Issuance date: 01.12.2020
Validity date: 01.12.2025

ADOPEN PLASTİK ve İNŞAAT SANAYİ A.Ş
ADO FLOOR - SPC and LVT vinyl floorings

EPD Program Operator:

Instytut Techniki Budowlanej (ITB)
Address: Filtrowa 1, 00-611 Warsaw, Poland
Website: www.itb.pl
Contact: Michał Piasecki
m.piasecki@itb., energia@itb.pl

Owner of the EPD:

ADOPEN PLASTİK ve İNŞAAT SANAYİ A.Ş
Organize sanayi bölgesi 2.Kısım Mah.21 Cad.No:3
Döşemealtı/Antalya, Turkey
Contact: + 0242 236 20 00
info@adopen.com.tr
Website: https://adopen.com

ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

Basic information

This declaration is the type III Environmental Product Declaration (EPD) based on EN 15804:2012+A1 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment. Their aspects were verified by the independent body according to ISO 14025. Basically, a comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804:2012+A2:2019 (see point 5.3 of the standard).

Life cycle analysis (LCA): A1-A3, C1-C4 and D modules in accordance with EN 15804:2012+A1 (Cradle to Gate with options)

The year of preparing the EPD: 2020

Product standards: EN ISO 10582

Service Life: no RSL declared

PCR: ITB-PCR A (PCR based on EN 15804)

Declared unit: 1 square metre of SPC and LVT floor

Reasons for performing LCA: B2B

Representativeness: Turkish production, year 2019 (production)

MANUFACTURER AND PRODUCTS DESCRIPTION

Adopen, the global PVC products manufacturer, was established in Antalya in 1997, with knowledge and experience of Çağlar Plastics Ind., which is one of the pioneering PVC producers of Turkey. Adopen new facilities were located at the Antalya Industrial Zone in 2003, which is one of the largest industrial zones of Middle East. Manufacturing process is carried out in shifts 7 days a week, 24 hours a day at the Adopen production facilities which cover an area of 550k m².

This declaration refers to ADO floor covering product for the European market. The CPC classification code is 36910 Floor coverings of plastics, in rolls or in the form of tiles; wall or ceiling coverings of plastics.

LVT and SPC floorings are used in both commercial and residential interiors. They are available in 5.0 mm thickness. The wear layer is 0.55 mm thick. The weight of the product is 7.6 kg/m² (for SPC) and 10.7 kg/m² (for LVT). The product is available in plank and tile. Decorative applications and a transparent PVC wear layer are applied to the surface and a lacquer is used as a finish on the wear layer. PVC floorings are mainly made of Polyvinyl Chloride (PVC). Vinyl plank is made primarily from chalk, polyvinyl chloride, plasticisers and additives (i.e. pigments and stabilisers) (see Table 1). It is structured with layers: two PVC backing layers, one high definition photographic layer, one clear PVC embossed wear layer and a last PU protective layer. The product group has the following composition (Table 1).

Table 1. The PVC ADO Floor product's input composition (approx.)

Input products	Description	Content (mass basis) %
PVC	PVC resin	30
Recycled material	Flooring Recyclate (PVC)	<10
Filler	Chalk	46
Plasticizers	DOTP	5
Other Additives	Additives for PVC resin	9
	TOTAL	100

note: SPC products do not contain plasticizers.

Chalk is used as inert filler. It can be ground to varying particle sizes and is widely used as filler in formulated flooring systems. Polyvinyl chloride PVC is derived from fossil fuel and salt, it is the third-most widely produced polymer, after polyethylene and polypropylene. Petroleum or natural gas is processed to make ethylene. Salt electrolysis produces chlorine. Ethylene and chlorine react together to produce ethylene dichloride, which is further processed at high temperature into vinyl chloride monomer. Polymerisation of vinyl chloride monomer converts it into a fine white powder called vinyl resin. Recycled polyvinyl chloride is also used. Plasticisers are colourless and odourless liquids commonly used in vinyl products to make them more flexible and /or durable. Plasticisers used in the production of these floorcoverings are DOTP manufactured from DMT and 2-ethylhexanol. Additives products are used to make vinyl resistant to light and oxidation and are made of alkaline earth metal (barium or calcium) and zinc salts of fatty acids. These are viscous liquids. Finish is polyacrylate UV cured lacquer. Inks are used to print the decorative patterns. A cross-section diagram (multi layers) of an example product is presented in the figure 1.

Figure 1. Example cross section of ADO floor product

Production process is presented in Figure 2. The raw materials are mixed and heated. The mixture is calendared in sheet to create the backing or the transparent PVC layers. The sheets are cut and laminated with a printed film. The semi-finished product is coated with a lacquer and annealed. Finally, the product is cut into tiles or planks and packaged. Quality checks are made at each step of the production process.

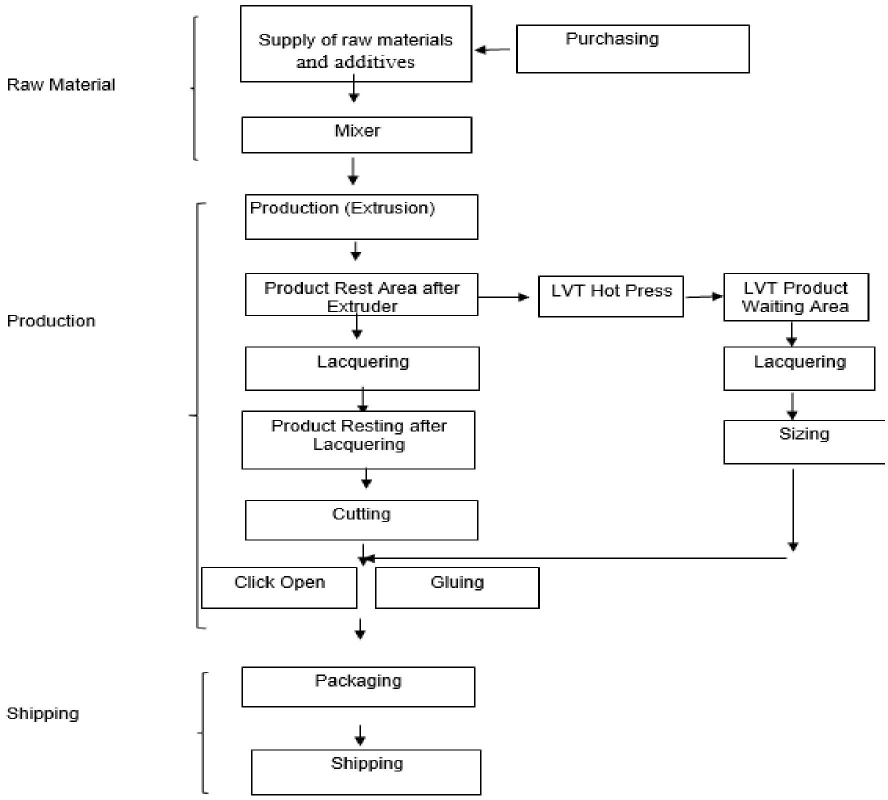

Figure 2. A scheme of manufacturing process of the ADO floorings

In production process (Figure 2) a special compound is prepared by adding the PVC raw material, produced with polymerization of vinyl chloride monomer, components providing impact resistance, color pigments, stabilizer and other filling materials. The preparation of this compound by adding high quality additives is the first step to the production of ADO floors. This compound is processed by the extruders and Adopen tooling components and, then converted into Ado floor's products.

All detailed technical documentation of ADO Floor products (Table 2) can be found at http://www.adopen.com.

Table 2. ADO Floor Product's technical specification

PRODUCT	LVT STANDARD	LVT-5.0/0.55 CLİCK	SPC-STANDARD	SPC-4 mm+1 mm IXPE 0,55
Dimensions (LenghtxWidthxHeight)		16.90cmx121.04cmx0.5 cm		177.80 mm/1219.20 mm
Installation type		Click		Click
Total Thickness		5.0 mm		5.0 mm
Wear Layer Thickness		0.55 mm		0.55 mm
Total mass (gr/m2)		10.7 (kg/m^2)		7.6 (kg/m^2)
Usage Classification	EN-ISO 10582	Class 23 / Class 33 / Class 42	EN-ISO 16511	Class 23 / Class 33 / Class 42
Reaction to fire	EN-ISO 10582	Bfl S1	EN 14041:2018	Bfl S1
Formaldehyde	EN 717-1:2014	<0.01 ppm	EN 717-1:2014	≤0.008 ppm
Pentachlorophenol	EN ISO 17070	<0.1 mg/kg	EN 14041:2018	<0.1 mg/kg
Slip Resistance	EN 14041:2018	DS	EN 14041:2018	DS
Electrical behavior (antistatic)	EN 14041:2004+C1:2006	(-1,8kV)	EN 14041:2018	(-1,8kV)
Acoustic sound insulation	EN ISO 10140-1-5:2010 EN ISO 717-2:2013	ΔLw = 8 dB	ISO 717-2	ΔLw = 19 dB
Area density (g/m^2)	TS EN ISO 1582	10060	TS EN 16511	7587
Thermal Conductivity (m^2 K/W)	ISO 8302:1991	0.0193 (m^2 K/W)	EN 14041:2018	0.0177 (m^2 K/W)

Additional environmental information about the ADO floor products

According to the latest revision of Article 59, the Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and restriction of Chemicals (REACH), "the REACH list", of substances of very high concern' (SVHC) the ADO Floor product is not manufactured with or contains any of these substances above a concentration of 0.1% by weight.

The formaldehyde HCHO emission for the LVT product tested in accordance with EN 717-1 (chamber method) is less than <0.01 ppm. The HCHO formaldehyde emission for the SPC product is less than <0.008 ppm. The pentachlorophenol content tested in accordance to EN ISO 17070 is less than 0.1 mg/kg for LVT and SPC products.

Manufacturer declares that lead and other heavy metals are not used in the PVC input material production.

Manufacturer declares PVC recycling product input in co-extrusion process at a rate no higher then 1%0 for PVC floors production. Main part of the recycling input are own materials from production. Manufactures uses virgin (fresh) PVC in all product external layers and covers.

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

The LCA for this EPD is conducted according to the guidelines of ISO 14040-44, the requirements given in the Product Category Rules (ITB PCR-A), PN EN 15804:2012 + A1:2013 Sustainability of Construction Works: Environmental Product Declarations and the general program guidelines by ITB EPD system. As on the day of issuing the declaration, the transition period for the implementation and implementation of the EN 15804 + A2 standard applies, therefore ITB partially does it best to implement the new provisions of Annex 2 . The LCI inventory (verified) for the LCA study is based on the year 2019. Production figures for ADO floors and detailed information from production plant were collected by manufacturer in LCI questionnaire. This LCA was modelled with ITB software using the latest version of the Ecoinvent database and impact models. The EPD, its background data and the results may be used for business-to-business communications and is expected to be a reliable document for green building designers, architectures, manufacturers of construction products and the other stakeholders in the construction sector to understand the potential environmental impacts caused by PVC products.

Unit

The declared unit is 1 m² of installed floor covering for specified application and use areas according EN ISO 10582.

System boundary

Type of EPD: cradle to gate with options. The life cycle analysis of the declared products covers "Product Stage" A1-A3, and End of Life stage C1, C2, C3, C4 and gains beyond system in D module (Cradle to Gate with options) accordance with EN 15804:2012+A1:2013 and ITB PCR A. The system boundary covers the production of raw materials, all relevant transport down to factory gate and manufacturing by ADO Floor (cradle to gate). The review framework comprises the following details:

- Raw materials acquisition and transport,
- Further processing of raw materials for main bodies of PVC products,
- Production operations includes extruder, cooling ponds, dragger, cutting for delivery,
- Energy and water consumption, waste management.

Modules A1-A3 include processes that provide materials and energy input for the system, manufacturing and transport processes up to the factory gate, as well as waste processing. Module C1 considers electricity supply for the deconstruction of the flooring. Module C2 includes transportation of the postconsumer waste to waste processing. End of life scenarios are declared for two scenarios in accordance to table 3 and 4. Module D includes potential benefits from all net flows given in module A1 and C3 that leave the product boundary system after having passed the end-of-waste state in the form of recovery and/or recycling potentials. Module D is declared both scenarios separately.

Allocation

Production of the ADO flooring products is a line process in one manufacturing plant located at Antalya Industrial Zone, Turkey. Allocation of impact is done on product mass basis (100 % of whole production). The impacts from raw materials extraction/production (PVC, chalk, plasticizers, additives, recycled content) are allocated in A1 module of the LCA (not excluding more than 1% of secondary production inputs). Not less than 99% of impacts from a line production were allocated. Module A2 includes transport of all raw materials such as PVC from their suppliers to manufacturing plant. Municipal wastes of factory were allocated to module A3. Energy supply (Turkish electricity mix -based on resource data reference https://doi.org/10.3390/en9010031) was inventoried for whole factory and allocated to the product assessed A3 but electricity production to A1. Emissions in the factory are assessed using national Turkish emission factors for energy carriers (oil) and Turkish electricity and were allocated to module A3.

System limits

99.0% input materials and 99.5% energy consumption was inventoried in factory and were included in calculation. In the assessment, all significant parameters from gathered production data are considered. It is assumed that the total sum of omitted processes does not exceed 1% of all impact categories. In accordance with EN 15804:2012+A1:2013, machines and facilities (capital goods) required for and during production are excluded, as is transportation of employees. The impact of the production of packaging materials and wooden pallets was not taken into account (in 1% of impacts not included).

A1 and A2 Modules: Raw materials supply and transport

Raw materials come mainly from suppliers that environmental data for production (ISO 14001) is published in reports or can be found in a relevant literature. Data on transport of the different input products to the manufacturing plants were inventoried in detail as LCI and modelled by assessor. Means of transport include trucks. For calculation purposes European fuel averages are applied. Transport is only relevant for delivery of raw materials to the plant and in C2 module as transport to the process plants.

A3: Production

The production process is presented in Figure 2. The raw materials are mixed and heated. The mixture is calendared in sheet to create the backing or the transparent PVC layers. Production stages start with extrusion of PVC and continue with cooling, dragging and cutting for PVC Floors products. Only electric energy is consumed during the manufacturing of ADO floorings, no natural gas is consumed for the production.

End of life scenarios (C module)

It is assumed in phase C1 that ADO floor products may be removed/re-assembled by a small-scale electro-mechanical equipment (electricity used). It is assumed that at the end of life the transport distance from the product deconstruction place to waste processing (C2) is 50 km on > 16 t loaded lorry with 75% capacity utilization and fuel consumption of 30 l of ON per 100 km. Materials recovered from dismantled products are recycled, incinerated and landfilled according to the realistic Turkish and European treatment practice (mass allocation) of industrial waste what is presented in Table 3. The second scenario assumes complete incineration of waste after its disassembly (Table 4). The recycling potential for a new product systems is considered beyond the system boundaries (module D) based on literature recommendations (Turkish Life Cycle Inventory Dataset) and potentially realistic practice (where PVC after reprocessing can be the resource to production of new PVC).

Table 3. End of life – realistic scenarios for ADO PVC floors (Scenario no 1)

ADO products	Material recovery	Recycling	Landfilling	Incineration
LVT and SPC	99%	31%	55%	14%

It is assumed a second scenario where 100% of demolition PVC waste is incinerated with energy recovery. The efficiency of the combustion process is 0.6 with the calorific value of PVC at 41 MJ / kg.

Table 4. End of life –the incineration scenario for ADO PVC floors (Scenario no 2)

ADO products	Material recovery	Recycling	Landfilling	Incineration
LVT and SPC	99%	0%	1%	99%

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2019 – 31.12.2019 (1 year). The life cycle assessments were prepared for Turkey as reference area.

Data quality

The data quality can be described as fair to good. The primary data collection has been done thoroughly, all relevant flows are collected and considered in LCI questionnaire document. Technological, geographical and temporal representativeness is given. The values determined to calculate A3 originate directly from verified LCI inventory data filled by ADO representative. A1 values were prepared considering Ecoinvent data V3.7. PVC data is supported by Plastics Europe report and European Commission Report on PVC and other scientific papers: Data on Turkish electricity is supported by a scientific paper: https://doi.org/10.3390/en9010031, data on plasticizer is supported by a scientific report: https://www.europeanplasticisers.eu/wp-content/uploads/2015/10/21872-ecpi-eco-profile-dinp-2015-02-05.pdf

Calculation rules

LCA was done in accordance with ITB PCR A document.

Databases

The background data for the processes come from the following databases: Ecoinvent v.3.7, Plastic Europe. Specific data quality analysis was a audited. Characterization factors are CML ver. 4.2 based. ITB-LCA algorithms were used for all impact calculations. The time related quality of the data used is valid (5 years).

Comparability

Caution should be used when comparing the results presented in this EPD to the environmental performance of other vinyl tile products as the thickness or weight of floors will influence the environmental impacts. Environmental product declarations of construction products may not be comparable if they do not comply with EN 15804 and environmental product declarations within the same category from different programs may not be comparable. The manufacturer is responsible for its own data presented in the declarations.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to the unit FU– 1 m^2 of the ADO floor product (LVT) and (SPC).

Table 5. System boundaries (modules included) in a product environmental assessment

Environmental assessment information (MA – Module assessed, MNA – Module not assessed, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse-recovery-recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
MA	**MA**	**MA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MA**	**MA**	**MA**	**MA**	**MA**

Table 6. Environmental product characteristic – 1 m^2 of SPC product (7.6 kg/m^2, the end of life scenario no 1)

Environmental impacts: (DU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	1.46E+01	1.73E-01	1.12E+00	1.66E-01	2.89E-02	3.37E+00	2.51E-01	-2.09E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	5.05E-06	0.00E+00	9.12E-09	1.83E-09	0.00E+00	6.67E-07	9.57E-09	-1.26E-06
Acidification potential of soil and water	kg SO_2 eq.	3.19E-01	1.27E-03	2.79E-03	1.46E-04	2.10E-04	4.01E-03	2.93E-04	-8.90E-02
Formation potential of tropospheric ozone	kg Ethene eq.	1.39E-02	9.01E-05	1.43E-01	7.56E-04	1.49E-05	4.37E-03	5.43E-05	-3.21E-03
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	3.07E-02	2.24E-04	8.22E-04	6.09E-06	3.71E-05	2.80E-03	1.43E-04	-5.21E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	1.49E-01	0.00E+00	1.17E+01	1.23E-03	0.00E+00	1.17E-02	5.02E-03	-1.43E-02
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.22E+02	9.39E-01	5.47E+01	1.90E+00	1.55E-01	1.86E+01	1.09E+00	-1.35E+01
Environmental aspects: (FU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.53E+01	6.57E-02	3.58E+00	2.85E-01	1.09E-02	2.55E+00	1.13E+00	-9.29E+00
`Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.37E+02	9.86E-01	5.69E+01	2.09E+00	1.62E-01	2.10E+01	1.13E+00	-2.20E+01
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	4.93E-02	0.00E+00	0.00E+00	8.15E-03	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	7.28E-01	7.60E-06	4.53E-02	6.00E-04	1.26E-06	9.73E-03	8.36E-04	1.19E-01
Other environmental information describing waste categories: (FU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.75E-04	3.49E-05	6.02E-03	2.53E-06	5.77E-06	2.86E-05	1.59E-06	9.92E-06
Non-hazardous waste disposed	kg	1.31E+00	3.24E-02	1.88E-01	2.29E-02	5.36E-03	2.66E-01	4.19E+00	2.99E+00
Radioactive waste disposed	kg	4.61E-04	0.00E+00	0.00E+00	2.53E-06	0.00E+00	4.50E-05	6.02E-06	-1.29E-05
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	1.87E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.15E+00
Materials for energy recover	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 7. Environmental product characteristic – 1 m^2 of SPC product (7.6 kg/m^2, 100% incineration - end of life scenario no 2)

Environmental impacts: (DU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	1.46E+01	1.73E-01	1.12E+00	1.66E-01	2.89E-02	1.75E+01	4.56E-03	-3.07E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	5.05E-06	0.00E+00	9.12E-09	1.83E-09	0.00E+00	4.69E-06	1.74E-10	-5.68E-12
Acidification potential of soil and water	kg SO_2 eq.	3.19E-01	1.27E-03	2.79E-03	1.46E-04	2.10E-04	2.28E-02	5.32E-06	-4.65E-03
Formation potential of tropospheric ozone	kg Ethene eq.	1.39E-02	9.01E-05	1.43E-01	7.56E-04	1.49E-05	1.06E-03	9.88E-07	-5.21E-04
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	3.07E-02	2.24E-04	8.22E-04	6.09E-06	3.71E-05	1.98E-02	2.61E-06	-3.85E-04
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	1.49E-01	0.00E+00	1.17E+01	1.23E-03	0.00E+00	3.42E-02	9.12E-05	-6.60E-07
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.22E+02	9.39E-01	5.47E+01	1.90E+00	1.55E-01	5.73E+01	1.98E-02	-4.34E+01
Environmental aspects: (FU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.53E+01	6.57E-02	3.58E+00	2.85E-01	1.09E-02	6.84E+00	2.06E-02	-8.83E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.37E+02	9.86E-01	5.69E+01	2.09E+00	1.61E-01	6.64E+01	2.06E-02	-5.32E+01
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	4.93E-02	0.00E+00	0.00E+00	8.15E-03	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	7.28E-01	7.60E-06	4.53E-02	6.00E-04	1.26E-06	4.56E-02	1.52E-05	-1.20E-02
Other environmental information describing waste categories: (FU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.75E-04	3.49E-05	6.02E-03	2.53E-06	5.77E-06	1.03E-04	2.89E-08	-2.12E-08
Non-hazardous waste disposed	kg	1.31E+00	3.24E-02	1.88E-01	2.29E-02	5.36E-03	9.88E-01	7.62E-02	-2.76E+00
Radioactive waste disposed	kg	4.61E-04	0.00E+00	0.00E+00	2.53E-06	0.00E+00	2.20E-04	1.09E-07	-3,87E-05
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	1.87E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.66E+00
Materials for energy recover	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 8. Environmental product characteristic – 1 m^2 of LVT product (10.7 kg/m^2, realistic end of life scenario no 1)

Environmental impacts: (DU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	2.11E+01	2.43E-01	1.58E+00	2.34E-01	4.07E-02	4.75E+00	3.53E-01	-2.94E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	7.18E-06	0.00E+00	1.28E-08	2.58E-09	0.00E+00	9.39E-07	1.35E-08	1.78E-06
Acidification potential of soil and water	kg SO_2 eq.	4.51E-01	1.79E-03	3.93E-03	2.06E-04	2.96E-04	5.64E-03	4.12E-04	1.25E-01
Formation potential of tropospheric ozone	kg Ethene eq.	1.92E-02	1.27E-04	2.01E-01	1.07E-03	2.10E-05	6.15E-03	7.65E-05	-4.53E-03
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	4.27E-02	3.16E-04	1.16E-03	8.57E-06	5.22E-05	3.94E-03	2.02E-04	7.34E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	2.06E-01	0.00E+00	1.64E+01	1.73E-03	0.00E+00	1.64E-02	7.06E-03	2.02E-02
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3.52E+02	1.32E+00	7.70E+01	2.68E+00	2.18E-01	2.62E+01	1.53E+00	-1.90E+01
Environmental aspects: (FU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.11E+01	9.25E-02	5.04E+00	4.01E-01	1.53E-02	3.59E+00	1.59E+00	-1.31E+01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3.72E+02	1.39E+00	8.01E+01	2.94E+00	2.28E-01	2.95E+01	1.59E+00	-3.09E+01
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	6.94E-02	0.00E+00	0.00E+00	1.15E-02	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	4.20E-01	1.07E-05	6.38E-02	8.45E-04	1.77E-06	1.37E-02	1.18E-03	-1.67E-01
Other environmental information describing waste categories: (FU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	2.70E-04	4.60E-06	7.92E-04	3.33E-07	7.59E-07	3.76E-06	2.09E-07	-1.40E-05
Non-hazardous waste disposed	kg	1.69E-01	4.27E-03	2.47E-02	3.01E-03	7.05E-04	3.50E-02	5.51E-01	-4.21E+00
Radioactive waste disposed	kg	5.71E-05	0.00E+00	0.00E+00	3.33E-07	0.00E+00	5.92E-06	7.92E-07	-1.82E-05
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	2.46E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.15E+01
Materials for energy recover	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 9. Environmental product characteristic – 1 m^2 of LVT product (10.7 kg/m^2, 100% incineration life scenario no 2)

Environmental impacts: (DU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2 eq.	2.11E+01	2.43E-01	1.58E+00	2.34E-01	4.07E-02	2.46E+01	6.42E-03	-4.32E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	7.18E-06	0.00E+00	1.28E-08	2.58E-09	0.00E+00	6.60E-06	2.45E-10	-8.00E-12
Acidification potential of soil and water	kg SO_2 eq.	4.51E-01	1.79E-03	3.93E-03	2.06E-04	2.96E-04	3.21E-02	7.49E-06	6.55E-03
Formation potential of tropospheric ozone	kg Ethene eq.	1.92E-02	1.27E-04	2.01E-01	1.07E-03	2.10E-05	1.50E-03	1.39E-06	7.34E-04
Eutrophication potential	kg $(PO_4)^{3-}$ eq.	4.27E-02	3.16E-04	1.16E-03	8.57E-06	5.22E-05	2.78E-02	3.67E-06	-5.41E-04
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq.	2.06E-01	0.00E+00	1.64E+01	1.73E-03	0.00E+00	4.82E-02	1.28E-04	9.30E-07
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	3.52E+02	1.32E+00	7.70E+01	2.68E+00	2.18E-01	8.07E+01	2.78E-02	-6.11E+01
Environmental aspects: (FU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.11E+01	9.25E-02	5.04E+00	4.01E-01	1.53E-02	9.63E+00	2.89E-02	-1.24E+01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3.72E+02	1.39E+00	8.01E+01	2.94E+00	2.28E-01	9.35E+01	2.89E-02	-7.49E+01
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	6.94E-02	0.00E+00	0.00E+00	1.15E-02	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	4.00E-01	1.07E-05	6.38E-02	8.45E-04	1.77E-06	6.42E-02	2.14E-05	-1.69E-02
Other environmental information describing waste categories: (FU) 1 square meter									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	2.70E-04	4.60E-06	7.92E-04	3.33E-07	7.59E-07	1.46E-04	4.07E-08	-2.98E-08
Non-hazardous waste disposed	kg	1.69E-01	4.27E-03	2.47E-02	3.01E-03	7.05E-04	1.39E+00	1.07E-01	-3.88E+00
Radioactive waste disposed	kg	5.71E-05	0.00E+00	0.00E+00	3.33E-07	0.00E+00	3.10E-04	1.54E-07	-5.45E-05
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	2.46E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.08E+01
Materials for energy recover	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-0.00E+00

RESULTS INTERPRETATION

Interpretation of the results has been carried out considering the methodology, data-related assumptions and any limitations declared in the EPD. The amount of primary energy required for the production of a ADO floor SPC is 237 MJ/m^2 and 370 MJ/m^2 for LVT. The environmental impact of PVC product (cradle to gate with options) is largely dependent on the energy-intensive and chemical production of PVC resin also plasticizer on which the manufacturer has a limited influence. More than 60% of the total primary energy (A1-A3) is consumed in the production of PVC resin.

The impact of the production line depends on the amount of electricity consumed by manufacturing plant but in overall results is not significant (less than 20%). There are no large scale emissions or detected in the A3 production processes alone. Summary of overall life cycle impacts when taking into account the Global Warming Potential of A1-A3 it becomes clear that the carbon impact 15 and 21 kg CO_2/m^2 of ADO floor is relatively similar to other PVC products on the market. In GWP category almost 50% of GWP impact comes also from PVC production. The production of high-quality PVC as input material (module A1) therefore has the greatest impact on the environmental profile of ADO floor products. The production processes of the PVC input material continue to dominate the ecological impact in all categories.

Recycling is a crucial issue for the life cycle of PVC products. A controlled loop recycling scenario results in considerably lower environmental impacts. However, high recycling level can only work in growing PVC markets (export to Europe), i.e. PVC recycling potential in Turkey is limited. In addition, problems may arise in recycling because of the fast enhancement of stabilizer systems that may lead to non-compatible stabilizer systems appearing in the same recycling material. This problem, however, is not prevalent at the moment, as the most common stabilizers are compatible and can therefore be mixed together. Co-extrusion with a cover layer of virgin material solve this problem for non-compatible stabilizers. The ADO products, due to the average actual potential for reuse and the potential for significant reuse for PVC production, have no significant environmental gains in module D. The second scenario, based on the potential of full waste incineration, gives significantly better environmental benefits than the mixed scenario no 2.

VERIFICATION

The process of verification of this EPD was in accordance with ISO 14025 and ISO 21930. After verification, this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years, if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804:2012+A2:2019 and ITB PCR A
Independent verification corresponding to ISO 14025 (sub clause 8.1.3.) ☒ external ☐ internal
External verification of EPD: Ph.D. Eng. Halina Prejzner LCA, LCI audit and input data verification: Ph.D. Eng. Michał Piasecki, m.piasecki@itb.pl Verification of LCA: Ph.D. Eng. Justyna Tomaszewska, j.tomaszewska@itb.pl

Normative references

- Atilgan, B.; Azapagic, A. Assessing the Environmental Sustainability of Electricity Generation in Turkey on a Life Cycle Basis. *Energies* 2016, *9*, 31.
- EN ISO 10582:2012 (EN 649) – Resilient Floor coverings – Heterogeneous vinyl floor coverings - Specification.
- EN ISO 10874:2012 (EN 685) – Resilient, Laminate and Textile Floor coverings - Classification. • EN 13501-1:2002 – Fire Classification of construction products and building elements.
- EN 14041:2004 – Resilient, Textile and Laminate Floor coverings - Essential characteristics.
- https://pvc4pipes.com/wp-content/uploads/2018/02/PlasticsEurope_Eco-profile_VCM_PVC_2015-05.pdf
- https://ec.europa.eu/environment/waste/studies/pdf/pvc-final_report_lca.pdf
- ITB PCR A General Product Category Rules for Construction Products
- ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- EN 15804:2012+A2:2019 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- /Ecoinvent / Ecoinvent Centre, www.Eco-invent.org
- /TLCID/ Turkish Life Cycle Inventory Database, Turkish Center for Sustainable Production Research and Design (SÜRATAM), www.surdurulebiliruretimmerkezi.org

Instytut Techniki Budowlanej
00-611 Warsaw, Filtrowa 1

Thermal Physics, Acoustics and Environment Department
02-656 Warsaw, Ksawerów 21

CERTIFICATE № 139/2020
of TYPE III ENVIRONMENTAL DECLARATION

Product:

ADO FLOOR - SPC and LVT vinyl floorings

Manufacturer:

ADOPEN PLASTİK ve İNŞAAT SANAYİ A.Ş

Organize Sanayi Bölgesi 2.Kısım Mah.21 Cad.No:3 Döşemealtı/Antalya,Turkey

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

PN-EN 15804+A1

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued for the first time on 1st December 2020 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Deputy Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, December 2020