

US BUILDING CODES CHANGES MAY HELP PU'S PROSPECTS

Report by *Liz White, editor*

Building codes in the US are becoming increasingly stringent, particularly in terms of energy conservation, and this is a major factor driving up demand for all types of insulation, including rigid polyurethane foam.

Spray PU foam (SPF) technology, which has been around for perhaps 20 years, is now achieving widespread use, said Monica Karamagi, insulation marketing manager for Huntsman in the Americas.

She believes this uptake results from a combination of factors.

One is changes in the building codes: "These are a strong driver," and are "going to become even more stringent in 2012," Karamagi said.

As Frost & Sullivan analyst Ashwini Ravishankar puts it, enforcement of energy efficiency codes in residential and commercial construction is playing "a key role in the adoption of higher R-value insulation materials." (R value is unit thermal resistance, measured in the US in ft²·°F·h/Btu).

Overall, increased enforcement of more stringent building codes is likely: "As a result rigid polyiso (polyisocyanurate, PIR) and SPF are expected to post higher growth rates in the future," Ravishankar added.

A simple advantage for polyurethane is that it offers more R value compared to other insulation products. As R value requirements increase, insulation needs to be thicker to meet the demands, and space becomes a concern. "With PU you get the most insulation in the narrowest distance," Karamagi explained.

The current drive to improve building insulation offers "one of the best bangs for the buck in terms of saving on carbon [emissions] and energy consumption," agreed Michael Fischer of Kellen Co., the code regulatory consultant for the Center for the Polyurethanes Industry (CPI) and the Polyisocyanurate Manufacturers' Association (PIMA). "So it is



Building codes a big driver for insulation – Monica Karamagi

30 PERCENT TARGET CLOSER

A milestone at the ICC code talks in Baltimore, Maryland, in Nov 2010 means that the US Department of the Environment is close to its goal of a 2012 IECC that is 30-percent more stringent than the 2006 IECC. Only one round of public comment and the Final Action Hearings remain.

For residential buildings, proposal EC13 contains energy-efficiency improvements that, together with advances in the 2009 IECC, achieve most of the 30 % goal, said an IECC statement.

EC13 requires pressure testing to make sure homes are air sealed, and includes new provisions to reduce energy/water wasted in piping. It also wants increased R-values in many thermal-envelope assemblies, more efficient windows/skylights, and cuts in duct-leakage rates.

For commercial buildings the equivalent code proposal, EC147, has a cool-roof requirement for buildings in the southern tier of the US, using solar-reflective materials. And it offers three paths to increase efficiency: more efficient HVAC; more efficient lighting; or use of renewable energy.

actually a huge opportunity," for polyurethane insulation, he added.

Karamagi said the cost of utilities is another driver: high energy costs produce greater awareness of what's driving energy usage in a building.

Also there is, "greater understanding of the building science and the role of better or well-insulated building envelopes," Karamagi said. In general, society is increasingly aware of energy efficiency, and consumers have, "more desire to be green and efficient in resources," she added.

Fischer also noted the benefits of PU foam in terms of R value per inch.

And he said, "As developers, builders and specifiers look for ways of providing structures that meet these new requirements, one of these considerations is going to be not just how they meet energy codes, but all other codes."

ENERGY EFFICIENCY IN ARRA

Ravishankar said the ARRA act has been important in various energy efficiency, programs:

- Incentives/funds for residential insulation.
- Some \$20 000 million for rebates for improvements, aid to low income families, etc.
- Obama's Better Buildings Initiative aims for a 20 % rise in energy efficiency in commercial buildings.
- Home Star for residential energy efficiency, with

According to Frost & Sullivan's Ashwini Ravishankar, the 2009 IECC code lays down tighter demands on thermal insulation, including:

- Walls (R-20 in 2009 in climate zone 5 and 6).
- Floor (R-38 in 2009 in climate zone 7 and 8).
- Basement wall insulation (R-15/19 in 2009 in climate zones 6-8, R-5/13 for other zones (the higher the number the colder the zone).
- Increased insulation on mechanical system pipes (R-3 in 2009).
- Increased requirements for insulation in high-rise residential and commercial buildings.

Wind resistance is important, he said, for example, in areas around the Gulf such as Florida, which experience hurricanes. "So there's been a lot of work, with the foam-sheathing coalition, PIMA and CPI supporting it," Fischer said.

Karamagi and Fischer spoke to UTI 11 Oct at the conference of the Center for the Polyurethanes Industry held with the UTECH 2010 event in Houston, Texas.

Airtightness becomes mandatory

US codes for energy efficiency in construction address both new building and remodelling, and are developed by the IECC (International Energy Conservation Council) and the ICC (International Code Council), Fischer said.

Karamagi said codes are now starting to call for air tightness, a measure which "will particularly make spray PU a preferred product."

With other insulation materials, a building would have to be wrapped with some kind of barrier to pass the air-tightness test, the Huntsman insulation expert noted.

Airtightness is especially being mandated in the military, Karamagi said, where the new standard of the US Army Corp of Engineers requires 0.25 ft³/min/ft² of air tightness. That is a much more stringent standard than for commercial buildings, which are typically 3-4 times leakier, the Huntsman expert added.

"So those kind of codes will stir things in the favour of PU," she said.

S&F analyst Deepan Kannan also mentioned the mandate for air barriers in commercial buildings, noting that this favours use of SPF insulation, as it is a better air barrier.

On the commercial construction side, Karamagi said ASHRAE 90.1 will for the first time require complete continuous insulation on the exterior of all commercial buildings. (ASHRAE is the American Society for Heating, Refrigeration and Air Conditioning Engineers,

\$6 billion in rebates for appliances and insulation.

- \$3.2 billion in the Energy Efficiency & Conservation Blocks Grants Program for energy efficiency conservation, to local governments/ states.
- Tax credits of 30 % of the cost up to \$1500 for insulation, energy-efficient windows, HVAC.
- All Energy-Star-certified products get tax credits.
- DOE's weatherisation assistance program aims to insulate the homes of low-income families.

SPF MORE MAINSTREAM

Custom home builder Frankel Building Group in Houston elected to have all the 58 homes in a recent building project insulated with spray polyurethane foam. "That is pretty rare and pretty bold," said Monica Karamagi, insulation marketing manager for Huntsman in the Americas.

The group won a 2010 award from the Greater Houston Builders Association for the project, at ParkGate Reserve, a development in Shenandoah, just north of Houston, Texas.

According to Scott Frankel, vice president, Frankel Building Group, "We wanted to go with an insulant that provided a tight envelope around the building. ... SPF delivers an effective, tight thermal and air barrier around the exterior of a home or commercial structure."

Karamagi sees the project as important because it indicates that "spray foam is really becoming more

while 90.1 is the 2010 version of that standard).

Continuous insulation is used to mitigate the thermal shorting effect in steel-stud buildings. "When you insulate the cavity, you still have a conduit for heat loss for each and every stud," she said.

It is now mandatory that insulation is fitted outside. "That will lead to a huge expansion. They are estimating a tripling of the market between now and 2020," she added.

On the commercial side, this is a huge



mainstream now, it's no longer a niche type of insulation product. Once we have builders accepting it, that means that the product is really marketable."

She also commented that SPF supplier, CertainTeed was once associated only with fiberglass, but "is now more a general insulation provider, looking for solutions for the building envelope, spray PU foam being one. Huntsman supplies open-cell spray-foam technology to CertainTeed,

"CertainTeed's CertaSpray SPF complements our

development, Karamagi said. The 2007 version, "only had that requirement in the colder climate zones," but now it is nationwide.

The codes are mandatory, Karamagi said. "What happens is that the international building code (IBC) will reference ASHRAE 90.1."

IBCs are the required standards for all commercial buildings in the US, she added. But states have different levels of code adoption, with some — California, Georgia — using stricter specifications, Ravishankar commented.

existing line of insulation products for the building market. Because SPF helps eliminate air infiltration, it adds comfort, energy savings and a healthy indoor



A ParkGate Reserve home insulated with CertaSpray

environment to the residential and commercial buildings where it is used," said Lionel Rossignol, product manager, CertainTeed Insulation.

Karamagi feels there has been a "sort of a turn in the industry ... spray foam has now been

accepted and we really think that going forward is going to be a permanent part of the scene," with increasing use in the building envelope.

Ravishankar also noted in written answers for UTI that future IECC codes aim at increasing energy savings of 30 percent over the 2006 version.

Karamagi also noted this change, saying that, on the residential side, the 30-percent boost in energy saving requires better insulation and better windows (see 30-percent box p 33).

Fischer said the US Department of Energy is "the driving force" pushing for this 30 percent improvement in building energy efficiency.

He also noted that the CPI is a participant in the Energy-Efficient Codes Coalition which promotes better technology in energy saving (EECC web 30percentsolution.org).

"This coalition is driving some of the solutions on the structural side that will facilitate the use of PU foams in walls and construction," Fischer added.

Karamagi commented that the American Recovery and Reinvestments Act (ARRA) of 2009 has specific requirements for states to adopt the most current codes, before they could accept ARRA cash. "That is starting to come into effect now," she said.

"So that means legislation is lifting up insulation usage," she said.

Fischer also noted this route to energy efficiency: the 30-percent saving will come in because the Federal Government has tied certain funding to its being achieved, "so the carrot is there, the financial incentive," he said.

Also, the Home Star bill will give credits for home retrofits of \$4000, Karamagi added.

That will also increase insulation usage, because owners will have an incentive to upgrade their homes, Karamagi said, adding that potentially over 60 million US homes are not properly insulated and could be improved.

Since only about half-a-million homes are being built in the US a year now, compared to the 1.2 million homes built in the heyday of domestic construction, "You really need to focus on under-insulated homes," to gain energy benefits, Karamagi stressed.

Fischer added that a number of local state and federal purchasers, building developers and agencies have signed up to sustainable construction through LEED programmes.

One of the cornerstones of sustainable buildings is energy efficiency performance, he added, noting that many of these programmes, such as Energy Star, are above code.

Karamagi said the general feeling is that US construction recovery will happen in 2011. "As far as commercial construction goes, it is down this year. It lagged residential construction but in the end it did turn. The hope is that in early 2011, residential comes back and commercial will lag that slightly," she commented.

In this context, F&S noted that, "The downturn in the construction industry had a great impact on the market, leading to significant year-on-year decline in unit shipment of insulation." F&S's data show the North American market for energy-efficient building materials as at around 7812 million lb (3543 kt) in 2009, a 30-percent drop from 2006.

Anecdotal reports say spray foam continues to grow in a recession, Karamagi said: "We are still hearing that growth is in the high single digits." And "given the changes in the codes and the better understanding of the building standards, once construction returns, SPF is in a very healthy place for strong growth," she said.

CPI data showed US use of SPF at 190 kt in 2008, while a 2009 report from Principia Consulting said 2008 US demand was at 163 kt, valued at \$680 million.

ADDITIVES FOR INSULATION

In terms of megatrends in rigid foam, "energy efficiency is everywhere" said Bruce Smoyer, global technology leader for rigid urethane with Momentive Performance Materials.

"Rigid PU foam is a wonderful insulator," he said, noting that whether because of legislation or the need to reduce dependency on petroleum, there is rising demand for better energy efficiency in appliances and homes.

Smoyer's colleague Tony Lanchak, global business director for urethanes additives, also noted that China's government has a target of raising the energy efficiency of new buildings by 80 percent over the next five years, with PU often the only material that will allow this to be achieved.

Momentive offers silicone additives to help rigid foamers, for example, to get a foam with 2-3 percent better density distribution. It has another type to give good compatibility with natural oil polyols (NOPs), allowing foamers to use 20-30 percent NOP with no loss of properties, said Smoyer, discussing Momentive's additives for rigid foam at the CPI/UTECH event in Houston, Texas, 11 Oct.

In rigid foam, as blowing agents (BAs) move from hydrofluorocarbons (HFCs) to hydrocarbons (HCs), Lanchak said that users want better combinability, solubility and miscibility, with improved flow properties to cut voids in the foam.

In appliances, "It's all about blowing agents,"



Bruce Smoyer

and this is true globally, Smoyer said. For HFC 245fa, Momentive offers Niax L6952, developed to give a high water level, and cut the expense of the BA. This gives a lower K factor (higher R factor), better flow and low voids, he added.

For HCs, Momentive offers: L6887 for compatibility; L6988 for the lowest K factor; and L6990 for high loading of aromatic polyester polyols (APPs) on the resin side. The latter is valuable for uses such as water heaters, Smoyer explained, where, "As you load the formulation with APP, you start to lose compatibility."

For these lower-density foams, "The problem ... is resin compatibility and shelf life stability – they've really struggled with this, and L6165 in those formulations has solved these issues," Smoyer said.

In North America: "Spray foam for cavity wall filling is seeing very high percentage growth," noted Smoyer, and additives for SPF are again aimed at compatibility and shelf-life stability.

"People getting into the business have compatibility issues as they tweak these low-density water-blown spray foams for optimum performance. For this we've developed 6189 which overcomes those deficiencies," Smoyer said.

SPF suppliers also want plenty of latitude in production and in the products possible with it: Momentive's L5151 is aimed at allowing use of many different types of polyester polyols, he noted.

For flexible-faced rigid foam boardstock, Smoyer said, "the keyword is versatility." Momentive has silicones for void reduction in rigid-faced lamination where voids cause problems as the temperature changes, so eliminating them is crucial in keeping up energy efficiency, he said.

PU insulation can be laminated with metals or polymer films, and better foam adhesion is needed, he added. Momentive gave a paper at the CPI conference on this, looking at one additive designed for high-water-level PIR foam, and another for all-water-blown PU, Smoyer said.

F&S's Kannan also commented on the rising popularity of SPF, which he said is due to its high R-value and several benefits over other insulation materials.

Kannan said SPF's increased penetration in

roofing, and proposed building codes amendments are expected to mean the material achieves higher growth than other insulation materials, with a CAGR of 7.1 percent by volume from 2009 to 2016.

Insulation set to grow again

F&S sees the market for energy efficient materials as "set to recover and post a positive growth rate from the last quarter of 2011," with annual growth of 1.8 % from 2009 - 2016.

F&S thinks fibreglass insulation will post the lowest growth, and face strong competition with the other high R-value materials in the coming years. Increased demand for spray PU foam and rigid PIR is expected to result in high growth rates, boosted by continuous amendments to building codes which will favour materials with higher R values.

PIR and SPF have 10.0 and 3.0 % by volume respectively, in North America's insulation market, according to F&S. Kannan expects PIR to post significantly higher growth than other materials, propelled by the need for high R-value materials in both commercial and residential uses.

High cost may limit PIR's move into residential uses, which are dominated by fibreglass, said Kannan. F&S expects the overall growth (CAGR) of PIR from 2009-2016 to be around 4.2 %.

Currently, SPF is used widely in commercial roofing, and is used for retrofitting since it can be sprayed over existing roofing, the F&S analyst said.

In housing, SPF is predominantly used in attics and crawl spaces. However, prospects in residential roofing are good due to SPF's advantages, such as high R-value. Its use in domestic interior wall insulation is set to acquire significant market share from fibreglass in the coming years, Kannan said.

The advent of 0.5 lb density foam is aiding SPF's growth in commercial and residential uses, he said.

• Frost & Sullivan's report on 'Materials for Energy Efficient Buildings in North America, costs \$6000. See www.frost.com for more information.