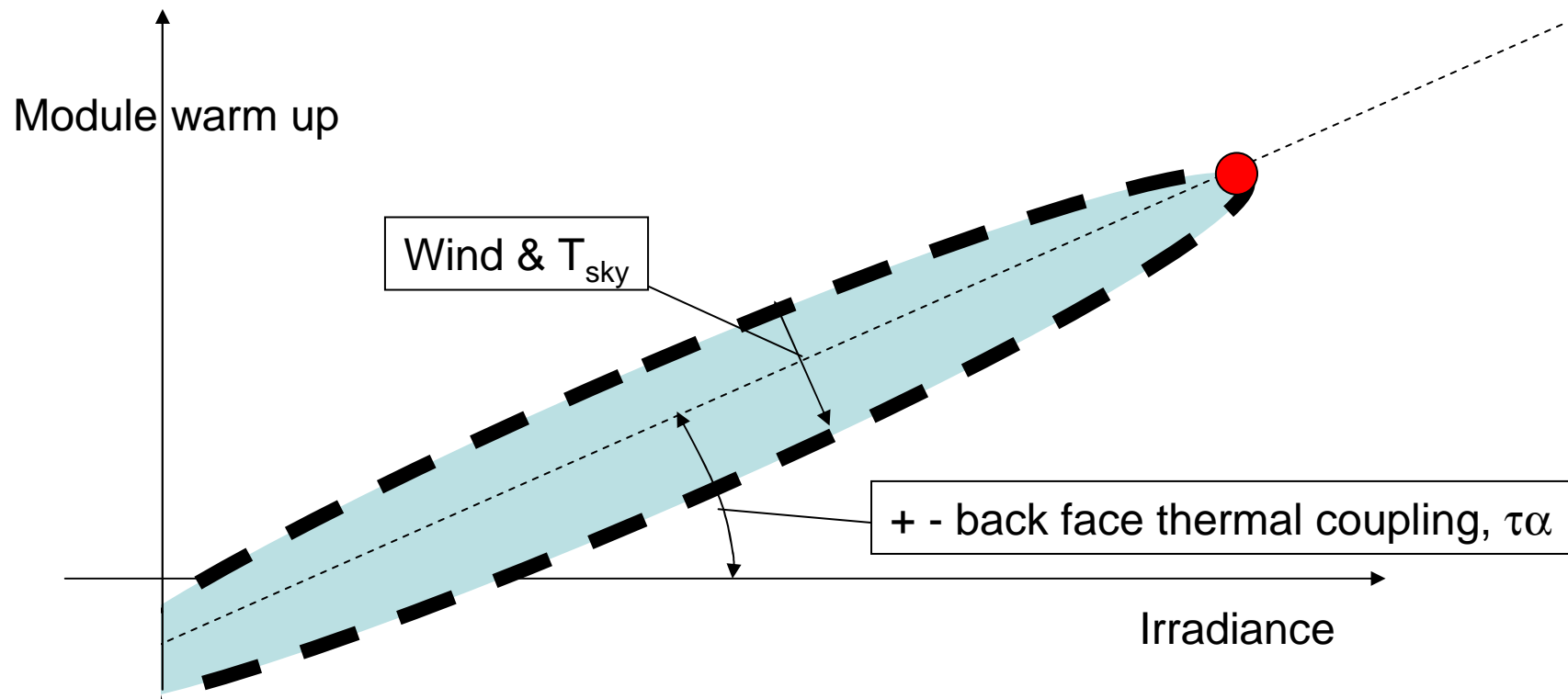
- 2020 all new building positive energy building :
definition of BEPOS in progress (CSTB major actor).

PV valorization should avoid any thermal sieve and PV energy rating should be “enough” accurate.

=> Again energy rating = important issue for C.S.T.B.

Some BIPV technical issues 1/6

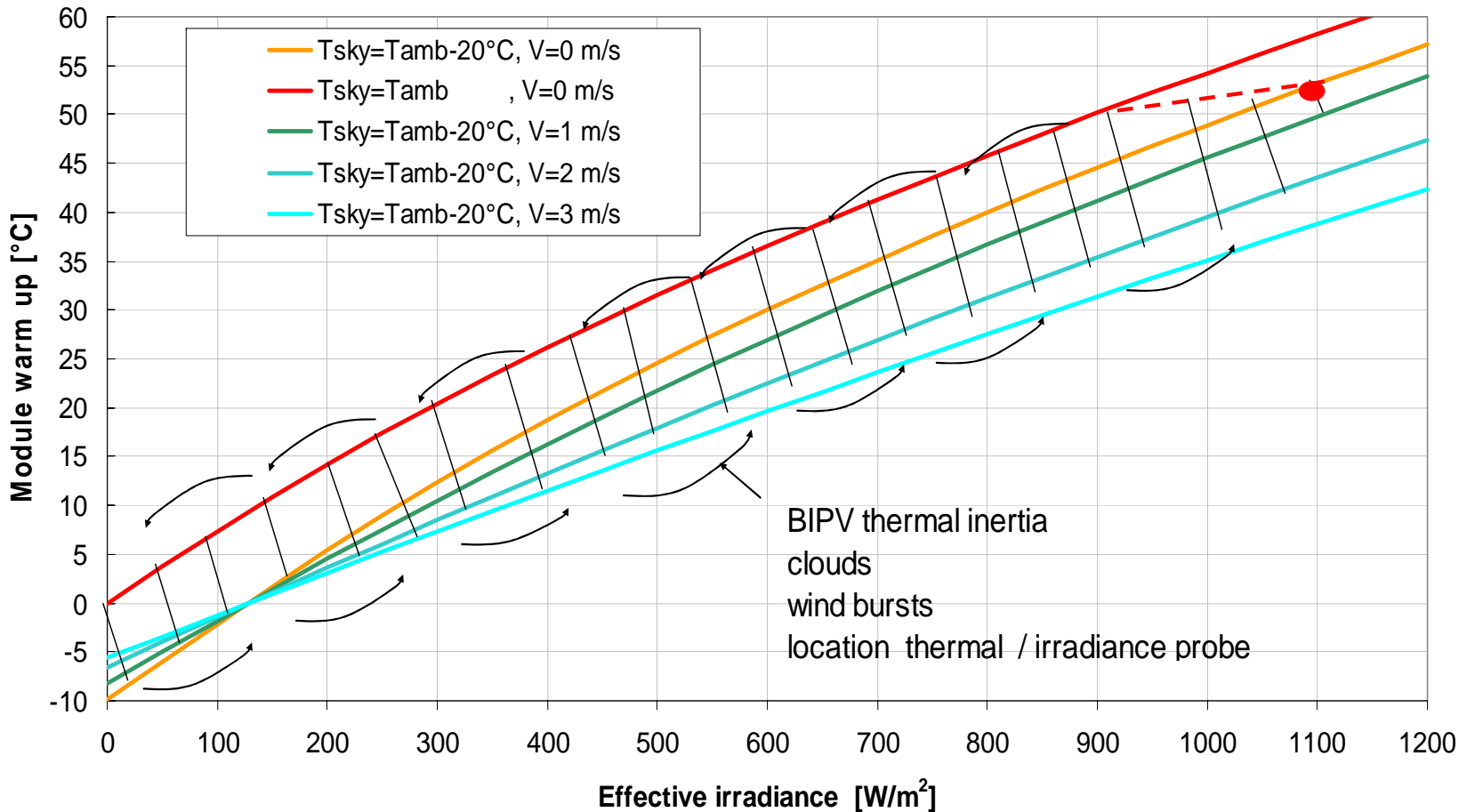
- Thermal resistance to ambient : compared with shed may be /2 :



Some BIPV technical issues 2/6

- 1 D static thermal model adiabatic back face ($H_{conv}(T,V) + \Delta T^4 + \text{module ON...}$) :

Typical mc : Si



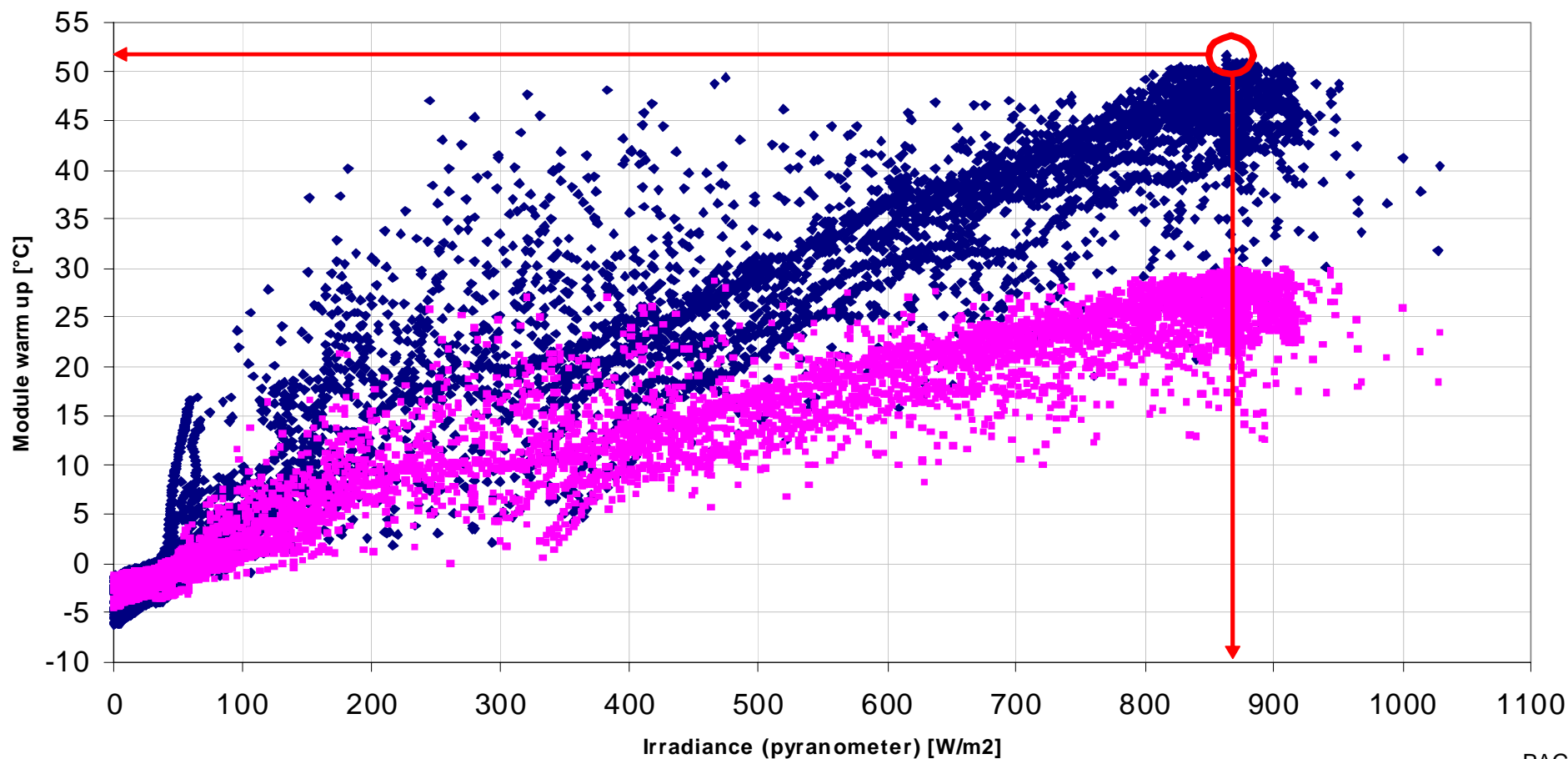
Tmax =
Tamb + (50-55)°C

Tmax =
30°C + 50-55°C =
80°C-85°C
with UV

IEC
duration
test to
revisit ?

Some BIPV technical issues 3/6

Real case adiabatic back face and shed at Sophia (mc : Si)
30° slope + South azimuth



Some BIPV technical issues 4/6

- BIPV => less ventilation => less kWh (c:Si). A simple model :

$$P / S = \eta_0 . G . (1 - \alpha . (T_m - T_0))$$

$$T_m = T_a + G . (\tau\alpha - \eta_0) . R_{th}$$

=>

$$\frac{R_{th}}{Wh} \frac{\partial Wh}{\partial R_{th}} = \frac{- \int \alpha G^2 (\tau\alpha - \eta_0) R_{th}}{\int G - \int \alpha (T_a - T_0) G - \int \alpha G^2 (\tau\alpha - \eta_0) R_{th}}$$

Some BIPV technical issues 5/6

c:Si from shed to BIPV :
 R_{th} from 0.045 K.m²/W to 0.090 K.m²/W
+
Typical Year Nice 30°/Sud
=>
about -10 % on kWh/years.

Comparable results with most detailed model TRNSYST,
MATLABSIMULINK

This point should be clarified (in situ RD)

Some BIPV technical issues 6/6

Long term experience with shed modules states Wc derating about -0.5% - 0.7 % years (cf ISPRA SANDIA SUPSI) for mc:Si.

**What about BIPV module :
higher temperature, IEC does not specify T + UV,
including promising thin film ??**

1. True market is between BIPV and BAPV
2. Many innovation to come. hybrid, thin film, renovation kit, intelligent grid / storage interface...
3. Building offers "free" m² BUT in a non uniform context (many typology)
4. quality process for PV as building material is problematic for this new industry : at present : learning stage PV // building
5. BIPV energy rating : a hot topic in view of high efficiency building code

BIPV ageing although difficult should be a real concern for RD :

GIVEN THE MARKET TREND WE CAN NOT DISCOVER THE PROBLEM (if any) IN 10 YEARS

CSTB PV team is in open position to collaborate at european level.