

## Authors

Julien Thomas, Sylvain Mangili (AQC, France), François Durier (CETIAT, France)

Technology All technologies	Aspect Quality of the works	Country France
--------------------------------	--------------------------------	-------------------

## INCREASING THE EXPERTISE OF BUILDING PROFESSIONALS FOR A BETTER QUALITY OF CONSTRUCTION: THE FRENCH PROGRAMME PACTE

*The quality of construction in France can still be improved, especially for high energy efficiency buildings. National programmes have been implemented. The national programme PACTE aims at increasing the expertise of building professionals through a series of dedicated actions. This fact sheet describes the programme PACTE and its outputs.*

Residential buildings <input checked="" type="checkbox"/>	Non-residential buildings <input checked="" type="checkbox"/>	Specific buildings: .....
New buildings <input checked="" type="checkbox"/>	Existing buildings <input checked="" type="checkbox"/>	

### Context

The situation on the ground in France shows that quality of construction must still be improved. The observed defects on new or renovated buildings cover design, construction and installation works. It is sometimes considered that the cost of non-quality in the French construction sector could represent about 10% of its turnover<sup>1</sup>. In this context, three national priority programmes were launched in 2015 by the French government about buildings.

- ✓ One programme aims at developing new techniques for detecting and eliminating asbestos in existing buildings (Plan Recherche et Développement Amiante).
- ✓ Another programme has the objective to prepare the implementation of digital technology in the building industry (Plan Transition Numérique dans le Bâtiment), with probably positive impacts on the improvement of quality.
- ✓ Finally, the programme PACTE (Programme d'Action pour la Qualité de la Construction et la Transition Énergétique / Action Programme for Construction Quality and Energy Transition) aims at increasing expertise of building professionals in energy efficiency, thus improving the quality of construction and the fulfillment of energy performance requirements. The objectives and first results of the programme PACTE are presented below.

### Objectives and problems addressed

The programme PACTE intends to mobilise the whole building sector in France for concrete actions, with the objectives to improve the quality of construction and of renovation of buildings, for really achieving high energy efficiency. The activities of the programme are divided into three categories:

1. Actions to develop, capitalise on and highlight knowledge concerning the risks of insurance claims for high energy performance buildings and their real performance,
2. Actions to update and develop professional guidelines, and develop practical and instructional tools and resources,
3. Actions to increase and improve local and/or regional actions for developing the expertise of building professionals.

PACTE covers all types of new and existing buildings.

<sup>1</sup> Percentage mentioned by a French association of architects (UNFSA) in October 2007 - [http://syndicat-architectes.fr/files/2011/09/PA22\\_ENCART.pdf](http://syndicat-architectes.fr/files/2011/09/PA22_ENCART.pdf)

## Approach to overcome identified problems

### Management of the programme

The programme PACTE results from a governmental initiative. It is planned for a 4 years duration (2015-2018). PACTE is managed by a steering committee composed of representatives of all stakeholders, i.e. government, regions, public bodies and all the professionals involved in the construction or renovation of buildings: construction product manufacturers, architects, economists, technical engineers, contractors, inspectors, insurers, real estate developers, social housing providers.

PACTE's technical secretary is managed by AQC (Agence Qualité Construction / Quality Construction Agency), an inter-professional non-profit organisation whose mission is to improve the quality in the construction sector and to reduce the number and scale of building defects. Activities of AQC include the observation of non-quality in construction, actions to prevent it, and communication towards professionals.

### Link with a previous programme

PACTE continues a collaborative work initiated by several stakeholders in a previous national programme called RAGE (Règles de l'Art Grenelle Environnement), operated between 2010 and 2014. The objective of the programme RAGE was to update (or create) standards and professional guidelines for the energy efficiency in buildings.



Figure 1: Logos of PACTE (2015-2018) and RAGE (2010-2014) programmes

The RAGE Programme produced more than 80 documents available for free download by interested professionals. They include professional recommendations (intended to help French standardisation committees for revising standards, and being recognised by insurance companies), technical guides (for less-mature technologies, having an instructional purpose) and reports. Documents provide recommendations for design, construction, installation, self-control of quality and commissioning.

All these documents (examples of cover pages in Fig. 2) can be downloaded at [www.programmepacte.fr](http://www.programmepacte.fr).



Figure 2: Cover page of documents from the programme RAGE

([www.programmepacte.fr](http://www.programmepacte.fr))

### Work programme and first results of programme PACTE

A first series of actions of PACTE has the objective to develop, capitalise on and highlight knowledge about the construction defects in high energy performance buildings and their real performance. This is

done in particular through a scheme called "REX Bâtiment Performant", which is a collection by AQC of all feedback from quality problems (Figure 3) encountered in high-performance buildings based on in-situ audits and interviews of the actors who participated in the various phases of construction. The purpose is to identify the non-qualities that impact the expected performance and prevent the achievement of targets for energy efficiency, comfort, indoor environment quality.... Collected data are analysed and synthesis document are published to highlight good practice and enable learnings from errors (Figure 4). Between 2010 and 2015, 750 new or renovated buildings have been visited (including 200 buildings in 2015) by more than 50 inspectors.



Figure 3: Example of observed defects in the ductwork of a high performance building ([www.programmepacte.fr](http://www.programmepacte.fr))



Figure 4: Example of an analysis document on construction products from bio-materials ([www.programmepacte.fr](http://www.programmepacte.fr))

The second series of actions of PACTE consists in continuing the update and development of professional guidelines. Practical and instructional tools and resources are also developed: notebooks for workers - including digital version for smartphones and tablets (Figure 5), protocols for reliable measurement of the actual energy performance of a completed building (Figure 6).

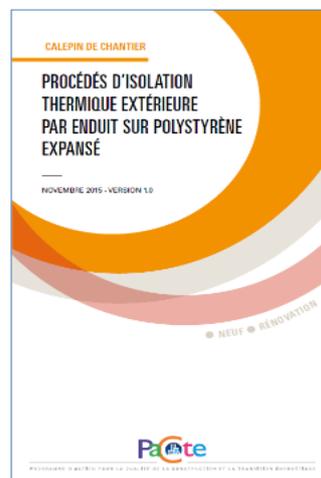


Figure 5: Example of a practical notebook for workers about external thermal insulation ([www.programmepacte.fr](http://www.programmepacte.fr))



Figure 6: Test of a protocol to assess the energy performance of a completed building (Photo credit: CSTB)

Finally, the third series of actions of PACTE aims at increasing and improving local and/or regional initiatives for developing the expertise of building professionals. The development of 40 innovative approaches by local training organizations is supported, including the development of Massive Open Online Courses (MOOCs - Figure 7) and Small Private Online Course (SPOC) for distance training, training with digital tools (virtual reality, augmented reality), practical training in simulated situations on full-size models, in situ training on construction site...).



Figure 7: Example of a MOOC on energy-renovation of buildings with 4000 registered users (<https://mooc-batiment-durable.fr/>)

### Market acceptance of the approach

PACTE is based on the collaborative work dynamic between all the sector's stakeholders in construction, which was initiated in RAGE programme. This dynamic is crucial for achieving the PACTE objectives set within tight schedules. To illustrate this point, a total of more than 200 experts and working professionals were involved in producing the RAGE guidelines (Figure 8). This is seen as an unprecedented national mobilization of the building's industry.

The dissemination of these new construction standards is now progressing. More than 200 000 downloads have been recorded since the first publication of RAGE guidelines.



Figure 8: Locations of the 200 experts involved in RAGE programme

### Pros and cons of possible options

The following table summarises some of the options chosen for the programme PACTE, together with the pros and cons.

Option	Pros	Cons
✓ A national priority programme launched by the government	✓ A national programme can federate actions from different stakeholders and avoid duplication between various similar initiatives	<ul style="list-style-type: none"> <li>✓ A national programme launched by public authorities requires that public financing is available for this purpose</li> <li>✓ It could be considered that building professional must work on their own to enhance quality levels</li> </ul>
✓ Involvement of stakeholders in a steering committee	✓ The involvement of all stakeholders is necessary to legitimate the programme and decide on priorities between actions	✓ Managing a programme with a lot of stakeholders can be difficult
✓ Management of the technical secretary of the programme by an existing organisation whose mission is to contribute to the improvement construction quality	<ul style="list-style-type: none"> <li>✓ Limits the direct involvement of the public workforce</li> <li>✓ The programme has good synergies with the usual activities of such an organisation</li> </ul>	
✓ Providing to professionals recommendations and guidelines that are available for free download	✓ Free access creates no barrier to dissemination	<ul style="list-style-type: none"> <li>✓ No income from the distributed documents</li> <li>✓ Something that is free can give the impression that it has no value</li> </ul>
✓ Implementing a collection and analysis of feedback from non-quality problems in high efficient buildings	✓ Useful to identify weak points from the ground and decide on priorities for recommendations and guidelines	✓ Requires audits and interviews, meaning substantial means dedicated to the action

✓ Developing notebooks for workers, including digital version for smartphones and tablets	✓ Crucial to explore / stimulate the use of new ICT tools (such as smartphones and tablets) by workers	✓ It is not yet sure that the use of new ICT tools will be rapidly accepted by workers
✓ Supporting the development of innovative training approaches: MOOCs, SPOCs, virtual reality, augmented reality, training on full-size models, in situ training...	✓ Interesting to rely on existing training organisations and to encourage them to innovate, even if the market is not yet fully ready to accept all these innovations	✓ It is not yet sure that innovative training approaches will all be accepted by the market

Table 1: description of some the options of the programme PACTE with their pros and cons

### Compliance concerns related to EP certificates and to the QM approach

No reporting <input type="checkbox"/>	Wrong reporting <input checked="" type="checkbox"/>	Not meeting the performance requirements <input checked="" type="checkbox"/>
---------------------------------------	---	--

Compliance concerns related to EP certificates (see QUALICHeCK terms and definitions)

All the actions of programme PACTE have the aim to improve the quality of works on the construction site. They can primarily lead to a construction that meets the performance requirements and accordingly also prevent wrong reporting.

### Financial aspects

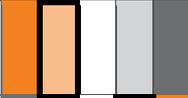
The previous programme RAGE (2010-2014) was financed by energy distributors in the framework of the energy efficiency obligation scheme required by the Energy Efficiency Directive (2012/27/EU). Financing of programme RAGE allowed energy distributors to receive white certificates for contributing to energy saving measures.

The current programme PACTE is granted with a budget of 30 M€ for a 4 years duration (2015-2018). This budget comes from the liquidation of the compensation fund of a passed insurance scheme for construction that was operated until 2005 before being replaced by another system.

### Overall evaluation

Pros	Cons
✓ A series of actions leading to effective outputs: better knowledge of the situation on the ground, development of guidelines and practical and instructional tools, training of building professionals through innovative approaches	✓ Public budget needed
✓ Contribution of all stakeholders	✓ Substantial efforts required

Table 2: Overall pros and cons of the approach

<b>Level of complexity</b> (dark orange = simplest)	
<b>Potential for replication</b> (dark orange = best)	

#### Prerequisites

E.g. : Willingness of public authorities

Hints	Pitfalls
<ul style="list-style-type: none"> <li>✓ Identify priorities from the analysis of the situation on the ground</li> <li>✓ Involve stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>✓ The budget must correspond to the level of ambition</li> <li>✓ The promotion of the developed documents and tools must be sufficient to make them known and used</li> </ul>

Table 3: Overall hints and pitfalls to avoid when developing such an approach

## References

- [1] Website of the programme PACTE: <http://www.programmepacte.fr/>
- [2] Sylvain Mangili (AQC) - *Professional rules and guidelines for installers: the French Programmes RAGE and PACTE* - Presentation at the QUALICHeCK Workshop "Renewable heating and cooling systems for buildings", 17 January 2017, Lyon, France.  
<http://qualicheck-platform.eu/wp-content/uploads/2017/01/QUALICHeCK-Lyon-4.1-Mangili.pdf>

*The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.*



Co-funded by the Intelligent Energy Europe Programme of the European Union