Technical Conclusion on Compliance

of extrusion-type expanded polystyrene slabs (XPS)
supplied by TechnoNICOL-Stroitel'nye Sistemy LLC
for the erection of LEED®-certified facilities

LEED

TECHNONICOL

eco STANDARD group

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General information

This expert assessment was made in March of 2017 by EcoStandard group for TechnoNICOL-Stroitel'nye Sistemy LLC.

The Contractor acted in accordance with the Law as an independent expert and has no financial, property or any other interest in the result of research.

This expert assessment was made only on the basis of the results of the performed research in accordance with the special knowledge of experts.

Purpose of research

Assessment of the products for compliance of the section Sustainable Sites (SS), Energy and Atmosphere (EA), Materials & Resources (MR), Indoor Environmental Quality (IEQ) with the criteria of the Leadership in Energy and Environmental Design standard (LEED, USA).

The research reviews the following standards: LEED 2009 for New Construction and Major Renovation Rating System or LEED 2009 for Core&Shell Development Rating System and LEED Reference Guide for Green Building Design and Construction, including the appendices thereto, and LEED v4 for New Construction and LEED v4 Reference Guide for Green Building Design and Construction.

Objects of research

List of products

The objects of this expert assessment are the **products** sold by TechnoNICOL-Stroitel'nye Sistemy LLC:

- *TECHNOPLEX*
- *TechnoNICOL CARBON ECO*
- *TechnoNICOL CARBON PROF*
- *TechnoNICOL CARBON SOLID*
- *TechnoNICOL CARBON SAND*

Manufacturers' addresses

- LLC TECHNOPLEX Plant, 21, Vostochny Promuzel, Ryazan, Ryazan Region, 390047
- LLC TECHNOPLEX Plant, Branch, 21, Vostochny Promuzel, Ryazan, Ryazan Region, 390047
- LLC TECHNOPLEX Plant, Branch, 3, Mosckovskaya str., Andzhievsky settlement, Mineralovodsky district, Mineralnye Vody, Stavropol Territory, 357217
- LLC TECHNOPLEX Plant, Branch, 1, Krovelnaya str., Uchaly, Republic of Bashkortostan, 453700
- LLC TECHNOPLEX Plant, 1, Krovelnaya str., Uchaly, Republic of Bashkortostan, 453700
- LLC TECHNOPLEX Plant, Branch, 8, October 60th Anniversary Avenue., Khabarovsk, Khabarovsk Territory, 680015
- LLC TechnoNICOL-Ulyanovsk Plant, 5Ц, Promyshlenny dr., Novoulyanovsk, Ulyanovsk Region, 433300
- LLC TechnoNICOL-Siberia Plant, 1, 1st Zheleznodorozhnaya str., Yurga, Kemerovo Region, 652050
- LLC TechnoNICOL-Northwest Plant, est. 11, 2nd Vertikalny dr., Annolovo settlement, Tosnensky district, Leningrad Region, 187021.

Official web-site: http://www.xps.tn.ru

Telephone: 8 800 200-0565

E-mail: xps@tn.ru

General information about the LEED standard, its application and relevance

The LEED Green Building Rating System® is a voluntary standard that defines high performance requirements for green buildings. The built environment has a profound impact on our natural environment, economy, health and productivity.

Designers, builders, operators and owners are transforming the built environment using the LEED® green building certification program developed by the U.S. Green Building Council (USGBC). They achieve this through the application of modern approaches to the design, taking into account natural and infrastructural features of a site, needs of end users. Considerable contribution to the creation of "green" building makes use of sustainable and safe construction and finishing materials.

LEED® system covers the various types of projects:

- Building Design and Construction
- Building Operations and Maintenance
- Interior Design and Construction
- Homes
- Neighborhood Development

This is a rating system. Based on the number of points, the building can be rated:

- LEED Platinum (80+ points)
- LEED Gold (60-79 points)
- LEED Silver (50-59 points)
- LEED Certified (40-49 points)

The process of assessment and certification is rather complex. The estimated building must comply with the requirements that are called prerequisites and “credits”. Main sections (may vary depending on the version of LEED® and the type of project) are as follows:

- Location & Transportation
- Sustainable Sites
- Water efficiency
- Energy and atmosphere
- Materials and resources
- Indoor environmental Quality
- Innovation in design
- Regional priorities

LEED® Certification is only for projects, not products. But products used as project materials can contribute toward the rating points needed for the building certification.

Information about the material and its advantages for green building

XPS slabs supplied by TechnoNICOL represent high-quality extrusion-type expanded polystyrene manufactured in compliance with the economic, construction engineering and environmental requirements.

Extrusion-type expanded polystyrene is widely used for the thermal insulation of foundations, roofs, floors, pipelines, highways and railways

Materials and application thereof

The manufacturing recipes for various types of XPS differ by the percentage of additives, type of foaming agents and ratio of polystyrene types. The key difference between the types consists in XPS strength, thermal conductivity and water adsorption properties. The said properties for each of the product types are available at http://www.xps.tn.ru/xps.

XPS TECHNOPLEX – thermal insulation slabs used for the insulation of balconies, partitions, for the construction of the floor and “warm floor”. XPS TECHNOPLEX is among the best thermal insulation materials for the insulation of summerhouses and apartments.

XPS TechnoNICOL CARBON ECO – material used for cottage and low-rise construction for the insulation of foundations, roofs, floors, and facades.

XPS TechnoNICOL CARBON PROF – material for professional builders. Has high strength and low thermal conductivity. The material is used for the construction of flat roofs in shopping and logistics centers, residential blocks, foundations of any complexity, load-bearing roofing structures, and ground floors. The family also includes special materials XPS TechnoNICOL CARBON PROF SLOPE for the creation of the slope on the flat roof.

TechnoNICOL CARBON SOLID is a thermal insulation material for the insulation of load-bearing floors, heat insulation of railways and highways. Its high strength ensures an even and hard bottom extending the heat-insulating system lifetime.

XPS TechnoNICOL CARBON SAND – thermal insulation slabs made from extrusion-type expanded polystyrene specifically designed to be used as the core in heat-insulating panels of various types (board-on-frame) or in composite materials.

Advantages for green building

TechnoNICOL XPS slabs have a number of properties that allow utilization thereof in green building:

- **Long lifetime**. The material is frost-resistant, chemically resistant to most types of acids, saline solutions, alkali hydroxides water and water-based paints, etc., does not absorb water, does not swell and shrink, is rot-resistant, fungi-proof, aging-resistant, shrink-resistant, wear-proof, durable, does not change its physico-chemical properties under the influence of external factors and ensures a long lifetime for the building, reduces the need of repairs and therefore, the negative environmental footprint.

- **"Green" roof**. The above properties of XPS slabs make this material a good heat-insulating base for the arrangement of accessible roofs, including "green" roofs. Greened roofs are viewed as an advantage during LEED certification and utilization thereof adds up to two points to the building. These roofs improve the building thermotechnical properties during the summer-time, create a comfortable environment for users' rest and reduce the so called "heat island effect" in case of heavy utilization in the urban realm.

- **Ensuring safety for users:**

– Are dielectric.

Regional sourcing

The LEED standard key requirement is the regional sourcing of the used construction materials. This means that extraction of raw materials and production facilities shall be located within a radius of not more than 500 miles (approximately 800 km). Purchase of materials produced nearby a certified object can help reduce adverse environment impacts and energy resources consumption during transportation due to reduction of transportation distance.

Raw suppliers' addresses

The raw material for TechnoNICOL XPS slabs is polystyrene.

The polystyrene for the slabs is supplied by PJSC Nizhnekamskneftekhim, address: Nizhnekamsk, Republic of Tatarstan, Russia.

Manufacturers' addresses

The products under consideration are supplied by TechnoNICOL and are manufactured from polystyrene at the following facilities:

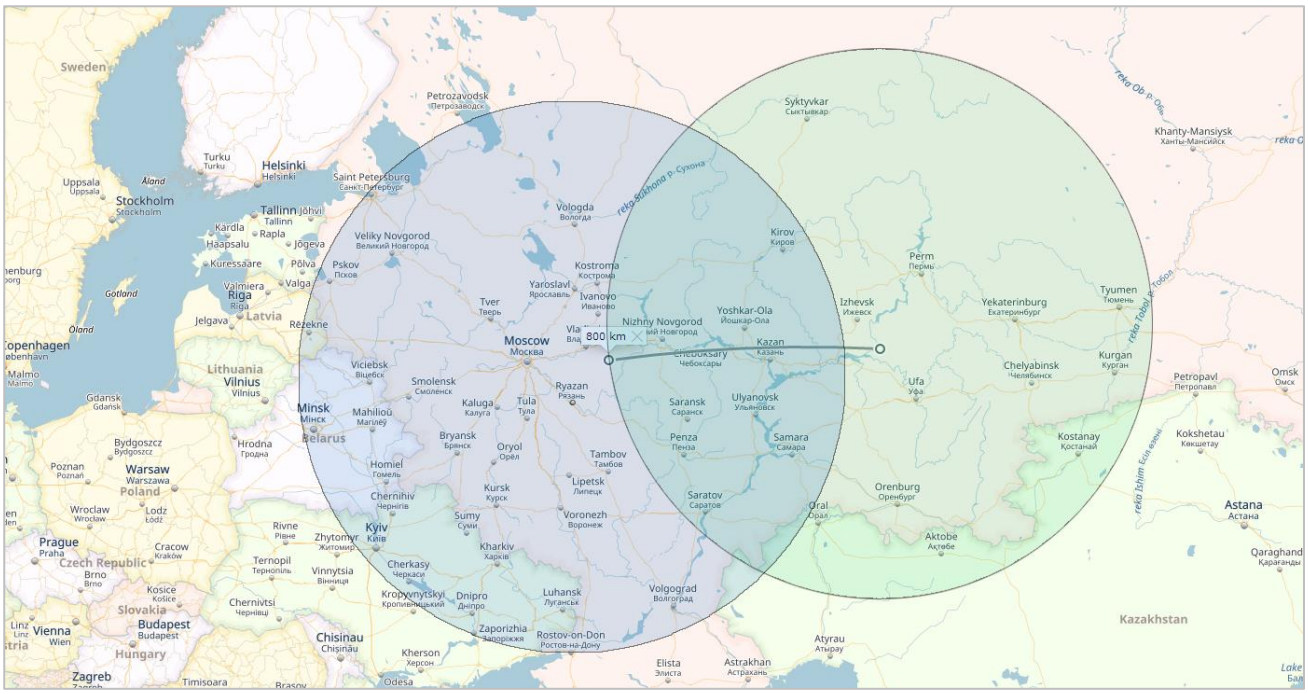
1. LLC TECHNOPLEX Plant, 21, Vostochny Promuzel, Ryazan, Ryazan Region, 390047
2. LLC TECHNOPLEX Plant, Branch, 21, Vostochny Promuzel, Ryazan, Ryazan Region, 390047
3. LLC TECHNOPLEX Plant, Branch, 3, Mosckovskaya str., Andzhievsky settlement, Mineralovodsky district, Mineralnye Vody, Stavropol Territory, 357217
4. LLC TECHNOPLEX Plant, Branch, 1, Krovelnaya str., Uchaly, Republic of Bashkortostan, 453700
5. LLC TECHNOPLEX Plant, 1, Krovelnaya str., Uchaly, Republic of Bashkortostan, 453700
6. LLC TECHNOPLEX Plant, Branch, 8, October 60th Anniversary Avenue., Khabarovsk, Khabarovsk Territory, 680015
7. LLC TechnoNICOL-Ulyanovsk Plant, 5Ц, Promyshlenny dr., Novoulyanovsk, Ulyanovsk Region, 433300
8. LLC TechnoNICOL-Siberia Plant, 1, 1st Zheleznodorozhnaya str., Yurga, Kemerovo Region, 652050
9. LLC TechnoNICOL-Northwest Plant, est. 11, 2nd Vertikalny dr., Annolovo settlement, Tosnensky district, Leningrad Region, 187021

The information regarding the overlap of manufacturing and sourcing areas is provided below. TechnoNICOL XPS slabs allow earning credit points for regional sourcing at the facilities located in these overlapping areas.

Note: If the facility is located near the border of the area, we recommend that the distance be further confirmed due to distortions on Mercator projection maps.

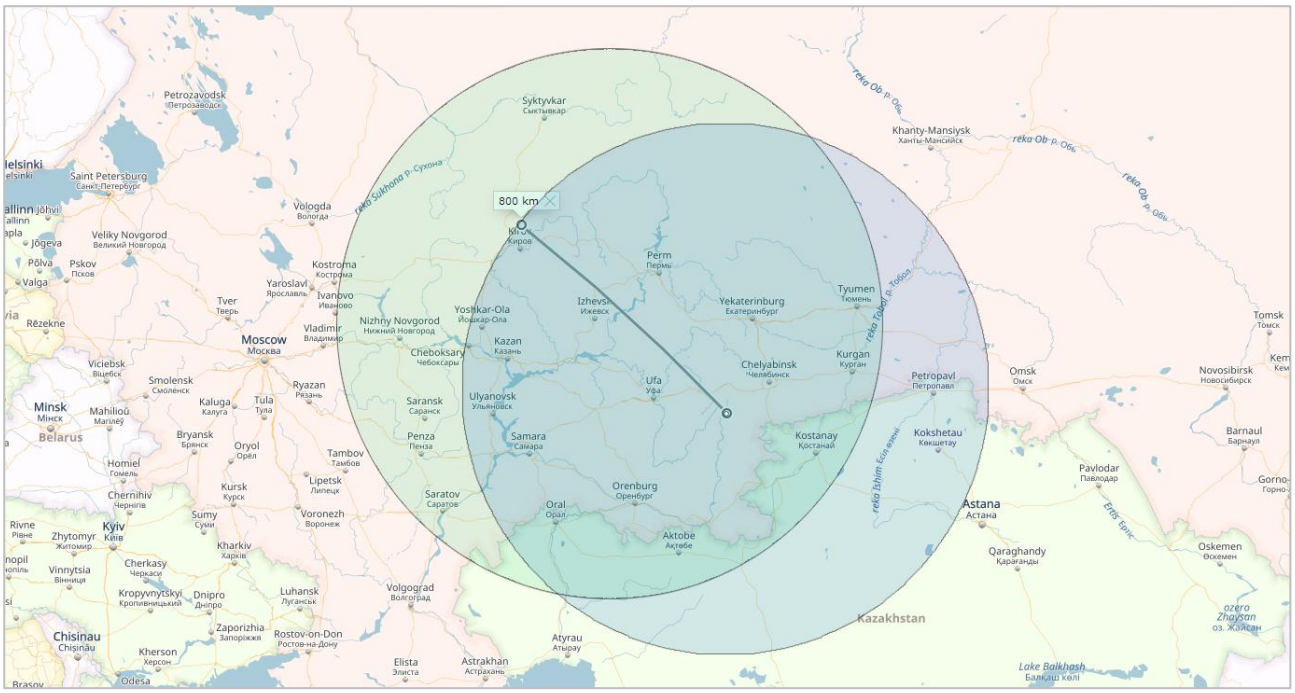
1. Ryazan

LLC TECHNOPLEX Plant, 21, Vostochny Promuzel, Ryazan, Ryazan Region, 390047
LLC TECHNOPLEX Plant, Branch, 21, Vostochny Promuzel, Ryazan, Ryazan Region, 390047



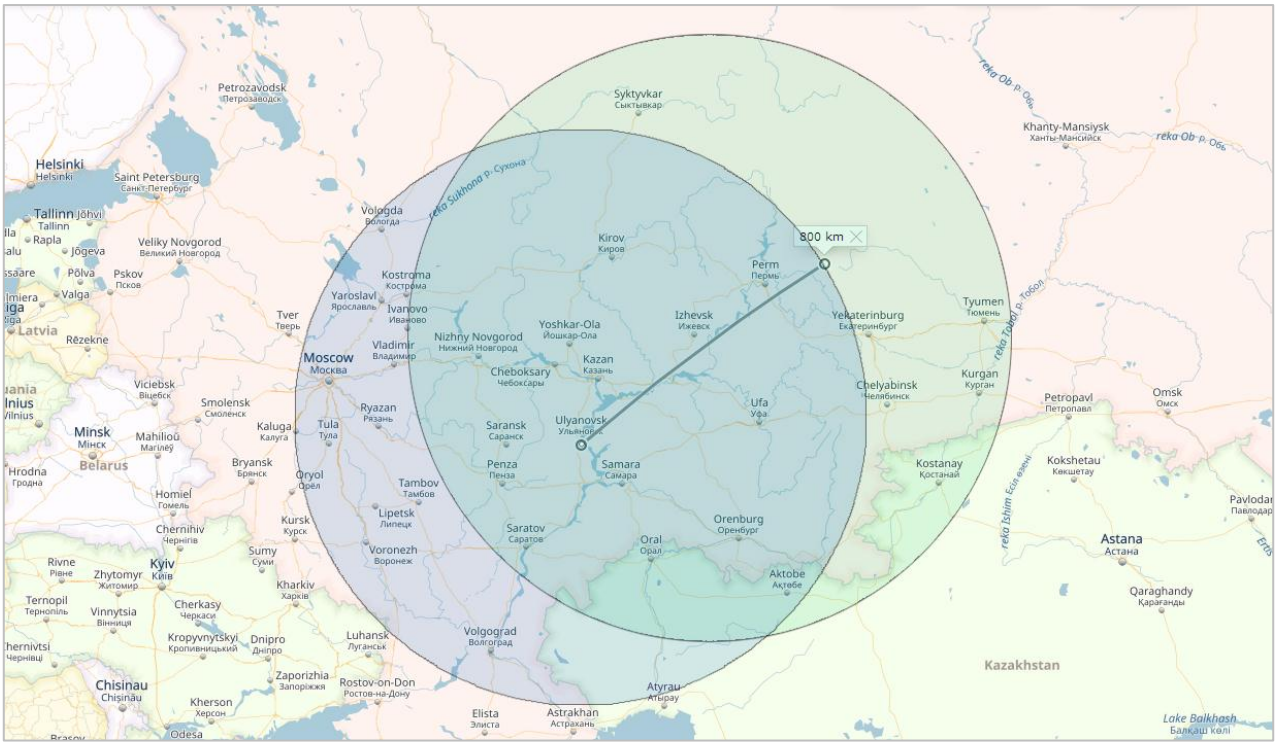
2. Uchaly

LLC TECHNOPLEX Plant, Branch, 1, Krovelnaya str., Uchaly, Republic of Bashkortostan, 453700
LLC TECHNOPLEX Plant, 1, Krovelnaya str., Uchaly, Republic of Bashkortostan, 453700



3. Novoulyanovsk

LLC TechnoNICOL-Ulyanovsk Plant, 5Ц, Promyshlenny dr., Novoulyanovsk, Ulyanovsk Region, 433300



The comments on the other facilities are provided below:

LLC TECHNOPLEX Plant, Branch, 3, Mosckovskaya str., Andzhievsky settlement, Mineralovodsky district, Mineralnye Vody, Stavropol Territory, 357217	Slight overlap of manufacturing and sourcing areas, no major cities
LLC TECHNOPLEX Plant, Branch, 8, October 60th Anniversary Avenue., Khabarovsk, Khabarovsk Territory, 680015	The manufacturing and sourcing areas do not overlap
LLC TechnoNICOL-Siberia Plant, 1, 1st Zheleznodorozhnaya str., Yurga, Kemerovo Region, 652050	The manufacturing and sourcing areas do not overlap
LLC TechnoNICOL-Northwest Plant, est. 11, 2nd Vertikalny dr., Annolovo settlement, Tosnensky district, Leningrad Region, 187021	Slight overlap of manufacturing and sourcing areas, no major cities

Conclusion:

The use of TechnoNICOL XPS slabs in construction may help earn extra credit points in LEED system for regional sourcing and manufacturing in certain regions of **Russia** (including Yekaterinburg, Izhevsk, Kazan, Kirov, Nizhny Novgorod, Orenburg, Penza, Ryazan, Samara, Saratov, Tyumen, Ulyanovsk, Ufa, Chelyabinsk) and in a few regions of **Kazakhstan.**

List of credits points in which can be earned with the help of the material to be assessed and material specification

The table below reviews the requirements of various categories and credits of the LEED standard, points in which, subject to certain conditions, can be earned by using TechnoNICOL XPS slabs.

LEED categories & credits	LEED requirements	Impact of TechnoNICOL XPS slabs reinforced gas-concrete lintels on the score
Sustainable Sites (SS)		
SS Credit 7.2[1] Heat island effect – roof (1 point)	Greening at least 50% of the total area of the roof. OR Installing a high Solar Reflectance Index (SRI) roof and greening the roof (the ratio is calculated individually for each case).	XPS slabs are a good base for the greened roof due to high compressive strength and water-resisting properties.
Energy and Atmosphere (EA)		
EA Prerequisite 2 Minimum Energy Performance	10 % (18 %[2]) performance improvement for new buildings or 5% (14 %[1]) better performance for renovated existing buildings compared with the baseline building performance rating calculated as per the method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 for the whole building simulation model.	TechnoNICOL XPS slabs are used to insulate the inner and outer walls, covers and floors, roofs, foundations. This helps reduce the thermal conductivity of the structures, energy consumption for heating and comply with the prerequisite.
EA Prerequisite 2 Minimum Energy Performance *LEED v4 only*	5 % performance improvement for new buildings 3 % performance improvement for renovated existing buildings 2 % performance improvement for “Core and Shell” (w/o interior finish) compared with the baseline building performance rating calculated as per the method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2010 for the whole building simulation model.	TechnoNICOL XPS slabs are used to insulate the inner and outer walls, covers and floors, roofs, foundations. This helps reduce the thermal conductivity of the structures, energy consumption for heating and comply with the prerequisite.
EA Credit 1	Improved building performance rating compared with the baseline building	The building heat insulation helps reduce energy consumption and

[1] LEED v4 does not contain the numeration of the credits (here and elsewhere)
[2] For facilities registered with LEED Online after October 20, 2016 according to LEED 2009

Optimize Energy Performance (1-19 Points)	performance rating, calculated as per the method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 for the whole project simulation model with the points awarded according to LEED® table.	maximize thermal comfort. The ultimate result depends on thermal resistance and thermal conductivity of the insulation as a whole, on the structural peculiarities and design solutions combined. Use of TechnoNICOL XPS slabs helps earn more points due to energy savings throughout the full-year cycle.
Materials & Resources (MR)		
MR Prerequisite Construction and Demolition Waste Management *LEED v4 only*	Reduction of construction waste and demolition debris removed to disposal areas and waste incineration plants due to recycling, salvaging and processing the materials.	The waste produced from the installation and adjustment of TechnoNICOL XPS slabs can be salvaged and further recycled and used as raw materials for new products ensuring compliance with this prerequisite.
MR Credit 2: Construction Waste Management (1-2 points) / *LEED v4: Construction and Demolition Waste Management*	Recycling and/or salvaging nonhazardous construction waste and demolition debris. Calculation may be done either by weight or volume, but must be consistent throughout. The minimum content of recycled or salvaged waste: 50% – 1 point, 75% - 2 points.	The waste produced from the installation and adjustment of TechnoNICOL XPS slabs can be salvaged and further recycled and used as raw materials for new products.
MR Credit 5: Regional Material (1-2 points) *Not included in LEED v4*	Construction materials/products (or components thereof) extracted and manufactured within a 500-mile (800-km) radius from the project site must account for 10% (1 point) or 20% (2 points) of the total cost of materials at the least.	The use of TechnoNICOL XPS slabs in construction may help earn extra points in LEED system for regional sourcing and manufacturing in certain regions of Russia (including Yekaterinburg, Izhevsk, Kazan, Kirov, Nizhny Novgorod, Orenburg, Penza, Ryazan, Samara, Saratov, Tyumen, Ulyanovsk, Ufa, Chelyabinsk) and in a few regions of Kazakhstan (see pp. 9-10). Meanwhile, the material regional content is to account for at least 100% of the weight (and therefore, of the cost) of the material.
Indoor Environmental Quality (IEQ)		
IEQ Кредит 7 / 7.1 Thermal Comfort – Design (1 Point)	Design HVAC systems and building envelope to meet the requirements of ASHRAE Standard 55-2004 (55-2010 in LEED v4), Thermal Comfort Conditions for Human Occupancy. Demonstrate design compliance in accordance with the Section 6.1.1	TechnoNICOL XPS slabs used as thermal insulation (of the roof, walls and/or foundation) contribute to improvements in the building thermal performance.

	documentation.	
IEQ Credit 10 (Schools only – LEED for Schools 2009 New Construction) Mold Management (1 point) *Not included in LEED v4*	Added to IEQ Credits 3.1, 7.1, and 7.2, HVAC systems/controls limit RH to 60% and IAQ program based on U.S. EPA document, Building Air Quality: A Guide for Building Owners and Facility Managers, EPA reference number 402-F-91-102, December 1991.	TechnoNICOL XPS slabs do not decay, are fungi-proof and do not provide breeding grounds for mold and bacterial growth.
Innovation in Design (ID)		
ID Credit 1 Innovation in Design (1-2 points) *Not applicable in LEED v4*	The points for this credit may be earned by implementing Innovation in Design and outperforming the requirements of certain criteria.	In case of using thermal insulation products TechnoNICOL XPS slabs, there is a high likelihood of outperforming the requirements of MR Credit 5: Regional Material.

Conclusion, calculation of possible score and summary of the assessment performed

The results of the assessment indicate that TechnoNICOL XPS slabs, if used properly, provide a number of advantage: they are durable, recyclable, have excellent heat-insulating properties, are produced in various types for different types of facilities, may be used with the “green” roof, have regional sourcing areas, are resistant to fungus and external impacts

The assessment results for the products:

- TECHNOPLEX,
- TechnoNICOL CARBON ECO,
- TechnoNICOL CARBON PROF,
- TechnoNICOL CARBON SOLID,
- TechnoNICOL CARBON SAND.

supplied by TechnoNICOL-Stroitel’nye Sistemy LLC (see manufacturers’ addresses at p. 4) prompt **the conclusion that they are fit** for the construction of “green” buildings to be certified under international certification systems, including LEED.

Therefore, utilization of TechnoNICOL XPS slabs may help earn **up to 28 points and comply with the requirements** depending on the type and version of LEED and on the number of design solutions involving utilization of TechnoNICOL XPS slabs.

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Preparation of the information

Information about the applicability of TECHNONICOL XPS extruded foamed polystyrene in the construction of objects certified in accordance with LEED® is prepared by specialists of Certification department of EcoStandard group:

Irina Bykova (PhD, Coordinator of Ecocertification Department),

Anastasia Makarenko (Project Manager of Ecocertification Department)

Approved by Kseniya Lukyaschenko (PhD, DGNB Auditor, LEED AP BD + C).

Company EcoStandard group has been working successfully throughout Russia and the CIS since 1997. This is the leader in the field of environmental monitoring and expertise services, in the field of occupational safety, engineering studies, development of project documentation, implementation of "green" technologies, international certification, environmental PR.

EcoStandard group has successful experience as with objects of federal importance, projects of the largest Russian and International corporations, as well as in providing services to small and medium businesses. Among our clients there are:

- OOO «Directorate Sochi-2014»,
- RAO «UES of Russia»,
- OAO «Gazprom»,
- ZAO «UralSib»,
- OAO «Russian Railways»,
- OAO «Norilsk Nickel»,
- Banks OAO «Alfa Bank», «VneshEconomBank», «Swiss Credit First Boston», «Mezhprombank»,
- Telecompany «CNN»,
- «IKEA», «Leroy Merlin», «Media Markt», hypermarkets «O'key», «Decatlon»
- Hotels «Ararat Park Hyatt Moscow», «Novotel»,
- Companies «Siemens», «SAS», «THK-BP», "Evrocement", «FM Logistic Vostok», «Office Solutions», «BBDO», «Deloitte», «Xerox», «Mail.ru», «Nestle», «Coalco Development», «Rosgossrrakh».

EcoStandard group is…

- Member **of the US Green Building Council**,
  Council on "green" construction (NP SPZS)
  International Alliance «Active House»
- Accredited certification body of the
  Center for Environmental Certification "Green Standards"
- One of the developers of green real estate assessment standards "Green Standards"
  assessment of low-rise suburban real estate **EcoVillage,**
  assessment of green offices **EcoPro**,
  assessment of building materials **EcoMaterial,**
  assessment of real estate **"Green Standards"**
  assessment of environmental sustainability **"SAR-SPZC"**

EcoStandard group provides a full range of consulting services for the project certification according to standards LEED®, BREEAM® and DGNB®.

Objects certified by EcoStandard group:

- Scientific-industrial complex Hamilton Standard Nauka, LEED
- Raymond, the plant for production of fasteners, Nizhny Novgorod region, LEED
- VIP eco-office Sberbank of Russia, BREEAM
- Administrative building Clinic new medical technologies (Klinika novyh meditcinskyh tekhnologiy), BREEAM

Nowadays EcoStandard group conducts certification in accordance with LEED® of several different by functional purpose buildings in Russia:

- **R&D Renova, Skolkovo,**
- **Full-cycle plant Mondēlez,**
- **RS Partners LLC (Q1), the office of top-company;**
- **Millhouse Group administration building,**
- **Development company, a fast food restaurant (confidential information);**
- **Development company, administrative building with underground parking to accommodate units of the Bank, Moscow (confidential information);**
- **And others.**