

**PROJECT
PROMOTION OF NON-FIRED BRICK (NFB) PRODUCTION
AND UTILIZATION IN VIET NAM**

Atlas Award ID: 00087517

FINAL REPORT AND PROJECT EXIT PLAN

Period: November 2014 - February 2020

**PROJECT MANAGEMENT UNIT
Ha Noi, February 2020**

Executing Entity: Ministry of Science and Technology
Implementing Entity: Department of Science and Technology
for Economic - Technical Branches

Co-Implementing Entity: Ministry of Construction

FINAL REPORT OF THE PROJECT AND PROJECT EXIT PLAN

Project Title: Promotion of Non-Fired Brick Production and Utilization in Viet Nam

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ACRONYMS

Acronym	Meaning
AAC	Autoclaved aerated concrete bricks
BAU	Business-as-usual
CBB	Concrete brick block
CDM	Clean Development Mechanism
CEB	Compressed earth block
CME	Coordinating management entity (For CDM-PoA)
CP	Country Programme
CPAP	Country Programme Action Plan
DOC	Provincial Department of Construction
DOIT	Provincial Department of Industry and Trade
DOST	Provincial Department of Science and Technology
ECC	Energy Conservation Centers (Ha Noi, Hai Phong, Da Nang, Can Tho & HCMC)
EE&EC	Energy Efficiency & Energy Conservation
EIAs	Environmental Impact Assessments
EOP	End of Project
FCB	Fired clay brick
FY	Fiscal year
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gases
GIZ	German International Assistance
GoV	Government of Viet Nam
GJ	Gigajoules
HUST	Ha Noi University of Science and Technology
IBST	Institute for Building Science and Technology
IEA	International Energy Agency
INTRACO	Investment and Trade Consultancy Company Limited (Proposed CME for CDM-PoA)
kgoe	Kilogram oil equivalent
kWh	Kilowatt hours
LGF	Loan guarantee fund
MDG	Millennium Development Goals
MFI	Micro-finance institution
MJ	Megajoules
MOC	Ministry of Construction
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment

Acronym	Meaning
MOST	Ministry of Science and Technology
MPa	Megapascal (A unit of pressure)
MTDF	Medium Term Development Framework
MTOE	Million tonnes of oil equivalent
NAFOSTED	National Foundation for Science and Technology Development
NATIF	National Technology Innovation Fund
NFB	Non-fired brick
NFBD	Non-fired brick development
NGOs	Non-Government Organizations
NPD	National Project Director
NPFE	National Portfolio Formulation Exercise (Under GEF)
PIR	Project Implementation Report
PMU	Project Management Unit
PoA	Programme of Activities under CDM
ProDoc	UNDP Project Document
PSC	Project Steering Committee
R&D	Research and Development
SBU	Standard brick unit
SME	Small and medium enterprises
STAMEQ	Standard, Metrology and Quality under DoST
TJ	Tera joules
TOE	Tons of oil equivalent
TOR	Terms of Reference
TTC	Technology Transfer Centers (Located in provincial centers)
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAA	Viet Nam Architect Association
VABM	Viet Nam Association for Building Materials
VEPF	Viet Nam Environment Protection Fund
VFA	Viet Nam Farmer's Association
VFCEA	Viet Nam Federation of Civil Engineering Association
VIBCA	Viet Nam Building Ceramic Association
VietinBank	Viet Nam Joint Stock Commercial Bank for Industry and Trade
VIGLACERA	Viet Nam Building Glass and Ceramic Corporation
VOV	Voice of Viet Nam
VSBK	Vertical shaft brick kiln
VTV	Viet Nam Television
VWU	Viet Nam Women's Union
VYU	Youth Union of Vietnam
WB	World Bank

1. GENERAL INFORMATION

1.1 General information about the Project

- **Vietnamese title and ID of the Project:** Tăng cường sản xuất và sử dụng gạch không nung ở Việt Nam - 00087517
- **English title and ID of the Project:** Promotion of Non-Fired Brick Production and Utilization in Viet Nam - 00087517
- **Location for implementing the Project:** Viet Nam
- **Donor:** Global Environment Facility (GEF)
- **Executing Organization:** UNDP Viet Nam
- **Executing Entity:** Ministry of Science and Technology
- **Project duration:** 60 months
- **Signing date of the Project Document:** 4 November 2014
- **Starting date:** 4 November 2014
- **Expected end date:** 4 November 2019;
- **Actual end date:** 30 May 2020, according to Decision No. 18 dated 18 December 2019 of the Minister of Science and Technology
- **Funding:**
 - Implementation budget: 38,880,000USD
 - ODA funding from GEF: 2,800,000USD
 - Co-financing sources: 36,080,000 USD

1.2 Project overview

1.2.1 Scope and objectives of the Project

The Project is designed to remove barriers to increased production and utilization of NFBs to contribute to the implementation of the goal of the Government's Non-fired building material development program under Decision No. 567/QĐ-TTg dated 28 Apr 2010.

The Project aims to reduce the annual growth rate of GHG emissions by displacing the use of fossil fuels and good quality soil for brick making through the increased production, sale and utilization of NFBs in Viet Nam. To achieve this goal, the Project will contribute to removing barriers to increased production and utilization of NFBs through 4 components:

- (i) Component 1: Policy support for NFB technology application;
- (ii) Component 2: Technical capacity building on NFB technology applications, operation and use of NFB products;
- (iii) Component 3: Sustainable financing support for NFB technology application;

- (iv) Component 4: NFB production, technology demonstration, investment and replication.

The Project will be implemented over a 5-year period and is expected to generate GHG emission reduction through the displacement of coal-fired clay brick kilns. Direct GHG emission reduction is estimated at 383 ktonnes of CO₂, indirect GHG emission reduction is estimated at 13,409 ktonnes of CO₂ that is cumulative for a 10-year period after the end of the Project.

The Project is expected to achieve the following outcomes:

Outcome 1: Approval and enforcement of an improved legal framework to encourage NFB production and use, and enhanced government capacity and knowledge to regulate NFB development and usage.

Outcome 2: Increased availability of technically skilled and qualified local service providers for NFB plants, and enhanced stakeholder knowledge on NFB usage.

Outcome 3: Improved availability and sustained access to financial support for NFB technology applications.

Outcome 4: Boosted confidence in NFB technology application resulting in an increased market share of NFBs.

1.2.2 Organization for implementation

The Ministry of Science and Technology has taken all responsibilities of the Project Executing Entity under the National Implementation Modality and later the “Harmonized Programme and Project Management Guidelines” (HPPMG) between the Government of Viet Nam and the United Nations in Viet Nam. The Ministry of Science and Technology has been responsible to the Government of Viet Nam and UNDP for effective implementation of the following tasks:

1. Very effectively use GEF resources and funding contributed by Vietnamese organizations to the Project implementation;
2. The Project’s products/outputs are of high quality and have impacts on promoting activities in a sustainable way in the field of building materials in Viet Nam;
3. The co-financing sources of Vietnamese partners are mobilized and allocated very effectively and at the right time for Project implementation;
4. Successfully coordinate and mobilize the participation of relevant partners/organizations from ministries/sectors to the provincial level in the Project implementation.

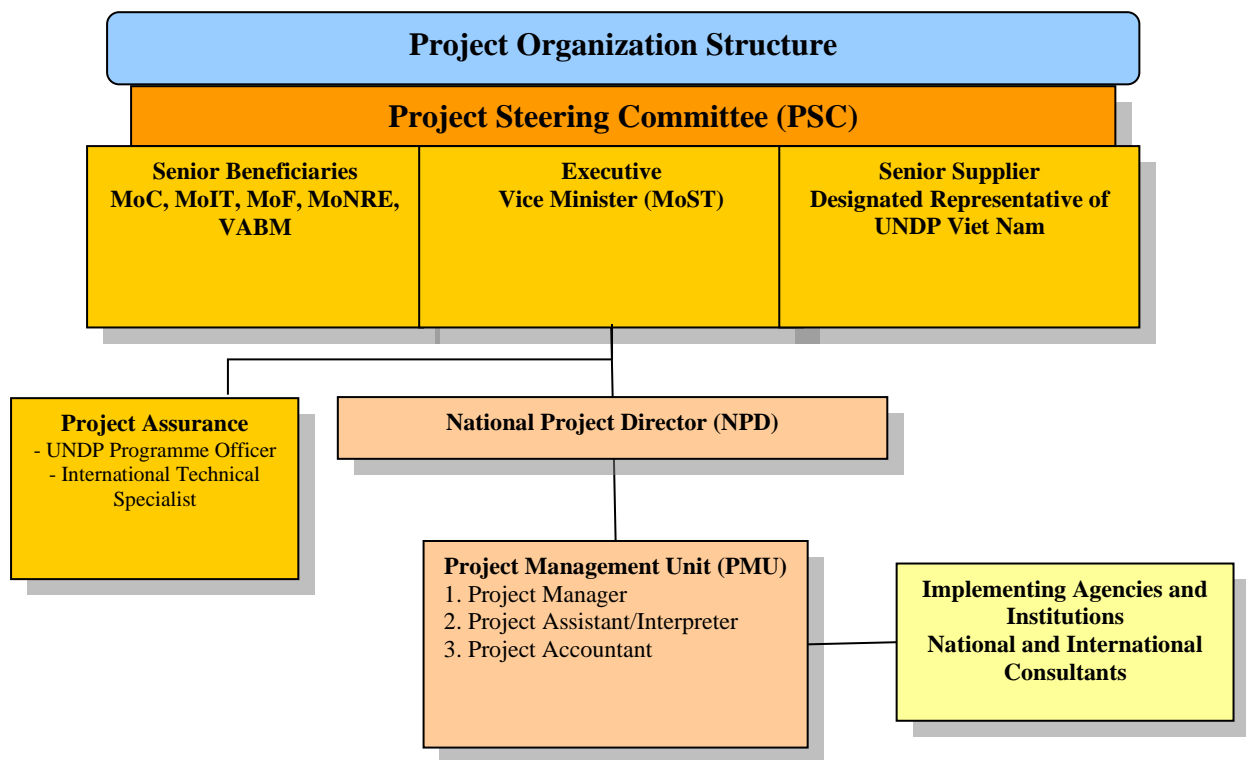
The Director General of the Department of Science and Technology for Economic - Technical Branches (Department of S&T Branches) has been appointed as the National Project Director, responsible to the Ministry of Science and Technology for achieving the Project's objectives and responsible to UNDP and the Government for the effective use of resources allocated to the Project. A Project Management Unit (PMU) was established in early 2015 to assist the Department of S&T Branches in implementing Project’s components and activities, ranging from daily management

tasks to financial management and overall operation of the Project and reporting of quarterly and annual GEF's funding use in accordance with UNDP regulations. The PMU was established with the following members:

- National Project Director (NPD)
- Project Manager (PM)
- National Senior Technical Advisor (NSTA)
- Building Materials Expert (BME)
- Project Assistant/Interpreter
- Project Accountant

Project organization structure is shown in Figure 1 below:

Figure 1: Project organization structure



The PMU has been very successful in coordinating and mobilizing the active participation of stakeholders from central to local levels such as Ministry of Construction (MOC), Ministry of Finance (MOF), Ministry of Natural Resources and Environment (MONRE), Viet Nam Association for Building Materials (VABM), Viet Nam Institute for Building Materials (VIBM), Viet Nam Institute for Building Science and Technology (IBST), Research and Application for Tropical Building Materials Institute, Departments of Construction of 63 provinces and cities, National University of Civil Engineering, Ha Noi University of Science and Technology, Research Center for Technology and Industrial Equipment of Ho Chi Minh City University of Technology, financial/banking institutions, 6 NFB technology equipment suppliers and technology service/transfer suppliers, and

especially the active participation of 26 NFB manufacturers in the demonstration and replication program.

During the period of 2015-2019, the PMU worked closely with the above stakeholders and mobilized their resources and expertise to carry out activities towards the agreed goals beneficial for both parties. The following Table 1 presents details of stakeholders and their role in implementing the Project:

Table 1: Key stakeholders and their role in implementing the Project

Stakeholders	Role on the NFB Project
Government Stakeholders	
Ministry of Science and Technology (MOST)	<p>MOST has been the Project implementing partner accountable to the Government of Viet Nam and UNDP for: (i) the successful implementation of the Project; (ii) mobilization of all resources including needed co-financing for the Project implementation; (iii) the proper coordination among all related ministries, agencies, provinces and stakeholders involved in the Project implementation; (iv) management of the day-to-day operations of the Project implementation as per approved work plans.</p> <p>MOST has been responsible for developing and implementing the R&D investment plan on NFB production technologies and equipment; providing guidance on NFB technological transfer and in cooperation with the Ministry of Construction to issue NFB technical standards; accrediting the NFB quality evaluation agencies.</p>
Ministry of Construction (MOC)	<p>MOC has been co-implementing partner and responsible for developing policies, technical standards and regulations on NFB production and usage promotion. They has ensured strong coordination during Project implementation with all stakeholders, notably new NFB manufacturers and NFB users, to maximize their synergies to meet the objectives of the National NFB development program.</p>
Ministry of Finance (MOF)	<p>MOF has been responsible for the development and issuance of regulations on tax incentive and financial incentives for NFB development promotion. MOF will instruct, guide, supervise and implement these regulations.</p>
Ministry of Natural Resource and Environment (MONRE)	<p>MONRE has been responsible for regulating land use for sourcing clay for FCB production into the National land use planning, instructing provinces and cities in developing their</p>

Stakeholders	Role on the NFB Project
	provincial land use planning to include land use planning for brick production; developing and issuing policies and mechanisms to discourage the use of agricultural land for FCB production; and monitoring GHG reductions from the growth of NFB production in Viet Nam.
Ministry of Industry and Trade (MOIT)	MOIT has been responsible for the entry of locally manufactured NFB equipment and the NFB manufacturing production lines into the List of key mechanical products and the List of key mechanical product investment projects period from 2009 to 2015. This is to be done for the industry to access financial incentives provided by GoV in accordance with Decision No. 10/QD-TTg on 6 Jan 2009 of the Prime Minister.
<p>Local Government Agencies:</p> <ul style="list-style-type: none"> • Department of Construction (DOC) • Department of Science and Technology (DOST) • Department of Industry and Trade (DOIT) • Technology Transfer Center (TTC) • Energy Conservation Center (ECC); and • Sub-Directorate for Standard, Metrology and Quality (STAMEQ) under DOST 	Local government agencies has been responsible for development of local incentive policies and land use planning that support the replacement of FCBs with NFBs. The local government agencies (Such as DOC, DOST, and DOIT) will participate in the Project at the provincial level for effective Project implementation. The human resources of these local agencies are identified as important target groups participating in capacity building on M&E and NFB quality control/inspection.
Industrial Associations	
<ul style="list-style-type: none"> • Viet Nam Association for Building Materials (VABM) • Viet Nam Building Ceramic Association (VIBCA) • Center for Science and Technology under 	These associations has participated in the Project and provide in-kind contributions as co-financing through their networks and staff. These institutions has played an active role in the dissemination of NFB information and raising the awareness of different stakeholders on NFB benefits by using their current networks and participating in technology transfer (See more specific descriptions below).

Stakeholders	Role on the NFB Project
Building Ceramic Association (CERATEC) <ul style="list-style-type: none"> • Viet Nam Federation of Civil Engineering Association (VFCEA) • Viet Nam Architect Association (VAA) 	
Brick industry associations (i.e. Hai Duong VSBK associations)	National and provincial brick associations has been involved in NFB awareness raising and information dissemination activities on the Project.
Private Sector Entities	
Viet Nam Building Glass and Ceramic Corporation (VIGLACERA)	VIGLACERA is a prominent business group in the field of building material production in Viet Nam and as well as infrastructure development, industrial parks, residential and business properties. VIGLACERA will be hosting an AAC demonstration and NFB technology application.
Viet Nam Machinery Erection Corporation (LILAMA) Construction and Mechanical Corporation (COMA)	LILAMA is a leading contractor for mechanical and equipment manufacture in Viet Nam. LILAMA will be involved in supplying the equipment as components and parts of the NFB production line. They will be potential partners with international NFB equipment suppliers.
NFB equipment suppliers: <ul style="list-style-type: none"> • DmC in Hai Duong Province; • Thanh Phuc manufacturing company in Hai Phong City; • Trung Hau company in Ho Chi Minh City; and • Other suppliers 	These suppliers are manufacturing and supplying equipment and consulting for NFB investment projects, technology transfer to NFB investors. They are identified as main target groups participating in training to become NFB service providers of engineering and consultancy services.
Financial Entities	
Viet Nam Joint Stock Commercial Bank for Industry and Trade (VietinBank)	VietinBank is one of the largest commercial banks in Viet Nam and has a nationwide operating network spreading to district levels. VietinBank has participated in the Project as the NFB financing institution that will provide commercial loans for NFB technology application investments.

Stakeholders	Role on the NFB Project
Viet Nam Environment Protection Fund (VEPF) managed by MONRE	VEPF is a state financial institution responsible for financial support through soft loans, loan guarantees, funding grants for programs and projects on natural conservation and bio-diversity operations, pollution prevention and control of national inter-disciplinary and inter-region pollutions, depression and settlement of local environmental problems. In the past, several EE&EC investment projects have been supported by the VEPF. On the NFB Project, VEPF has been involved in the provision of soft loans for NFB production projects.
National Foundation for Science and Technology Development (NAFOSTED) under MOST	NAFOSTED is a state financial institution responsible for supporting research activities in Viet Nam. One of its missions is to promote research efforts in enterprises, with focus on core technologies development that contribute to national economic growth and competitiveness, promotion of research efforts in enterprises. Presently, NAFOSTED is managing a 1.7 million USD loan guarantee, it has been involved in the NFB Project as a provider of loan guarantees for SME brick producers who are unable to access loans from financial institutions for NFB investments.
Civil Society Organizations	
Viet Nam Architects Association (VAA)	The Project has provided VAA with workshops on promoting NFB products. VAA is a voluntary social professional organization of architects designed to enhance their knowledge and professional skills, provide legal protection for its members, implement a function of consultation and social appraisal according to request of the Government on strategy, policy, planning, management on construction and civil engineering for large important projects of country, enhance the R&D on modern and traditional architecture of Viet Nam, and training architects and develop talents on architecture.
Viet Nam Association for Building Materials (VABM)	The Project has assisted in the building of VABM capacity to promote and become the NFB champion that provides expert advice for the building and construction industry on NFB usage. VABM is voluntary social professional organization that enhances the knowledge of building materials to its membership consisting of technical staff and scientists working in the field of building materials science, disseminates innovative building technology information;

Stakeholders	Role on the NFB Project
	apply new technology to production in building material sector, assists VABM members to access to science and technology institutes and organizations, provides strategy and policy advice on issues pertaining to the building material industry; provides legal protection to its membership; and develops international cooperation on science and technology with international organizations and institutes to obtain best practices in the building material industry.
Viet Nam Farmer's Association (VFA)	The VFA is a political social organization led by Viet Nam Communist Party and is a Member of the Viet Nam Fatherland Front. The Project has worked with VFA to help the shift from FCB kilns towards NFB technologies for the benefit of its farmer membership. VFA mobilizes and educates its membership and farmers on farming and environmental issues, and provides to them the benefits of legal advice to protect and improve their agriculturally-based livelihoods.
Viet Nam Federation of Civil Engineering Associations (VFCEA)	The Project has provided VFCEA with workshops on promoting NFB products. VFCEA is voluntary social professional organization of the Civil Engineering Association, and Provincial Engineering Associations. VFCEA membership consists of individuals and leading experts on civil engineering sector enhancing the knowledge and professional bases of the civil engineering profession in Viet Nam, undertakes R&D projects and advanced technology transfer on new civil engineering technologies, organizes training and professional skill for its membership, provides legal protection of its membership, and organizes international exchanges with overseas agencies and institutes on civil engineering.
Vietnam Building Ceramic Association (VIBCA)	The Project has provided VIBCA with workshops on promoting NFB products. VIBCA is voluntary social professional organization established according to the Government's Decision No. 41/1999/QD dated 4 Oct 1999 and is comprised of a membership of 100 entrepreneurs working on building ceramic industry, linked with R&D institutes, consultancies, and consulting engineers.
Viet Nam Women's Union (VWU)	The Project has worked closely with VWU to improve their working conditions within the brick manufacturing industry through its promotion of NFBs. The migration of brick manufacturing to NFBs will improve working conditions for

Stakeholders	Role on the NFB Project
	women in the brick industry. VWU mobilizes women to implement the policy of the Party and the law of the State; propagandizes gender equality; supports women to enhance their capacity, knowledge, and their mental well-being, and to develop gender equality and fairness in the work place.
Viet Nam Youth Union (VYU)	The Project has worked closely with VYU to improve their working conditions within the brick manufacturing industry through its promotion of NFBs, and to provide more opportunities for youth to find employment in this sector. VYU mobilizes and encourages members to actively participate to industrialization and modernization of country, provides them legal advice on employment issues, and strengthens its activities with international organizations to promote youth development.
Academic Organizations	
<ul style="list-style-type: none"> • Institute for Building Science and Technology (IBST) • Ha Noi University of Science and Technology (HUST) • National University of Civil Engineering (NUCE) and HCMC University of Civil Engineering 	These universities and academic institutes has been involved in the provision of technical training and technology transfer.
Viet Nam Institute for Building Materials (VIBM)	VIBM has provided consultancy services to demo projects, replication projects and supporting training courses and NFB technology transfers.

2. RESULTS

2.1 Implementation of the Project objectives

As mentioned in the Project Document, the main objective of the Project is to reduce the annual growth rate of GHG emissions from NFB production and utilization by removing barriers to the wide application of NFB production and utilization technology.

According to the objective set out in the Project Document, the successful implementation of the Project will result in a total energy saving of 30,782 thousand tons of oil equivalent (TOE) and total greenhouse gas emission (GHG) reduction of 383 thousand tons of CO₂ equivalent.

Over 5 years, with efforts to implement 4 demonstration projects as well as technical assistance to implement more than 22 replication projects on NFB production technology, the result is a saving of 36,560 tons of oil equivalent (TOE) during the Project implementation period and a total direct GHG emission reduction of 1,513,000 tons of CO₂. NFB's market share increased from 13% at the beginning of the Project to 28.5% at the end of the Project. Three main indicators that evaluate the success of the Project achieved and exceeded the final targets. See figures in Table 2 below:

Table 2: Rating on progress towards achievement of objectives

Objectives	Indicator description	Target level by EOP	Target achievement by 31 Dec 2019	Rating to target level
1. Reduce the annual growth rate of GHG emissions	Cumulative direct and direct post-project 10 years CO ₂ emission reductions resulting from the NFB plant investments and technical assistance (3 CBB plants and one AAC plant and 21 replication projects during the Project time) by EOP, Mtons	0.088 1.270	0.380 1.513	Over target
2. Energy saving	Cumulative direct energy saving (TOE) from displacement of coal through the demonstration NFB plants (3 CBB plants and one AAC plant and 21 replication projects during the project time) by EOP, TOE	30,782	36,560	Over target
3. Market share	% of NFB to total bricks consumption nation wide	25	28.5	Over target

2.2 Achieved outcomes of the Project

Over 5 years of implementation, the Project has made significant/positive impacts on policy development as a result of capacity building and awareness raising among policy makers at all levels mostly at the local level.

All activities in the 4 components of the Project implemented within 5 years have created a favorable environment for promoting investment in NFB production and utilization nationwide.

+ The Project, in collaboration with the MOC, has supported to improve legal documents which have been approved and implemented to promote the NFB production and utilization including:

- Decree No. 24a/2016/ND-CP dated 5 Apr 2016 on the management of building materials. This new Decree supplements existing policies on investment promotion, land lease, land use fees, and technology transfer for the production of NFBMs.

- Circular No. 13/TT-BXD dated 8 Dec 2017 regulating the use of NFBMs for construction works, superseding Circular No. 09 issued in 2012.

- Decree No. 121/2013/ND-CP on administrative sanctions related to construction operations (Specifically the section on utilization of NFBMs). The revised contents are included in Decree No. 139/2017/ND-CP of the Government dated 27 Nov 2017.

- Decision No. 1264/QD-BXD publishing the cost norms for construction work estimation related to NFBMs. This Decision takes effective from 1 Feb 2018.

- Circular No. 01/2018/TT-BKHDT dated 30 Mar 2018 to remove incentive for imported NFB equipment for production lines of less than 20 million SBUs/year.

- 11 documents issued by 11 People's Committees of provinces, cities on the planning of building materials / plans for development of NFBMs / roadmap and incentive policies when eliminating manual brick kilns / enclosed policies to the Decision No. 567 of the Prime Minister.

+ Successfully implemented the training and capacity building program for Project partners including central and local managers and policy makers, NFB production investors, construction contractors, design consulting agencies, financial institutions. Developed 5 sets of training materials and conducted 26 training courses for nearly 2,000 managers and technicians from 63 provinces, cities. This activity contributed to enhancing knowledge, awareness and skills for making development policies at the local level, managing and operating NFB production lines, using NFBs in construction works, etc.

+ Mobilized and connected financial institutions with enterprises to support for concessional and commercial lending in investment in NFB production across the country with the result that 40 enterprises were supported with concessional and commercial loans of nearly 624 billion VND. This contributed to solving difficulties for enterprises in raising capital for investment in NFB production.

+ Mobilized private enterprises to invest nearly 1,000 billion VND to implement 26 demonstration and replication projects with a design capacity of 1,200 million SBUs, since then it has been widely replicated in provinces and cities contributing to increasing the confidence for investors for NFB production and promoting NFB market share increased to 28.5% by the end of 2019 compared to 13% at the beginning of the Project.

Conclusion: The Project has completed all 17 targets and exceeded 12/17 targets approved in the Project Document (See details in Table 3 below).

Table 3: The degree of achieved outcomes in comparison with the baseline

Project expected outcomes	Baseline situation	Current situation
<p>Outcome 1: Approval and enforcement of an improved legal framework to encourage NFB production and use, and enhanced government capacity and knowledge to regulate NFB development and usage</p>	<ul style="list-style-type: none"> ▪ A number of plans/policies have been adopted to encourage NFB developments: (i) Master plan on development of building materials by 2020; (ii) Decision No. 567/2010/QD-TTg; (iii) Directive No. 10/CT-TTg on promotion of NFB production and utilization; (iv) Circular No. 09/2012/TT-BXD creating NFB demand; (v) Decision No. 1449/QD-TTg for retirement of traditional brick kilns. ▪ Lack of standards and policies on NFB equipment to encourage and attract local enterprises to invest in NFB production lines. ▪ Insufficient NFB standards make it difficult to control quality of NFB produced, quality of buildings where NFBs are used. ▪ No standards / norms have been adopted for EE and emission reduction for production of building materials as well as NFBs. ▪ Limited capacity of the government officers in NFBs in general, quality control of NFB manufacturing, production and uses in 	<p>Policy framework improved:</p> <ul style="list-style-type: none"> ▪ 15 policies including decrees, circulars, national decisions and provincial directives to promote the production and use of NFBs and decrease FCBs. ▪ 2 standards / policies approved to promote local manufacturers. ▪ 1 circular issued by MPI to remove incentive for imported NFB equipment for production line of less than 20 million SBUs thus to promote the local production of NFB equipment. ▪ 1 standard on NFB mould developed with support by the Project (A standard of NFB mould was approved and announced by Thanh Phuc Company) ▪ 3 national standards (TCVN) on NFB (Concrete bricks) adopted by MOST in 2017 ▪ 3 standards on AAC panel approved by MOC and MOST by 2019. ▪ 2 norms on energy consumption and GHG emission for NFB

Project expected outcomes	Baseline situation	Current situation
	<p>particular.</p> <ul style="list-style-type: none"> ▪ No training courses have been held to enhance capacity of the government officers in NFB development and management. 	<p>recommended.</p> <ul style="list-style-type: none"> ▪ 1,000 government officers at national and provincial level trained on policies and standards, legal framework, regulating the production and use of NFBs, NFB technologies, investment in NFB production lines, etc in 2017 and 2018.
<p>Outcome 2: Increased availability of technically skilled and qualified local service providers for NFB plants, and enhanced stakeholder knowledge on NFB usage</p>	<ul style="list-style-type: none"> ▪ Lack of local technical knowledge on how to manufacture equipment for NFB production lines that can be competed with those internationally produced (Quality and price). ▪ Lack consumer confidence and knowledge on using NFBs. ▪ Limited NFB knowledge amongst engineers, designers and building developers. ▪ No training has been provided to stakeholders regarding NFB associated issues. ▪ Little or no knowledge amongst construction workers on NFB building techniques and best practices on using NFBs in construction. ▪ Low awareness on the advantages and environmental benefits of NFBs within the construction and building sector in Viet Nam. 	<p>Enhanced knowledge and technical skills for target stakeholders:</p> <ul style="list-style-type: none"> ▪ 5 sets of training materials prepared and used for training courses. ▪ Module 1: Introduction (Basic knowledge) of NFBs, policy and standards; Module 2: Design and construction of buildings using NFBs; Module 3: Production technology of Autoclaved aerated concrete (AAC); Module 4: Production technology of concrete block brick (CBB); and Module 5: Investment planning and capital loan applications for NFB projects. ▪ 01 curriculum for construction universities and technical high colleges. ▪ 3,000 copies of training materials printed and transferred to Department of construction of 63 provinces and others stakeholders. ▪ 26 training courses

Project expected outcomes	Baseline situation	Current situation
		<p>conducted in 2017-2019 with total of 1,890 people from 63 provinces who were trained on various NFBs' aspects focusing on 5 key areas, of these: 1,000 governmental and local officers, 270 designers and constructors, 492 NFB investors, 128 people from other related areas, 2,115 is the number of buildings that used NFBs (Data formally provided by DOCs of 20 provinces on the buildings that used NFBs).</p> <ul style="list-style-type: none"> ▪ 02 companies received technical assistance from the Project: Thanh Phuc NFB Company received support in setting up standard for NFB mould that helped improve NFB quality and Duc Thanh NFB Company for designing and manufacturing automatic NFB press machine.
<p>Outcome 3: Improved availability and sustained access to financial support for NFB technology applications</p>	<p>A number of financial institutions such as Vietinbank, VEPF, NOFOSTED, Green Investment Facility (GIF) have interest in supporting SMEs for NFB investment, however:</p> <ul style="list-style-type: none"> ▪ No dedicated financing for NFB production. ▪ Many potential NFB investors are SMEs who have difficulties in accessing to loans. ▪ Lack of knowledge and 	<ul style="list-style-type: none"> ▪ 12 NFB enterprises got concessional loans from VEPF of 167 billion VND. ▪ 28 NFB enterprises got loans from Vietinbank of 446.5 billion VND. ▪ 40 enterprises accessing 27.26 million USD.

Project expected outcomes	Baseline situation	Current situation
	ability of potential SME investors to apply for concessional financing for NFB projects.	
<p>Outcome 4: Boosted confidence in NFB technology application resulting in an increased market share of NFBs</p>	<p>As of 2015 there exist:</p> <ul style="list-style-type: none"> (i) more than 1,000 CBB production lines (Yearly production of 5.6 million SBUs); (ii) 12 AAC companies (Yearly production of about 1.3 million SBUs); (iii) 17 foamed brick companies (Yearly production of 0.12 billion SBUs). <ul style="list-style-type: none"> ▪ Most of CBB technologies imported from China are low quality. ▪ NFB entrepreneurs lack of knowledge on the production of qualified NFBs, lack of knowledge in designing, constructing, operating and maintaining a NFB plant. ▪ Very few examples of well-managed and profitable NFB production facilities existed. ▪ Lack of local technical knowledge of planning, designing, constructing, operating and maintaining a NFB plant. ▪ 13% is the market share of NFBs in 2011 from MOC and VABM. ▪ Very few information on 	<ul style="list-style-type: none"> ▪ 3 CBB demonstration projects of design capacity of 125 million SBUs. ▪ 1 AAC demonstration plant with design capacity of 140 million SBUs. ▪ 22 replication projects implemented with design capacity of 926.5 million SBUs. ▪ 53 new NFB production lines of which investment plans were approved ▪ Total designed capacity of 26 demo and replication projects is 1,191 million SBUs. ▪ The market share of NFBs is 28.5%. ▪ 25 workshops conducted on NFB technology and benefits from using NFBs with 2,000 participants from 40 provinces, hundreds of news/articles posted on newspaper and radio. ▪ Published 6 leaflets and 1 posters (Printed 50,000 copies for 63 provinces & cities) to disseminate benefits of NFBs. ▪ Produced 5 video clips on NFB production technology and benefits. ▪ Established, operated the website: duangachkhongnung.vn

Project expected outcomes	Baseline situation	Current situation
	media about NFBs and building using NFBs. Few people know and understand about benefits of NFBs.	(With 300,000 visits). <ul style="list-style-type: none"> ▪ Hundreds of news/articles produced and posted on mass media. ▪ 28.5% is the market share of NFBs in 2019

2.3 Implementation of the Project components and outputs

Component 1: Policy support for NFB technology development

Expected results of output 1.1: Existing legal framework reviewed and further strengthened to promote NFB production and utilization
+ Mechanisms, policies supplemented, completed and implemented to promote the development of NFBs in Viet Nam.

Results of output 1.1: Mechanisms, policies supplemented, completed and implemented to promote the production and utilization of NFBs:
Decree 24a/2016/ND-CP on the management of building materials;
Decree No. 139/2017/ND-CP dated 27 Nov 2017 on administrative sanctions related to construction operations;
Circular No. 13/2017/TT-BXD regulating the use of NFBMs for construction works;
Circular No. 01/2018/TT-BKHDT dated 30 Mar 2018 to remove incentive for imported NFB equipment for production lines of less than 20 million SBUs/year;
Circular No. 10/2017/TT-BXD dated 29 Sep 2017 promulgating NFB products when being used in the market should have certificate of conformity

The Decree No. 24/2016/ND-CP has been issued together with many investment incentive policies for NFB production, in which NFB production is entitled to the State's investment incentive and supportive policies under Article 38 of the Decree, investment incentive policies under the Clause 1, Article 15 and investment support under the Clause 1, Article 19 of the Law on Investment 2014, support with technology transfer expenses for investment projects according to Articles 9 and 39 of the Law on Technology Transfer 2006.

The Circular No. 13/2017/TT-BXD stipulates that all construction works using State budget of 30% or more are required to use NFBs. Ha Noi and Ho Chi Minh City must use 100% NFBMs, urban centers of grade III or higher must use at least 90%.

The newly issued documents have had very positive impacts on NFB production and utilization nationwide. NFB market share has increased from 13% in 2015 to 28.5% in 2019.

Expected results of output 1.2: Strategies to implement FCB kiln replacements.

- + Report on the results of the survey, analysis and assessment of the state of manual brick plants, vertical shaft brick kilns, round kilns, tunnel kilns of 63 provinces/cities across the country.
- + Report on summary and evaluation of the development of the roadmap to retire manual brick kilns, improved manual kilns, vertical shaft brick kilns and round kilns in all provinces / cities during the 2013-2015 period.
- + Report on the results of issuance of the strategy / planning / policy / roadmap to retire manual brick kilns, to develop technologies for NFB production of at least 10 provinces/cities.

Results of output 1.2:

+Report on the results of the assessment of the state of manual brick plants, vertical shaft brick kilns, round kilns, tunnel kilns of 63 provinces/cities across the country. According to the report, by the end of 2014 there were nearly 700 tunnel kilns with the output of 16 billion SBUs, 5,037 manual kilns of all types, vertical kilns, round kilns with the output of 13.5 billion bricks. In 2016, there were more than 4,000 manual brick plants nationwide with the output of 10 billion bricks, tunnel kilns with the output of 13 billion bricks.

+Report on the plan to retire all types of manual kilns of provinces and cities in accordance with the Prime Minister's Decision No. 1469/QD-TTg in 2014. By the end of 2018, 58 provinces have developed and issued roadmap to gradually reduce and retire manual brick kilns, improved manual brick kilns, round kilns using fossil-fuel and develop plan to develop NFBMs in their provinces; 25 provinces have developed and issued directive on promoting production and utilization of NFBMs, limiting production and utilization of FCBs in their provinces.

+11 provinces/cities have issued master plans/plans/policies to retire FCB kilns (Except tunnel kilns) and developed NFBMs, contributing to the implementation of the Decision No. 1469/QD-TTg of the Prime Minister in 2014 on the Master plan for building materials development until 2020 with vision to 2030, including the roadmap to retire all types of FCB kilns (Except tunnel kilns). These provinces are: Bac Can, Lao Cai, Nam Dinh, Tien Giang, Binh Dinh, Can Tho, Cao Bang, Hue, Kon Tum, Khanh Hoa, and Lam Dong.

Together with the MOC's state management activities in implementing the Government's Decision No. 567, the Project has organized many activities to directly or indirectly support the implementation of Decision No. 567 in number of provinces, cities such as organized nearly 25 workshops, conducted training program to improve the management capacity for 1,000 provincial officials to carry out their tasks, communicated through printing and distributing 50,000 copies of brochures promoting NFB images and benefits to 63 provinces and cities.

Expected results of output 1.3: Recommended policies and standards on domestic production of NFB equipment and technology.

+ Report on the results of the survey, assessment of the state of capacity of domestic manufacturers of NFB production equipment and the market demand for NFB production equipment and spare parts in Viet Nam.

+ Report on the results of the review and evaluation of the state of issued mechanisms and policies, proposing mechanisms and policies that need to be amended, supplemented and issued, criteria for encouraging development and manufacturing, using domestic NFB production equipment.

+ Economic-technical report on investment in development of projects of new investment or expansion or modernization of technologies to raise the capacity of designing and manufacturing NFB production equipment for 3 potential manufacturing establishments to be selected and recommended for capital support for implementation.

Results of output 1.3:

+ Evaluation report based on prepared criteria with a list of 6 manufacturing companies having the localization level of over 70% and being accepted by the market for equipment lines manufactured by these companies, they are:

- ❖ Thanh Phuc Mechanical and Construction Material JSC
- ❖ Duc Thanh Investment and Industry JSC
- ❖ Doan Minh Cong Joint Stock Company
- ❖ Trung Hau Production Co. Ltd
- ❖ Gia Hung Equipment Co. Ltd
- ❖ Bien Bac Joint Stock Company

+ Circular No. 01/2018/TT-BKHDT dated 30 Mar 2018 to remove incentive for imported NFB equipment for production lines of less than 20 million SBUs/year;

+ Report on result of supporting Thanh Phuc Company (Hai Phong) to upgrade the technology of annealing NFB mould to improve the quality and reduce the cost compared to the same equipment from China.

+ Report on result of supporting Thanh Phuc Company to formulate and announce the quality standard of NFB mould production Jul 2019.

+ Report on result of supporting Duc Thanh Investment and Technology Company in designing and manufacturing technology of automatic brick machine with the capacity of 80 million bricks/year according to the design of Harex (South Korea). The machine has been tested and put into production lines at Tuy Phuoc NFB Company (Binh Dinh).

NFB equipment supply market in Viet Nam has many domestic and foreign suppliers. Domestic enterprises have met about 70% of needs of production lines and equipment of enterprises producing NFBMs of the domestic market with focus

on the concrete brick production lines. AAC brick production lines are mainly imported from abroad.

The Project has focused on supporting two domestic enterprises to improve domestic manufacturing capacity in which supported Thanh Phuc Company (Hai Phong) and Duc Thanh Company to upgrade manufacturing technology at reasonable costs to improve quality and compete with equipments imported from China.

Expected results of output 1.4: NFB product standards and building codes
+ 03 selected TCVNs compiled, completed and submitted to the MOST for issuance.
+ 03 TCVNs for AAC wall panels drafted and submitted to MOST for approval.

Results of output 1.4:

3 TCVNs announced and put into effect by the MOST:

TCVN 7959:2017 Lightweight concrete - AAC product - Technical requirements

TCVN 9029:2017 Lightweight concrete - Foam concrete and non AAC products - Technical requirements

TCVN 9030:2017 Lightweight concrete - Test methods

3 TCVNs have been announced by the MOC and submitted to the MOST for publication

3 TCVNs on AAC wall panels approved by the MOC and submitted to the MOST for publication include:

Steel reinforced AAC wall panels - Test methods

Steel reinforced AAC wall panels - Technical requirements

Steel reinforced AAC wall panels - Construction process and acceptance

The first 3 TCVNs for products have been completed in the direction of enhancing product quality criteria according to market requirements. 3 new TCVNs for AAC wall panels have been first drafted and issued. The new TCVNs on AAC wall panels help manufacturing enterprises have a legal basis for customers to believe in the quality of products, thereby promoting the market share.

Expected results of output 1.5:

+ Comparison of energy consumption and GHG emissions between concrete brick production and fired brick production in Viet Nam.

+ Standards of concrete brick products on energy efficiency and GHG emissions in Viet Nam.

Results of output 1.5:

+ Comparison of energy consumption and GHG emissions between concrete brick production and fired brick production in Viet Nam.

No.	Enterprises	Energy consumption rate (MJ/m ³ of SBU)	CO ₂ emission rate (kg/m ³ of SBU)
1	Fired brick plants	2,562.87	245.62
2	NFB plants	14.47	3.28

+ Energy efficiency and GHG emissions of concrete brick products manufactured in Viet Nam:

- ❖ Energy consumption rate (MJ/m³ of SBU): 689.53
- ❖ CO₂ emission rate (kg/m³ of SBU): 130.73

Currently, the management of GHG emissions and energy use for NFB products is mainly responsible by the production facilities. The MONRE and the MOC do not have plan to develop a national standard for this. Therefore, the Project's results still only recommend the rate of energy efficiency and GHG reduction for government agencies and enterprises for reference.

Expected results of output 1.6: Trained government personnel for promotion and improved regulation of the growth of NFB production and utilization.

Adjusted in accordance with the MTR as follows:

+ 940 local officials have been trained with necessary knowledge to improve the capacity to promote NFB production and utilization.

Results of output 1.6:

+ 1000 local officials have been trained with necessary knowledge to improve the capacity to promote NFB production and utilization.

Component 2: Technical capacity building on NFB technology application and operation and use of NFB products

Expected results of output:

A training program designed and developed to meet the capacity building needs of Project partners, to meet the requirements of the proposed outputs as follows in the Project Document:

Output 1.6: Trained government personnel for promotion and improved regulation of the growth of NFB production and utilization.

Output 2.1: Established strategic partnerships for NFB technology transfer.

Output 2.2: Completed technical courses on planning NFB investments.

Output 2.4: Completed training courses on the design, construction, production operation and maintenance of NFB plants.

Output 3.2: Completed workshops for financing institutions on NFB investments.

Output 3.3: Established business links on NFB manufacturing.

The content of this program includes:

+ Compiled 5 sets of training materials with following 5 contents:

Module 1: Introduction to NFBs, policies and standards;

Module 2: Design and construction of buildings using NFBs;

Module 3: Production technology of AAC bricks;

Module 4: Production technology of concrete block bricks (CBB);

Module 5: Investment planning for NFB projects.

+ Conducted 21 training courses for Project participants including:

Managers of Departments of Construction, related departments of provinces / cities and districts (1,000 participants)

Managers and technical staff of the NFB production enterprises (422);

Design consultants, construction supervisors, construction contractors (130);

Technology transfer consultancy and financial institutions and other units (128).

Results of output:

Compiled 5 sets of training materials with following 5 contents:

Module 1: Introduction to NFBs, policies and standards;

Module 2: Design and construction of buildings using NFBs;

Module 3: Production technology of AAC bricks;

Module 4: Production technology of concrete block bricks (CBB);

Module 5: Investment planning for NFB projects.

Printed a training curriculum for construction universities and colleges.

Printed and distributed 3,000 copies of training documents for 6 above training materials and curriculum to the Project's partners including 63 provinces and cities, MOC, institutes, universities and colleges.

Conducted 26 training courses for 1,890 participants including the Project's participants from 63 provinces and cities, specifically as follows:

Managers of Departments of Construction, related departments of provinces / cities and districts (1,000 participants);

Managers and technical staff of the NFB production enterprises (492);

Design consultants, construction supervisors, construction contractors (270);

Technology transfer consultancy and financial institutions and other units (128).

The training program has been carefully and specifically prepared by the Project since 2015, integrating the training activities of the Project Components. The PMU has organized a bidding to select an institution to develop the training program to be the Viet Nam Institute for Building Materials which mobilized a large number of domestic and international experts to participate in the formulation and implementation of the training program with support from UNDP in recruiting and coordinating international experts.

The training materials have been carefully prepared by the PMU, consulted with leading Vietnamese experts. The content of the training materials was compiled by experts with strong professional qualifications and practical experience, selected and reviewed by leading experts. The experts assessed the content of 5 training modules as good quality, which basically met the participant's expectations on the topics in each module, the training method has been completed through each course, the training content is highly applicable.

The PMU and the VIBM have cooperated closely in the process of developing and implementing the training program. The PMU has worked closely with the Department of Construction of 63 provinces/cities in sending right participants to meet the local needs, thus making an important contribution to the success of training courses.

Training courses have been widely organized to participants in provinces across the North, Central and South, a total of 26 training courses were conducted for 1,890 participants from 63 provinces and cities in 4 years (2016-2019).

The PMU has organized a comprehensive evaluation of the training program. Following are some conclusions in the evaluation report.

Frequent use of knowledge related to NFBs in practice of NFB production development management and use, actual operation of NFB production technology and equipment, practical design, construction and acceptance of construction works using NFBs: The frequency of use of knowledge in the work of all participants in general is high. The total percentage (High and average level) of the work groups accounts for about 85-100%, a small number works for Group 3 - Design consulting, construction supervision companies, construction contractors and Group 2 - Sales, marketing and promotion of NFB products have lower level.

Evaluation of the actual efficiency of the application of training knowledge in production: Productivity and product quality of NFB production enterprises achieved significant efficiency, production capacity and product quality increased. However, product consumption is difficult, the level of sales of many products is still low, due to higher supply than demand, many facilities have not built up their capacity, especially those with low capacity.

In the National aspect, there should be a roadmap to gradually reduce the market share of FCBs based on the restriction of material areas for production of building ceramic bricks, which only encourages localities where sources of raw materials are industrial wastes instead.

Expected results of output 2.5: Completed workshops on the use of NFBs as

building materials.

- + Prepared and organized workshops with focus on the Viet Nam Association for Building Materials and other end-users such as construction companies, architects, builders and buildings on the advantages of NFBs so that they may make their choice on the basis of complete information on the use of these products in construction activities;
- + Prepared and disseminated posters and leaflets to raise awareness about NFBs in training and awareness programs. The VABM may be the first to distribute these promotional materials to end users, government agencies, and non-governmental organizations for display and distribution, especially in national and international exhibitions on building materials and construction industry.

Results of output 2.5: (Combined with Output 4.10)

- +25 workshops have been organized across the country with the participation of 2,000 officials of construction companies, architects, builders and buildings, and local construction management officials on advantages of NFBs.
- +5 leaflets have been printed and distributed (Over 50,000 copies) to 63 provinces and cities to disseminate information about the benefits of NFBs.

Expected results of output 2.6: Technical assistance to VABM to promote NFB usage and facilitate NFB investments

- + Upgraded and maintained the website of the VABM to provide information on investment opportunities in NFB production;
- + Strengthened the capacity of VAB to report the progress of the conversion of the NFB market during and after the Project's completion.

Results of output 2.6:

The website of the VABM has been upgraded. Hundreds of articles and news articles about NFBs have been produced and published;

2017: 107 articles extracted from others sources and articles written by VABM;

2018: 150 articles extracted from others sources and articles written by VABM;

2019: 200 articles extracted from others sources and articles written by VABM;

+ VABM has conducted 7 workshops in three regions of the country in association with VietBuild exhibition during 2017-2018;

+ VABM has implemented the Building Materials Forum 2019 along with the event "Honour the best practices in the production and utilization of NFBMs". 51 enterprises in 3 fields of manufacturing and using NFBs were honoured for their best practices.

Component 3: Sustainable financing support for NFB technology application.

Expected results of output 3.1: Completed study on the viable financing sources for scale-up of NFB investments

+ Selected at least 5 viable financing sources for NFBs investors to access loans.

Results of output 3.1:

VietinBank: i) Capital source: More than 500 billion VND ii) Commercial & fixed interest during the loan period; iii) Maximum 7 years for 1 project; iv) Up to 70% of the total project investment.

Viet Nam Environment Protection Fund: i) Capital source: More than 1,000 billion VND ii) Fixed interest rate: 3.6%/year during the loan period; iii) Maximum 10 years for 1 project; iv) Up to 70% of the total project investment.

National Foundation for Science and Technology Development: 23 billion VND guaranteed up to 70% of loans during the implementation of the NFB production investment project.

Ho Chi Minh City Environment Protection Fund: i) 100 billion VND; ii) 5.0%/year; iii) No more than 5 years for a project; iv) Maximum 70% of the project's total investment

HCMC Industrial, Handicraft and Pollution Reduction Fund: i) 24 billion VND; ii) 0%/year; iii) No more than 5 years for a project; iv) Up to 30% of the project's total investment.

Project “Developing Production of NFBMs and Limiting Production of FCBs in Dong Thap Province”: Total funding for the project is 84.274 billion VND.

Project “Reorganizing Vinh Long Brick and Ceramic Industry”: Total project capital is 338.344 billion VND.

Expected results of output 3.4 &3.5:

Output 3.4: Completed action plan for financing NFB SMEs

Output 3.5: Operational financing scheme for NFB projects

Results of output 3.4 &3.5:

+VEPF provided 167 billion VND as concessional loans to 12 projects.

+VietinBank lended to 28 enterprises with a total budget of 446.5 billion VND.

+Total 40 enterprises borrowed concessional and commercial loans to invest in NFB production with a total loan of nearly 613.5 billion VND (27.26 million USD).

The Project has connected financial institutions with potential enterprises investing in NFB production through workshops and training courses for these 2 groups of

target audiences to improve understanding for financial institutions about effective NFB technology and production projects from which financial institutions become capable of evaluating whether projects are eligible for lending. These financial institutions include: VietinBank committed 22 million USD in loans equivalent to nearly 500 billion VND, VEPF committed 3 million USD equivalent to nearly 70 billion VND, NAFOSTED guaranteed 1 million USD, etc.

In addition, the Project has provided technical assistance for 26 demonstration and replication projects so that they have all necessary documents to self-borrow loans from the banks. As a result, 26 demonstration and replication projects raised their own capital or borrowed from banks or funds to invest nearly 900 billion VND. This is a great success of the Project through connecting and mobilizing businesses and financial institutions to promote the expansion of investment in NFB production, therefore it contributed a lot to increasing the NFB market share recently.

Component 4: NFB technology application, investment and replication

Expected results of output: Output 4.1 - 4.6

Output 4.1: Bankable feasibility analyses of selected demonstration NFB (CBB) sites

Output 4.2: Financing for demonstration NFB projects

Output 4.3: Completed preparations for implementing NFB projects

Output 4.4: Installed and operational NFB demonstration plants

Output 4.5: Trained personnel to optimize NFB production

Output 4.6: Monitoring and evaluation reports on the operational and financial performances of the demonstration NFB projects

3 qualified CBB demonstration projects completed and put into operation.

Results of output 4.1- 4.6:

+1 report on criteria for evaluating the technological level of NFB production equipment.

+1 report on selection criteria of a feasible demonstration project on NFB production line.

+3 feasibility reports for NFB production projects which are eligible for investment bank loans.

+3 consultancy reports on NFB production equipment procurement, installation supervision, operation instruction and acceptance.

+ 3 M&E reports on trial operational results.

+ 3 workshops to present the results of 3 demonstration projects with the participation of 450 representatives of local management agencies, potential investors of neighboring provinces, construction contractors, equipment suppliers, financial institutions, and press media.

Produced and released 3 leaflets on results of 3 demonstration projects.

NFB products of the 3 companies all met TCVN 6477:2016 and were granted certificate of conformity.

Design capacity of 3 demonstration projects is 125 million of SBUs.

Energy efficiency of 3 projects is 7,295 TOE/year.

Efficiency of GHG emission reduction of 3 projects is 39,959 tons of CO₂/year.

+01 report on evaluation of completed demonstration and replication projects.

In order to implement demonstration and replication projects, the PMU has recruited a team of experts to develop criteria to select advanced NFB production technology as well as to select demonstration and replication projects. These criteria are considered as basis for the selection of effective implementation projects. The PMU collaborated with consulting agencies and Provincial Departments of Construction to select demonstration and replication projects.

In 2016, 3 demonstration projects on CBB production technology were successfully implemented in Hai Phong, Thai Nguyen and Da Nang. Of 3 CBB demonstration projects, 2 projects used imported equipment from China. Especially, the project at Thanh Phuc Company demonstrated automatic production line with capacity of 55 million SBUs/year manufactured by their own. The demonstration workshop at Thanh Phuc Company attracted the attention of local potential NFB investors and the public. Thanh Phuc Company sold an average of 30 NFB production lines per year in 2017 and 2018. This model continued to be introduced by Thanh Phuc at training courses organized by the PMU in cities and provinces in the North, Central and the South of Viet Nam.

The PMU has successfully implemented 3 demonstration projects, contributing to disseminating and replicating other 22 projects to the whole country. Some lessons learned from 3 demonstration projects include:

Select production equipment line with advanced technology to ensure that product quality is of top priority.

Select the optimum material mix to ensure the high quality, reasonable price and competitiveness of NFB products in the market.

Human resources should be carefully trained to obtain the necessary skills to properly operate and manage products quality with focus on curing products.

Promoting the product's advantages and guiding right construction technique are important lessons in product marketing.

It is necessary to link with the provincial/city development planning on NFB to extend consumption market and avoid the oversupply.

Expected results of output 4.7: AAC plants with improved production efficiencies
+ The selected demonstration plant is AAC Viglacera Plant (Of Viglacera Corporation) in Bac Ninh Province.

+ Within scope of this demonstration project, an energy and production audit of an existing AAC brick plant has been conducted to identify opportunities and recommend to-do actions to improve its production and enhance energy efficiency.

Results of output 4.7: AAC with improved production efficiencies

- + 1 energy audit report with 3 most feasible solutions selected for the plant.
- + 1 report on technical design and an investment project with 3 selected technical solutions.
- + 1 M&E report on results of 3 energy efficiency solutions.
- + 1 audit report on production technology with proposed production technology solutions for upgrading.
- + 1 report on research results of material mix using waste and fly ash of Pha Lai Thermal Power Plant.
- + Final report on improving technology to 200,000m³ per year.
- + Design capacity of the demonstration project is 140 million SBUs.
- + Energy efficiency of the project is 5,920 TOE/year.
- + Efficiency of the plant's GHG emission reduction is 11,112 tons of CO₂/year.

Mr. Nguyen Dinh Hau, Director General of Department of Science and Technology for economic and technical branches, Ministry of Science and Technology, Project Director said: This is one of the important technical activities/consulting products to improve production efficiency, energy saving and environmental protection for businesses producing non-fired building materials, and also a very good opportunity to get the support of scientists on building materials and energy audits with simple but very effective solutions. The results of the report should be studied, and the company should have an implementation plan based on its conditions and resources.

Mr. Nguyen Thanh Phong, Viglacera Plant Director thanked and highly appreciated the support of the Project, which is very necessary and brings practical and specific results to the plant. Energy audit report as well as assessment of the current state, proposed solutions to improve product quality and production efficiency of the plant are the basis for the Company to modernize and increase the capacity of the plant from 100,000m³/year to 200,000m³/year and improve product quality. These have been carried out by Viglacera in this investment project and the technical proposals of the consultants have been implemented by Viglacera. Thanks to the NFB Project of the Ministry of Science and Technology for supporting the review of 2 standards for lightweight concrete and wall panels, developing 3 standards for autoclaved aerated concrete wall panels and reinforcement which are being accepted for issuance, very necessary for Viglacera and autoclaved aerated concrete manufacturing sub-sector, creating favorable conditions for the plant to bring products to the market.

Expected results of output 4.8: Completed demonstration on the use of NFB

products

- + Lectures for technical staff and supervisors on CBBs building technique.
- + Lectures for building workers on CBB building technique.
- + Video script to train on CBB building technique
- + Lecture video on CBB building technique.
- + Report 1a on theoretical training and practical guideline for 10 technical officers and supervisors about CBB building technique.
- + Report 1b on theoretical training and practical guideline for 10 technical workers about CBB building technique.
- + Report 2 on results of building technique guideline and supervision technique of sample room construction process.
- + Report 3 on evaluation of the effectiveness of using NFBMs for construction works.

Results of output 4.8: Completed demonstration on the use of NFB products

- + 1 lecture for technical staff and supervisors on CBB building technique.
- + 1 lecture for building workers on CBB building technique.
- + 1 video script to train on CBB building technique
- + A video to train on CBB building technique.
- + Report 1a on theoretical training and practical guideline for 10 technical officers and supervisors about CBB building technique.
- + Report 1b on theoretical training and practical guideline for 10 technical workers about CBB building technique.
- + Report 2 on results of building technique guidance and supervision technique of sample room construction process.
- + Report 3 on evaluation of the effectiveness of using NFBMs for construction works.

At the request of the participants of 2016-2018 training courses, it is essential to develop lectures for building workers and technical officers on CBB building technique. The completion of output 4.8 satisfies this requirement, the lecture on CBB building technique has been presented at two training courses in Ho Chi Minh City and Thai Binh Province in 2019 and received high appreciation from 210 participants.

Expected results of output 4.9: Plans for replication of NFB plants

- + The Project shall provide technical assistance for the replication of more than 21 NFB plants after the successful implementation of demonstration projects with the capacity of 0.926 billion of SBUs/year.

Results of output 4.9: Plans for replication of NFB plants

- + 22 replication projects have been implemented with a total design capacity of 926.5 million SBUs/year.
- + Energy saving of 22 replication projects is 54,076 TOE/year.
- + GHG emission reduction of 22 replication projects is 296,202 tons of CO₂/year.
- + Typical CBB curing process for 3 climatic regions in the North, Central and South of Viet Nam.

The successful implementation of demonstration projects has had direct impacts on the number of replicated NFB plants throughout the Project implementation period. This is an excellent result of the NFB Project.

Expected results of output 4.10: Drafted and implemented communication and awareness raising plan (addition output to ProDoc)

Results of output 4.10: Drafted and implemented communication and awareness raising plan.

- + Strategy and plan on communication and awareness raising to promote the Government's NFBMs development program.
- + 25 workshops nationwide to promote the production and utilization of NFBMs for over 2,000 participants related to the development of production and utilization of NFBMs from 40 provinces/cities.
- + International Conference on "Science and technology of building materials for sustainable development" with the participation of more than 300 researchers, scholars, experts and policy makers from about 15 countries in the world. About 30 television and newspaper agencies have published more than 30 news, articles and reports on the event.
- + Building Materials Forum 2019 and the event "Honour the best practices in the production and utilization of NFBMs". 51 enterprises were honored for their best practices. Information about the event has been posted on 40 media / press channels with more than 50 news, articles and reports, Proceedings of the program.
- + The Project website has been operated since 2017 by the Viet Nam Association for Building Materials (VABM). To date, there have been more than 2,300,000 visits to VABM website (<http://hoivlxdvn.org.vn/>); over 260,000 visits to the Project website (<http://duangachkhongnung.vn> - Vietnamese page) and other 15,000 visits to the English page (<http://en.duangachkhongnung.vn/>). The PMU has posted 31 news, articles and 9 videos to the Vietnamese page and 29 news, articles and 5 videos to the English page. Hundreds of news and articles on the development of building materials in general and NFBMs in particular have been posted to these websites.
- + Produced 4 video clips including: Introduction of NFBs, Benefits of NFBs, Construction and acceptance of works using NFBs, Talk show about NFBs;
- + Designed and printed 50,000 leaflets and posters on the benefits of using NFBs to provide to 63 provinces and cities;

- + Printed 6,000 copies of 3 leaflets on 3 NFB demonstration projects in Thai Nguyen, Da Nang and Hai Phong;
- + The talk show “Production and utilization of NFBs” was produced and broadcasted by the People's Television. Attending the talk show were representatives of MOC, MOST, NFBM consultants, NFB producers, investors using NFBMs;
- + Published 42 thematic articles (31 Vietnamese articles, 11 English articles), 39 news about the Project's activities (31 Vietnamese news and 08 English news); broadcasted news on Voice of Viet Nam (VOV) including 05 news about the Project's activities and 02 thematic reports.
- + Published 1 special publication about NFBMs - Sustainable development trend (Including about 25 thematic articles).

(See Annex 3.1: Logframe and Project results)

2.4 Financial Performance

2.4.1 GEF Funding

The results of annual disbursement compared to the annual budget plans also achieved a relatively high rate, see the results of Table 3 below:

Table 3: Annual GEF disbursement results

Unit: Mil VND

Year	Budgeted Amount for all Years	Actual disbursement	Percentage of disbursement (%)
2015	5,674	4,841	85.32%
2016	10,928	9,646	88.27%
2017	17,263	15,735	91.15%
2018	20,073	14,172	70.60%
2019	12,834	11,051	86.11%

- The “Budgeted Amount for all Years” is the “Total of quarterly planned budgets at the end of Q4” = total quarterly planned budget each year (Not the approved annual planned budget). Use the quarterly planned budget to best reflect the estimated budget.

- The actual disbursement is the final amount of money on CDR annually converted into VND at the corresponding UNDP December rate.

2.4.2 Funding of co-financing from Project partners

Table 4: Project Budget and Expenditure
(For GEF grants)

Unit: USD

Activities	Disbursement by year						Total disbursement 2015-2020	Total planned budget 2015-2020	Difference
	2015	2016	2017	2018	2019	2020			
Component 1	93,534.19	82,335.35	106,164.69	123,076.83	135,010.09		540,121.15	568,550	28,428.85
Component 2:	47,806.05	196,369.81	349,981.51	98,001.80	23,386.93		715,546.10	562,820	-152,726.10
Component 3:	17,745.60	11,855.38	8,966.47	79,732.73	69,386.72		187,686.90	267,950	80,263.10
Component 4:	27,983.28	120,167.27	213,913.89	266,167.40	230,741.76		858,973.60	1,267,780	408,806.40
Component 5: Project management	24,578.86	12,731.50	13,373.95	38,609.38	17,064.09		106,357.78	132,900	26,542.22
Component 6: Monitoring and evaluation	3,802.28	1,973.37	240.95	1,622.87	798.51		8,437.98		-8,437.98
Total	215,450.26	425,432.68	692,641.46	607,211.01	476,388.10		2,417,123.51	2,800,000	382,876.49

(See Annex 3.2: Project Financial Report)

Table 5: Results of co-financing mobilization from Vietnamese partners

Unit: Million USD

Form of co-financing	Central State Organizations		Local State Organizations		Business Enterprise Area		Other organizations (NGOs, Institutions, Universities)		Total Co-financing	
	Commitment	Actual Disbursement	Commitment	Actual Disbursement	Commitment	Actual Disbursement	Commitment	Actual Disbursement	Commitment	Actual Disbursement
Loan										
Cash and invested capital	4.00	8.00	0.22	0.22	27.20	83.00	0.66	0.76	32.08	91.98
In-kind	4.00	4.36	0.20	0.00	0.00	0.00	0.66	0.42	4.86	4.78
Total	8.00	12.36	0.42	0.22	27.20	83.00	1.32	1.18	36.94	96.76

Notes: () Loan from Viet Nam Environment Protection Fund
 (**) Loan from VietinBank branches
 (***) Investment fund from Small and Medium Enterprises (SMEs)*

2.5 Factors affecting the Project implementation results

2.5.1 Policy, legal and economic environment

Over the past decade, the Government has issued a series of documents to further promote the development of NFBMs to implement Viet Nam's Green Growth Strategy.

Issued following Decision No. 567/QĐ-TTg dated 28 Apr 2010 on the development of NFBMs is a series of other documents such as Directive No. 10/CT-TTg dated 28 Nov 2012 on promoting using NFBMs and limiting the production and use of FCBs; Decision No. 1696/QĐ-TTg dated 23 Sep 2014 on a number of treatment solutions for ash, slag and gypsum of thermal power plants and chemical fertilizer plants to use as raw materials for building materials production; Decision No. 1469/QĐ-TTg¹ dated 22 Aug 2014 of the Prime Minister on approving the master plan on development of Viet Nam building materials to 2020 and orientation to 2030 (Effective until Aug 2019); Decree No. 24A/ND-CP dated 4 May 2016 on management of building materials (And Decree No. 95/2019/ND-CP dated 16 Dec 2019 amending a number of articles of Decree No. 24A/2016/ND-CP); Decree No. 139/ND-CP dated 27 Nov 2017 on sanctioning of administrative violations in the field of construction, including violations of regulations on the use of NFBMs in construction works.

The Ministry of Construction also issued Circular No. 13/2017/TT-BXD dated 8 Dec 2017 to replace Circular No. 09/2012/TT-BXD dated 28 Nov 2012 regulating the use of NFBMs in civil and industrial construction works; Decision No. 1264/QĐ-BXD dated 18 Dec 2017 on announcement of construction estimate norms - Construction part (Amended) - The use of NFBMs; Document No. 3314/BXD-VLXD dated 28 Dec 2018 guiding the use of ash, slag and gypsum in the production of building materials and construction works.

At the local level, 47 of 63 localities have developed and issued directives on increasing production and use of NFBMs, limiting the production and use of FCBs; 57 of 63 localities developed and issued roadmap to gradually reduce and retire manual brick kilns, improved manual brick kilns, round kilns, vertical sharp brick kilns using fossil-fuel as well as local plans for NFBM development.

2.5.2 Project management organization

The Ministry of Science and Technology as the Project executing agency has assigned a Deputy Minister as Chairman of the Project Steering Committee and the Director of the Department of Science and Technology for Economic - Technical Branches to be the Project Director. The active participation of leaders of the Ministry of Science and Technology and the timely support of functional units under the Ministry (Such as the Department of Finance and Planning, the Department of International Cooperation, the MOST Office, The Department of Legislation ...) have greatly contributed to the

¹ Replace Decision No. 121/2008/QĐ-TTg dated 29 Aug 2008 on approval of the Master Plan for development of Viet Nam's building materials to 2020; Decision No. 133/2004/QĐ-TTg dated 20 Jul 2004 and Decision No. 115/2001/QĐ-TTg of 1 Aug 2001 on approval of the Master Plan for development of Viet Nam's building materials to 2010;

successful implementation of the Project as well as mobilization of full and effective participation of project subjects and partners.

The Project Steering Committee includes representatives from relevant partner agencies such as MOST, MOF, MONRE, VietinBank, UNDP Viet Nam, VEPF, NAFOSTED, VABM. The Project Steering Committee, which met once a year, provided key directions for the annual Project Work Plan and determined a number of key Project issues. In addition, the members of the Project Steering Committee have also played an important role in integrating and connecting Project activities with national programs/activities related to sustainable development issues and business assistance.

The effective communication and close cooperation between the PMU and UNDP staff as well as timely monitoring, guidance and support of the UNDP-GEF Regional Technical Adviser on Climate Change in Asia-Pacific Region have also played an important role in ensuring the progress of the Project as planned. During the past 5 years, the PMU has received very effective support from UNDP Program Analyst and the Regional Technical Advisor to solve difficult problems and propose solutions to overcome difficulties.

With the guidance of the Project Steering Committee and the support of UNDP/GEF, the PMU, a team of experienced and highly responsible staff, have successfully completed the Project management tasks such as:

- GEF fund has been used very effectively and efficiently aligned with the plan in the Project Document signed between MOST and UNDP Viet Nam.
- Total co-financing of partners is over 96 million USD, nearly 3 times higher than the committed level in the Project Document (USD 36.08 million). This has been mobilized and used very effectively for all activities of the Project.
- Most of the Project's products/outputs are of high quality, have sustainable impacts, and help promote the development of NFBMs in Viet Nam.
- Activities of the Project partners and organizations have exerted a synergistic impact on the application of measures/technology in the production and use of NFBMs.

2.5.3 Project monitoring and evaluation

All Project's progress monitoring and reporting activities have been implemented in accordance with UNDP regulations:

- The Project inception workshop and Project inception report were completed in May 2015;
- All Project's quarterly and annual progress reports and work plans are of high quality and sent to the UNDP on time.
- The Project review meetings (or the Project Steering Meetings) are held once a year as planned.
- The Project's mid-term review and final evaluation reports have been completed following the M&E plan.

According to the Project's final evaluation report conducted by independent evaluators of UNDP, the M&E of the Project has been successfully conducted on the

basis of the detailed Log Frame, including expected outcomes and very feasible targets. The Project's Log Frame completed based on recommendations from the MTR is a very effective tool to monitor the Project's implementation progress. The Project's annual implementation reports (As required by the GEF) and the Project's annual progress reports are of high quality, providing detailed implementation progress of each component and achieved results.

All risks during the Project implementation have been recognized and managed on quarterly basis. With good management of identified risks, almost all activities of the Project are carried out as scheduled.

3. ANALYSIS OF SOCIO-ECONOMIC EFFICIENCY

3.1 Analysis compared with Project's objectives and design

Over 5 years, with efforts to implement 4 demonstration projects as well as technical assistance to implement more than 22 replication projects on NFB production technology, the result is a saving of 36,560 tons of oil equivalent (TOE) during the Project implementation period and a total direct GHG emission reduction of 1,513,000 tons of CO₂. NFB's market share increased from 13% at the beginning of the Project to 28.5% at the end of the Project. Three main indicators that evaluate the success of the Project achieved and exceeded the final targets, 12/17 of the Project's development targets exceeded the set targets.

Moreover, the Project has also succeeded in removing barriers through the completion of a policy framework with the release of new decrees and decisions of the Prime Minister, circulars and decisions of the MOC, MPI and MOF, aiming to promote the development of the NFB market. Training activities and workshops have helped increase knowledge and awareness of key partners of the Government's NFBM development program. The successful implementation of demonstration and replication projects has contributed to increasing the confidence of NFB investors and the market share of NFB to 28.5%.

3.2 Impacts on industry and region

Through the successful implementation of 26 demonstration and replication projects, 25 workshops with 2,000 participants and 26 training courses on knowledge and skills for NFB development for nearly 2,000 officials of line agencies from 63 provinces and cities, the UNDP-supported and GEF-funded Project has contributed positively to the significant growth in the NFBM market share of 13% from its beginning to 28.5% in the end of 2019.

The cooperation among the Government, investors, equipment suppliers and financial institutions has mobilized the investment of the private sector in NFB production lines in recent years. Typically, after the demonstration project in Thai Nguyen province, 15 NFB production lines were invested and similarly the demonstration project in Da Nang. The success of the demonstration project at Thanh Phuc JSC in Hai Phong helped the company manufacture and sell 30 NFB production lines in 2017 and 2018.

The Project has made positive and significant impacts on the implementation of the Government's NFBM development program to 2020 under the Prime Minister's Decision No. 567 in 2010.

3.3 Sustainability

- Following the Decision No. 567/QĐ-TTg of the Prime Minister, a series of policies, mechanisms and directions of the Government and ministries is a strong and important legal basis to promote activities of production and utilization of NFBMs.
- The MOC, as a Government agency mainly responsible for developing building materials, submitted the “Building materials development strategy to 2030 with a vision to 2050” to the Prime Minister for approval to increase the proportion of NFBMs to expectedly 40% of the total building materials by 2030. This document is an important legal basis for the continued development of building materials including NFBMs.
- The system of legal documents on promotion of NFBM production and utilization of has been basically adequate, its enforcement needs to be strengthened.
- The system of product standards, construction guidelines, and usage norms have existed and continued to be completed.
- 47/63 localities have developed and issued directives on increasing NFBM production and use, limiting the production and use of FCBs;
- 57/63 localities have developed and issued roadmap to gradually reduce and retire manual brick kilns, improved manual brick kilns, vertical sharp brick kilns, round kilns using fossil-fuel as well as local plans for NFBM development.
- The awareness of ministries, local authorities and communities on the purpose and significance of the NFBM development program has been raised, which helped find out good solutions to implement the Program 576.
- Information related to NFBMs and green materials is propagandized and disseminated and positively responded by the business community.
- Many of 40 domestic equipment suppliers have been proactively improving their NFB production lines by using advanced, highly automated technology to supply to the domestic and international markets.
- Technical consulting units who have been trained and practiced during the implementation of the Project are now capable of transferring NFB production and utilization technology effectively.
- A number of documents on technical training, skills and knowledge have been drafted, finalized, printed out and provided to the target audiences of Program 567.
- Capacity of VABM and other associations has been built in advocacy and propaganda for NFB enterprises with the following specific tasks:
 - ❖ Propagating and disseminating scientific and technological knowledge and engaging the community participation;
 - ❖ Conducting scientific research, technology development, training and transfer of scientific and technological advances in NFB production and utilization.

- ❖ Counseling and appraising social issues within the scope of its activities at the request of Government agencies or other organizations and individuals as prescribed by law.
 - ❖ Organizing the publication of magazines and publications on building materials in accordance with the Government regulations.
- Banks and financial institutions are ready to provide capital for investment in NFB production.
 - The MOST and the MOC annually invest hundreds billions VND in science and technology R&D for the building materials industry including NFBMs.

4. LESSONS LEARNT AND RECOMMENDATIONS

4.1 Lessons learnt

Below are some key lessons learned from the successful implementation of the Project:

1. **Project design is one of the factors that make it a success.** The Project, which includes objectives, expected outputs and feasible activities, was very well designed and prepared. The correct identification of key partners and the co-financing organizations during the Project preparation phase helped the Project meet the set schedule.

2. **Policy and legal development**

The selection of the right partner at the beginning of the Project design (MOC as Co-implementing Partner) to finalize NFBMs legal documents system played an important role in the successful implementation of the Project.

Recognizing the importance of establishing close relation and cooperation with functional authorities in the development of legal documents, the PMU has been very flexible in adjusting the time to conduct Project activities to be in line with the timeline of these agencies so that they could provide direct technical assistance from the drafting stage to the finalization of legal documents.

Provincial policies/planning/plans on NFB development have contributed significantly to the successful implementation of the Project. The Project has carried out a lot of activities in many provinces and cities. In fact, the PMU has taken every opportunity to raise the awareness of local Government leaders and support provinces to develop their NFB policies/programs. Experience from the Project has shown that in the provinces/cities, it is difficult to carry out replication and development/demonstration activities without the assistance and incentive policies of local governments.

Thus, to successfully implement the NFBM development program, the Government needs to have specific regulations requiring provinces/cities to issue their own policies and programs supporting NFB production and utilization.

3. **The design and implementation of technical capacity building training program for the Project's target audiences**

The Project has been very creative in integrating all training activities into a training program for the target audiences.

The training program has been developed on basis of 4 main target groups including i) management officials of the Government and of Provincial Departments of Construction; (ii) managers and technical staff of NFB plants; iii) consulting and design companies, construction supervisors, construction contractors; iv) other audiences are financial institutions, technology transfer consultants/consulting companies.

From that, 5 training modules were identified as follows:

- Module 1: Introduction of NFBs, policies and standards
- Module 2: Design and construction of buildings using NFBs
- Module 3: Production technology of AAC bricks;
- Module 4: Production technology of CBBs
- Module 5: Investment planning for NFB projects.

The Project has mobilized leading national and international experts to compile and edit training materials. The Project has also mobilized the active participation of 63 provinces and cities in organizing 26 training courses for 2,000 participants. The training program has made positive impacts on improving the knowledge, awareness and skills of activities related to the Government's NFBM development programme.

4. Mobilizing the participation in the implementation and co-financing for the Project

Mobilizing active participation of implementing partners and co-financing partners is a decisive factor to the success of the Project.

Organizations participating in the Project implementation include:

- 5 ministries
- 63 provinces and cities including DOCs, DOSTs, DOITs, Centers for technology transfer consultancy
- Associations
- Business and private sectors
- Financial institutions
- Academic institutes/universities

At the beginning, the total co-financing fund from above-mentioned organizations is 36.08 million USD. The success of demonstration and replication projects has helped increase investment capital of the private sector to 867,407 billion VND. Therefore, the total co-financing fund of the Project reached 96.24 million USD, equivalent to 240% of the initial estimated amount.

5. Demonstration and replication projects:

From beginning, the Project has focused on the method of implementing the demonstration and replication projects. Being well aware of the important role of technology towards NFB equipment and production lines, the Project has developed criteria to evaluate the technology level of NFB production lines as a basis for making advice to select equipment lines for demonstration and replication projects. In addition, capacity scale, region and potential of input

materials have been taken into account when identifying the criteria of economic and technical development to select demonstration and replication projects.

The Project has selected various forms of technical assistance suitable for NFB production enterprises that helped improve the efficiency of each enterprise. Technical assistance includes:

- ❖ Preparing feasibility studies, advising on equipment technology selection, supervising installation and training operation managers;
- ❖ Preparing loan application for submission to the VEPF.
- ❖ Providing guidance on selecting the optimal material mix, using ash and blast furnace slag to produce NFBs.
- ❖ Establishing quality management processes and certificate of conformity.
- ❖ Applying solar energy technologies for NFB curing to improve quality and shorten the time to meet TCVN 6477:2016.

The Project has worked closely with Provincial DOCs in the selection of demonstration and replication projects.

Knowledge transfer and improvement of management capacity of equipment lines are an important elements in the effective operation and management of NFB products.

Demonstration and replication projects have contributed positively to the achievement of the Project's goals. The targets include direct CO₂ emissions reduction of 0.38 million tons of CO₂ and reducing 36,460 tons of oil equivalent (TOE). This contributes to increasing the market share of NFB to 28.5%, increasing the confidence of financial institutions and investors, and mobilizing nearly 900 billion VND of the private sector to NFB production.

4.2 Recommendations

- MOC to study and improve mechanisms and policies to promote the NFBM production and improve the NFBM competitiveness through the application of environmental tax frame for FCB production, exemption and reduction of some types of taxes for NFBM products.
- MOC to study and improve mechanisms and policies to use more ash from thermal power plants as raw materials for NFBM production to increase the quality of NFBMs and minimize environmental pollution caused by electricity production.
- The Government should continue to improve regulations and strictly supervise the use of NFBMs in construction works to promote the continuous development of the market.

- MOC should continue to improve the system of standards and regulations on products and use of NFBMs towards international quality standards, focusing

on design, construction and acceptance standards of masonry blocks as detailed as possible.

- The MOC should strengthen the direction, inspection and supervision of localities to strictly implement the Government's and Ministry's documents on the implementation of the Prime Minister's Program 567 and Directive 10.
- The MOC should formulate criteria and promulgate legal documents on the implementation of the Green material, construction development program to integrate all social resources in the most effective way to implement the Viet Nam's green growth strategy.
- The MOST and the MOC should invest and support science and technology research to develop NFB technology, production equipment with diversified and high quality NFB products towards international quality standards.
- The Government, MOC and localities shall invest necessary resources to enhance the training, communication on NFBM benefits, production and utilization technique for the target audiences of the Program 567.
- The MOC should continue to support training programs on NFBM development. The training curriculum should continue to be updated and improved with knowledge and experience in green buildings for engineers, architects, technical staff and construction workers to effectively use NFBMs as well as solve wall crack and seepage at construction works.
- The MOC should develop a synchronized communication program as well as an effective communication network to promote the mechanisms, policies, and benefits of using NFBMs as green materials in line with the Viet Nam's green growth strategy.
- MOC and DOCs should conduct quality and effective communication on experience and knowledge of NFB production; conduct strong communication about design of buildings using NFBMs.
- MOC should strongly promote the role and responsibility of businesses and people to develop green materials, green buildings, green life, etc. to raise the social awareness about green materials.

5. PROJECT EXIT PLAN

During the 5-year implementation (2015-2019), the project has resulted significant number of important products and technical reports. These products and technical reports have been transferred to suitable partners/stakeholders during the project implementation (see details in Annex 3).

Hà Nội, 28 February 2020
National Project Director

 Nguyen Dinh Hau

5. ANNEX

5.1 Annex I: Project's Logical Framework and achieved results

Objective ²					
Reduce the annual growth rate of GHG emissions by displacement of fossil fuel use and the usage of good quality soil for brick making through the increased production, sale and utilization of non-fired bricks (NFBs) in Viet Nam					
Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
Cumulative direct and direct post-Project CO ₂ emission reductions resulting from the NFB plant investments and technical assistance by EOP, Mtons CO ₂ . (Per MTR, the text of this indicator was slightly revised to “Cumulative direct Project and Project CO ₂ emission ...” to improve the definition)	0 (Per the MTR, the baseline was revised for clarity, replacing the original “0” with text.) No NFB production lines in operation using modern technology No emission reduction through replacement of CFBs through modern NFBs	<i>(not set or not applicable)</i>	0.088 (This is the direct emission reduction during the course of the 5-year Project) 1.270 (This is the direct post-project emission reduction from NFB plants that received technical	0.060712 Target for year 3 is 0.029	0.180955 (Direct emission reduction) The value is calculated based on difference between CO ₂ emission reduction resulting from the total NFBs outputs produced by 4 demo projects + 18 replication projects as compared to the CO ₂ emission reduction of the same number of FCBs outputs (Higher results as compared to previous are caused by counting in the NFBs produced by 18 replication projects).

² Objective (Atlas output) monitored quarterly ERBM and annually in APR/PIR

Objective ²

Reduce the annual growth rate of GHG emissions by displacement of fossil fuel use and the usage of good quality soil for brick making through the increased production, sale and utilization of non-fired bricks (NFBs) in Viet Nam

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
			assistance from Project Output 4.9 during Years 4 and 5 to be implemented after EOP)		1.332 (Direct post-project emission reduction) The direct post project CO ₂ is calculated based on the cumulative NFB SBUs produced by 4 demo projects and 18 replication projects for 10 years period during 2020-2030
Cumulative direct energy saving (TOE) from displacement of coal through the demonstration NFB plants (3 CBB plants and one AAC plant and 21 replication projects during the project time) by EOP (Per MTR, additional text “and 21 replication projects	0 (Per the MTR, the baseline was revised for clarity, replacing the original “0” with text.) No NFB production lines in operation using modern technology No energy savings	<i>(not set or not applicable)</i>	30,782	14,608 Over target 2018 10,261	36,560 The value is calculated based on difference between energy saving resulting from the total NFBs outputs produced by 4 demo projects + 18 replication projects in and the energy saving of the same number of FCBs outputs

Objective ²**Reduce the annual growth rate of GHG emissions by displacement of fossil fuel use and the usage of good quality soil for brick making through the increased production, sale and utilization of non-fired bricks (NFBs) in Viet Nam**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
during the Project time” was added to improve the definition)	through replacement of CFBs through modern NFBs				
The progress of the objective can be described as:	Achieved				

Outcome 1

Approval and enforcement of an improved legal framework to encourage NFB production and use, and enhanced government capacity and knowledge to regulate NFB development and usage

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
<p>Number of policies, regulations and standards approved and enforced to encourage the increase in the production and usage of NFBs and decrease the use of FCBs (Per the MTR, the indicator was slightly revised to improve the definition)</p>	<p>0 (Per the MTR, the baseline was revised for clarity, replacing the original “0” with text) A number of plans/policies have been adopted to encourage NFB developments: (i) Master plan on development of building materials by 2020; (ii) Decision No. 567/2010/QD-TTg; (iii) Directive No. 10/CT-TTg (2012) on promotion of</p>	<p><i>(not set or not applicable)</i></p>	<p>10 Per the MTR, the target was revised to 13 additional policies approved and enforced to encourage NFB development (Investment, production and use) and decrease FCB usage by EOP 2 standards / policies approved to</p>	<p>14 Target for year 3 is 6 1 3</p>	<p>15 policies including Decrees, Circular, National Decisions and provincial directive to promote the production and use of NFB and decrease FCB 2 standards / policies approved to promote local manufacturers: 1 circular issued by MPI to remove incentive for imported</p>

Outcome 1**Approval and enforcement of an improved legal framework to encourage NFB production and use, and enhanced government capacity and knowledge to regulate NFB development and usage**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
	NFB production and utilization: (iv) Circular 09/2012/TT-BXD creating NFB demand; (v) Decision No. 1449/QD-TTg for retirement of traditional brick kilns Lack of standards and policies on NFB equipment to encourage and attract local enterprises to invest in NFB production lines Insufficient NFB		promote local manufacturers of NFB equipment and technology by year 4 3 standards/regulations approved by year 3 to govern quality of NFBs		NFB equipment for production line of less than 20 million SBUs thus to promote the local production of NFB equipment 1 standard on NFB mould was developed with support by the Project in (A standard of NFB mould was approved and announced by THANH PHUC Company) 3 national standards (TCVN) on NFB (Concrete bricks) were adopted by MOST in 2017 3 standards on AAC panel approved by MOC and MOST by 2019

Outcome 1**Approval and enforcement of an improved legal framework to encourage NFB production and use, and enhanced government capacity and knowledge to regulate NFB development and usage**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
	standards make it difficult to control quality of NFB produced, quality of buildings where NFBs are used				
Number of officially approved and enforced regulatory framework mandating the replacement of fired clay brick kilns by Year 2 (This indicator was deleted at the inception phase since the framework has been already in place)	0	<i>(not set or not applicable)</i>	1 (This will include a market analysis of fired kilns and VSBKs in operation, a timeframe over which these kilns can be retired, the setup of a cell within a government	This indicator is no longer tracked.	(not set or not applicable) This indicator is no longer tracked, in line with the MTR

Outcome 1**Approval and enforcement of an improved legal framework to encourage NFB production and use, and enhanced government capacity and knowledge to regulate NFB development and usage**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
			agency to assist FCB entrepreneurs in their transition to NFB technology voltage grid, references to NFB product testing procedures and directives to monitor, report and verify energy intensities of NFB production)		
Number of policies and	0	<i>(not set or</i>	3	This indicator is merged	<i>(not set or not applicable)</i>

Outcome 1**Approval and enforcement of an improved legal framework to encourage NFB production and use, and enhanced government capacity and knowledge to regulate NFB development and usage**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
standards developed for the local manufacture of NFB equipment and technology that are approved and enforced by Year 4 (This indicator will no longer be tracked, in line with the MTR)		<i>not applicable)</i>		with the earlier indicator “Number of policies, regulations and standards approved and enforced to encourage the increase in the production and usage of NFBs and decrease the use of FCBs”, in line with the MTR	This indicator is no longer tracked, in line with the MTR
Number of developed regulations, building standards and codes governing the use of NFBs in the construction sector that are approved and enforced by Year 3 (This indicator will no longer be tracked, in line	1	<i>(not set or not applicable)</i>	3	This indicator will no longer be tracked, in line with the MTR	<i>(not set or not applicable)</i> This indicator is no longer tracked, in line with the MTR

Outcome 1

Approval and enforcement of an improved legal framework to encourage NFB production and use, and enhanced government capacity and knowledge to regulate NFB development and usage

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
with the MTR)					
Number of standards/norms on energy efficiency (EE) and emissions reduction in NFB production developed (Per the MTR, the indicator was slightly revised to improve the definition)	0 (Per the MTR, the baseline was revised for clarity, replacing the original “0” with text) No standard / norms have been adopted for EE and emission reduction for production of construction of construction materials as well as NFBs	<i>(not set or not applicable)</i>	2 standards / norms on energy efficiency and emission reduction in NFBs production adopted by EOP (Per the MTR, description was added to the number for clarity)	0	2 norms on energy consumption and GHG emission for NFB are recommended.
Number of trained government officers in NFB quality control standards and	0 (Per the MTR, the baseline was revised for clarity, replacing the	<i>(not set or not applicable)</i>	100 (Assumes 10 officers trained in each of the 10	1,000 Over target year 3 (100)	1,000 government officers at national and provincial level trained on policies and standards, legal framework, regulating the

Outcome 1**Approval and enforcement of an improved legal framework to encourage NFB production and use, and enhanced government capacity and knowledge to regulate NFB development and usage**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
regulations and new building codes mandating the use of NFBs by EOP Per the MTR, the indicator was revised to Enhanced government capacity to improve NFB regulation, control and mandate NFBs production and markets	original “0” with text) Limited capacity of the government officers in NFBs in general, quality control of NFB manufacturing, production and uses in particular No training courses have been held to enhance capacity of the government officers in NFB development and management		provinces) Per the MTR, the target was revised to By EOP, 940 government officers at national and provincial level trained on various aspects of NFBs (Types, characteristics, requirement for control and promotion of NFB manufacturing, production technology,		production and use of NFB, NFB technologies, investment in NFB production lines, etc. in 2016-2019.

Outcome 1**Approval and enforcement of an improved legal framework to encourage NFB production and use, and enhanced government capacity and knowledge to regulate NFB development and usage**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
			usage, etc)		
Number of NFB plants that are compliant to new NFB quality control regulations and standards by EOP (This indicator will no longer be tracked, in line with the MTR)	0	<i>(not set or not applicable)</i>	6	This indicator will no longer be tracked, in line with the MTR.	(not set or not applicable) This indicator is no longer tracked, in line with the MTR
Number of building projects that are using new building codes that define and mandate the use of NFBs by EOP (This indicator will no longer be tracked, in line with the MTR)	0	<i>(not set or not applicable)</i>	6	This indicator will no longer be tracked, in line with the MTR	(not set or not applicable) This indicator is no longer tracked, in line with the MTR
The progress of the objective can be described as:	Achieved				

Outcome 2**Increased availability of technically skilled and qualified local service providers for NFB plants, and enhanced stakeholder knowledge on NFB usage**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
Number of new NFB plants that were designed and constructed by local engineering firms based on new NFB technical guidelines by EOP (This indicator will no longer be tracked, in line with the MTR)	0	<i>(not set or not applicable)</i>	6	This indicator will no longer be tracked, in line with the MTR	(not set or not applicable) This indicator is no longer tracked, in line with the MTR
Number of local firms that can manufacture NFB plant equipment based on set standards developed under this Project	0 (Per the MTR, the baseline was revised for clarity, replacing the original “0” with text) Lack of local technical	<i>(not set or not applicable)</i>	1 local firm able to manufacture NFB plants’ equipment based on set of standards developed under this	0	1 - Thanh Phuc NFB company received support by the project in setting up standard for NFB mould that help improve NFB quality

Outcome 2

Increased availability of technically skilled and qualified local service providers for NFB plants, and enhanced stakeholder knowledge on NFB usage

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
	knowledge on how to manufacture equipment for NFB production lines that can be competed with those internationally produced (quality and price)		project by year 4 (Per the MTR, description was added to the number for clarity)		
Number of building developers and owners used NFBs as building construction material by EOP	0 (Per the MTR, the baseline was revised for clarity, replacing the original “0” with text.) Lack consumer confidence and knowledge on	<i>(not set or not applicable)</i>	300 building developers and owners correctly use NFBs as building construction material by EOP (Per the MTR,	1,536 Target for year 3 is 100	2,115 Number of buildings that use NFBs. Data was formally provided by Department of Construction in 20 provinces on the buildings that used NFBs

Outcome 2**Increased availability of technically skilled and qualified local service providers for NFB plants, and enhanced stakeholder knowledge on NFB usage**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
	using NFB		description was added to the number for clarity)		
Number of visitors to NFB website and facilitation center at VABM by EOP (Per the MTR, this indicator has been replaced with the new indicator “Enhanced technical skills and stakeholder knowledge”, see the MTR for more detail)	0	<i>(not set or not applicable)</i>	1,000	This indicator has been replaced and will no longer be tracked, in line with the MTR	(not set or not applicable) This indicator is no longer tracked, in line with the MTR
Enhanced technical skills and stakeholder knowledge/information	No training has been provided to stakeholders	<i>(not set or not)</i>	By EOP, 21 training courses with	24 training courses In 2017, the project	26 training courses conducted in 2017-2019 with total of over 1,890 people from 63 provinces

Outcome 2

Increased availability of technically skilled and qualified local service providers for NFB plants, and enhanced stakeholder knowledge on NFB usage

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
<p>on NFB associated issues (Per the MTR, this new indicator has been added, replacing the old indicator “Number of visitors to NFB website and facilitation center”)</p>	<p>regarding NFB associated issues; Limited NFB knowledge amongst engineers, designers and building developers; Little or no knowledge amongst construction workers on NFB building techniques and best practices on using NFBs in construction; Low awareness on the advantages and environmental</p>	<p><i>applicable)</i></p>	<p>total of 1500 people from 50 provinces trained on various NFBs’ aspects. Of these:</p> <ul style="list-style-type: none"> • 940 gov and local officers • 121 designers and constructors • 399 NFB investors • 40 people from other related areas <p>2 training courses for 60</p>	<p>conducted 21 training courses with total of over 1,600 people from 63 provinces trained on various NFBs’ aspects.</p> <p>Of these:</p> <ul style="list-style-type: none"> - 1000 governmental and local officers - 130 designers and constructors - 422 NFB investors - 40 people from other related areas 	<p>who were trained on various NFBs’ aspects focusing on 5 key areas.</p> <p>Of these:</p> <ul style="list-style-type: none"> - 1000 governmental and local officers - 270 designers and constructors - 492 NFB investors - 128 people from other related areas <p>5 key training areas are:</p> <ul style="list-style-type: none"> -Module 1: Introduction (Basic knowledge) of NFB, policy and standards; Module 2: Design and Construction of buildings using NFB; Module 3: Production technology of

Outcome 2**Increased availability of technically skilled and qualified local service providers for NFB plants, and enhanced stakeholder knowledge on NFB usage**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
	benefits of NFBs within the construction and building sector in Viet Nam		people from vocational colleges of construction A NFB website developed, maintained and updated regularly		Autoclaved aerated concrete (AAC); Module 4: Production technology of concrete block brick (CBB); and Module 5: Investment planning and capital loan applications for NFB project 2 training workshops: No training is provided to the vocational construction colleges since these colleges no longer provide training to construction workers. <u>Instead, the Project</u> conducted 2 training workshops for 10 construction workers and 10 supervisors as part of activities to develop training documents and demonstrate the use of NFBs in construction work. A website page is available at

Outcome 2**Increased availability of technically skilled and qualified local service providers for NFB plants, and enhanced stakeholder knowledge on NFB usage**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
					http://en.duangachkhongnung.vn/ hosted by VABM (Viet Nam Association for Building Materials)
The progress of the objective can be described as:	Achieved				

Outcome 3

Improved availability and sustained access to financial support for NFB technology applications

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
<p>Number of financing institutions providing financial products for NFB investments by Year 3</p> <p>Per the MTR, the unit was revised:</p> <p>Loan volume provided by financial institutions (Including commercial banks) for NFB investments (m USD)</p>	<p>0</p> <p>Per the MTR, the baseline was updated to</p> <p>A number of financial institutions such as VietinBank, VEPF, NOFOSTED, Green Investment Facility (GIF) have interest in supporting SMEs for NFB investment, however: No dedicated financing for NFB production</p>	<p><i>(not set or not applicable)</i></p>	<p>6</p> <p>Per the MTR, the target was updated to</p> <p>At least U\$24 million provided by financial institutions for NFB production investment by Year 3</p>	<p>24</p> <p>(over target EOP)</p>	<p>US\$ 27.27 million</p> <p>VEPF and VietinBank provided loan volume provided by financial institutions (Including commercial banks) for NFB investments.</p>
<p>Number of SMEs and</p>	<p>0 (Per the MTR, the</p>	<p><i>(not set or</i></p>	<p>10</p>	<p>30</p>	<p>40</p>

Outcome 3**Improved availability and sustained access to financial support for NFB technology applications**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
NFB entrepreneurs with confirmed financing (Per the MTR, this indicator was slightly revised to improve the definition)	baseline was revised for clarity, replacing the original “0” with text) Many potential NFB investors are SMEs who have difficulties in accessing to loans Lack of knowledge and ability of potential SME investors to apply for concessionary financing of NFB Project	<i>not applicable</i>	Per the MTR, the target was revised to 30 NFB SMEs get loans from financial institutions by EOP (10 NFB projects get loan from VEPF and 20 projects get loans from VietinBank)	Over target EOP	12 NFB enterprises got concessional loans from VEPF 28 NFB enterprise got loans from VietinBank
The progress of the objective can be described as:	Achieved				

Outcome 4

Boosted confidence in NFB technology application resulting in an increased market share of NFBs

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
<p>Number of NFB demonstration plants in operation</p>	<p>0 (Per the MTR, the baseline was revised for clarity, replacing the original “0” with text.)</p> <p>As of 2015 there exist more than 1,000 CBB production lines 93% with capacity less than 7 million SBU, 7 % of production line with capacity more than 7 million SBU, total design capacity 5. 6 Billion SBUs); 12 AAC companies (with yearly</p>	<p><i>(not set or not applicable)</i></p>	<p>3 CBB demonstration plants operating at 90% designed capacity by EOP, with cumulative annual production of 65 million SBUs by EOP;</p> <p>1 AAC demonstration plant operating at 90% designed capacity by EOP</p>	<p>3</p> <p>0</p>	<p>3 CBB demonstration project operating at 70% of design capacity, with cumulative annual production of 87.5 million SBUs</p> <p>The operational capacity is lower, due to the greater increase of NFB production compared to the smaller increase in the NFB demand</p> <p>1 AAC demonstration plan operating at 74% design capacity and production output of 103.5 million SBUs</p> <p>The plant has increased the designed production capacity from 100,000m³ to 200,000m³ since November 2018, with technical support by the project in improved EE, production efficiency and optimal mix of inputs materials.</p>

Outcome 4**Boosted confidence in NFB technology application resulting in an increased market share of NFBs**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
	<p>production of about 1.3 million SBUs) but only 4/12 this production lines in operation; and 17 foamed brick companies (with yearly production of 0.12 billion SBUs).</p> <ul style="list-style-type: none">• Most of CBB technologies imported from China are low quality and not satisfied TCVN 4677-2011.• NFB entrepreneurs lack knowledge on the		(Per the MTR, the target was updated)		

Outcome 4**Boosted confidence in NFB technology application resulting in an increased market share of NFBs**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
	production of qualified NFBs, lack of knowledge in designing, constructing, operating and maintaining an NFB plant; <ul style="list-style-type: none">• Very few examples of well-managed and profitable NFB production facilities existed				
Number of AAC facilities with production at a 90% capacity factor by Year 3 (This indicator will no longer be tracked, in line	0	<i>(not set or not applicable)</i>	1	This indicator is merged with the earlier indicator "Number of NFB demonstration plants in operation", in	<i>(not set or not applicable)</i> This indicator is no longer tracked, in line with the MTR

Outcome 4**Boosted confidence in NFB technology application resulting in an increased market share of NFBs**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
with the MTR)				line with the MTR.	
Cumulative annual production of NFBs from 3 NFB demonstration plants in Viet Nam by EOP (SBUs) (This indicator will no longer be tracked, in line with the MTR)	0	<i>(not set or not applicable)</i>	65 million	This indicator has been replaced and will no longer be tracked, in line with the MTR	(not set or not applicable) This indicator is no longer tracked, in line with the MTR
MJ/standard brick unit (energy intensity) of CBB manufacture from demonstration NFB plants by EOP (This indicator will no longer be tracked, in line with the MTR)	3.554	<i>(not set or not applicable)</i>	0.455 (hollow bricks) 0.675 (solid bricks)	This indicator has been replaced and will no longer be tracked, in line with the MTR	(not set or not applicable) This indicator is no longer tracked, in line with the MTR
MJ/standard brick unit (energy intensity) of	3.554	<i>(not set or not applicable)</i>	1.284	This indicator has been replaced and will no	(not set or not applicable) This indicator is no longer tracked, in

Outcome 4

Boosted confidence in NFB technology application resulting in an increased market share of NFBs

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
AAC bricks by EOP (This indicator will no longer be tracked, in line with the MTR)		<i>applicable)</i>		longer be tracked, in line with the MTR.	line with the MTR
<p>Number of NFB plants with feasibility studies completed with assistance of VABM-associated consultants by EOP</p> <p>Per the MTR, this indicator was merged with the below indicator “Number of NFB plants that are planned by EOP” and revised to</p> <p>Number of NFB plants received technical assistance on optimization of raw</p>	<p>0</p> <p>Per the MTR, the baseline was updated to</p> <p>Lack of local technical knowledge on planning, designing, constructing, operating and maintaining an NFB plant</p>	<i>(not set or not applicable)</i>	24 (This assumes an average production rate of 20 million SBUs per CBB plant, and 100 million SBUs per AAC plant. GHG reductions from these potential projects will be counted as direct post-project	<p>10</p> <p>Target for year 3 is 6</p> <p>32</p> <p>Target for year 3 is 10</p>	<ul style="list-style-type: none"> • 22 <p>Target for EOP is 21</p>

Outcome 4**Boosted confidence in NFB technology application resulting in an increased market share of NFBs**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
materials, product quality control procedures, staff training and technology transfer, feasibility studies planned and operated			emissions) Per the MTR, the target was updated to With the project support, it's expected by EOP: <ul style="list-style-type: none">• 21 NFB plants received direct support in development of feasibility studies, optimization of inputs materials, production		<ul style="list-style-type: none">• 53 new NFB production lines of which investment plans were approved

Outcome 4**Boosted confidence in NFB technology application resulting in an increased market share of NFBs**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
			management , quality control, etc. and operated; 50 NFB plants with approved investment plan		
Number of NFB plants that are planned by EOP (Per the MTR, this indicator was merged with the above indicator “Number of NFB plants with Feasibility Studies completed”)	0	<i>(not set or not applicable)</i>	50 (This includes entrepreneurs who have expressed interest to VABM to develop an NFB plant but who will not have	N/A	(not set or not applicable)

Outcome 4**Boosted confidence in NFB technology application resulting in an increased market share of NFBs**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
			completed a feasibility study during the Project; as such, the GHGs from these developments will be counted as indirect (Bottom up replication)		
% of market share of NFBs in the local brick market	13 (This is market share of NFBs in 2011 from MoC and VABM) Per the MTR, the baseline was updated to By the Project	<i>(not set or not applicable)</i>	25 % of the NFB market share in the local brick markets by EOP (Per the MTR, description was added to	18% Target for year 3 is 13%.	28.5% Based on the survey done by the project. The survey covered the installed production capacity, actual production outputs, and consumption of both NFB and FCB of 63 provinces. Data was provided by the Departments of Construction of 63 on annual

Outcome 4**Boosted confidence in NFB technology application resulting in an increased market share of NFBs**

Description of indicator	Baseline level	Midterm target level	End of Project target level	Level at 30 June 2018	Cumulative progress since Project started to Dec 2019
	start, there exist about 70 NFB production facilities, with annually designed capacity of over 4.3 billion SBUs, accounted for 13% of the brick market share in Viet Nam Lack of consumers' confidence in the quality of NFBs limits development of the NFB market in Viet Nam		the number for clarity)		basis during 2016-2020. The market share of NFBs (28.5%) is calculated based on the consumption of NFB against the total consumption bricks estimated for 2019
The progress of the objective can be described as:	On track 17/17 indicators implemented with levels as EOP and 12/17 over target.				

5.2 ANNEX 2: DEMO & REPLICATION PROJECT LIST

N°	Name of Project	Address	Capacity (million SBUs/year)	Date put into operation	Type of technical support	Investment (Billion VND)	CO ₂	TOE
1	Thien Vu Dak Nong NFB Production Plant of Thien Vu Dak Nong Production - Trading Company Limited.	Tam Thang industrial park, Cu Jut district, Dak Nong province	12,5	8-2017	Prepare a feasibility study report and prepare a preferential loan dossier of Vietnam Environment Protection Fund.	13	3 987,79	766,18
2	Investment project on constructing Thanh An unburnt construction material factory of Thanh An Infrastructure Development and Investment Joint Stock Company, Thai Binh province	Trong Quan Commune, Dong Hung District, Thai Binh Province.	50	6-2018	Prepare a feasibility study report and prepare a preferential loan dossier of Vietnam Environment Protection Fund.	47	15 951,18	3 064,70
3	NFB factory and	Bac Cam Xuyen			Prepare a	68,5	35 092,59	6742,34

	commercial BT production, precast concrete components	industrial cluster, Cam Vinh commune, Cam Xuyen district, Ha Tinh province.	60+50	9- 2017	feasibility study report and prepare a preferential loan dossier of Vietnam Environment Protection Fund.			
4	Phase II expansion project of Kien Giang NFB Joint Stock Company, Kien Giang Province	Hon Dat Town, Hon Dat District, Kien Giang Province.	55	4 - 2018	Prepare a feasibility study report and prepare a preferential loan dossier of Vietnam Environment Protection Fund.	30	17 546 30	3 371,17
5	Investment project of Hoang Long construction materials factory of DIC Hanoi Construction Investment and Development Joint Stock Company	Hoang Long Industrial Park, Tao Xuyen Ward, Thanh Hoa City, Thanh Hoa Province	10	7 - 2017	Prepare a feasibility study report and prepare a preferential loan dossier of Vietnam Environment Protection	13,6	3 190,24	612,94

					Fund.			
6	Unburnt brick factory of Bata materials Co., Ltd., Ha Nam province	Bui Mountain, Thanh Son Commune, Kim Bang District, Ha Nam Province	40	4-2017	Optimization of materials proportion to improve the quality and reduce the cost of concrete bricks	45	12 760,94	2 451,76
7	Global NFB Factory of Global Construction Material Joint Stock Company	Tan Son Hamlet, Hoa Son Commune, Luong Son District, Hoa Binh Province	150	7 - 2018	Prepare feasibility study report.	71	47 853,54	9 194,10
8	Anh Duc NFB Factory of Anh Duc-Hai Phong Manufacturing and Trading Co., Ltd.	No. 20, Phuc Hai Residential Group, Street 361, Da Phuc Ward, Duong Kinh District, Hai Phong City	10	10 - 2017	Supporting the development of documents on product standard conformity certification.	3	3 190,24	612.94
9	NFB Plant of Ha Long Joint Venture Joint Stock Company 135	Dong Tam Hamlet, Le Loi Commune, Hoanh Bo District, Quang Ninh Province, Vietnam	44	11 - 2017	Supporting the development of documents on product standard conformity	19	14 037,04	2 696.94

					certification.			
10	NFB factory of Thanh Nhan Co., Ltd., Ha Tinh.	Khe Co industrial cluster, Son Le commune, Huong Son district, Ha Tinh - Company's Office: Block 9, Pho Chau Town, Huong Son District, Ha Tinh Province	30	11 - 2017	Supporting the development of documents on product standard conformity certification.	14,5	9 570.71	1 838.82
11	Vinh Long NFB Factory - Vinh Long Green Material Company Limited.	No. 9, Pham Hung Street, Ward 2, Vinh Long City, Vinh Long Province	08	9 - 2017	Prepare feasibility study report.	3,34	2 552.19	490.35
12	Unburnt brick factory, Dai Dung Green Material Company.	Hiep Phuoc Industrial Park, Hiep Phuoc Commune, Nha Be District, Ho Chi Minh City.	110	9-2018	Support the transfer of heat-curing technology for Concrete bricks with solar energy	180	35 092.59	6742.34
13	Bicons- Binh Duong NFB Factory.	No. 02 Tran Van On, Phu Hoa Ward, Thu Dau Mot, Binh Duong.	55	8 - 2018	Prepare a feasibility study report and prepare a preferential	23	17 546.30	3 371.17

					loan profile of Vietnam Environment Protection Fund.			
14	Invest in building NFB SOMI factory - Quang Binh	Thuan Duc Industrial Cluster, Dong Hoi City, Quang Binh Province. Hop Hai-Kinh Ke industrial cluster, Lam Thao district, Phu Tho province.	15	7 - 2018	Prepare feasibility study report.	10,3	4 785.35	919.41
15	Investment project to build production of NFB and light BT bricks Phu Tho. Belonging to Lam Viet VLKN One Member Co., Ltd.	Thuan Duc Industrial Cluster, Dong Hoi City, Quang Binh Province. Hop Hai-Kinh Shelf industrial cluster, Lam Thao district, Phu Tho province.	- Gạch bê tông = 15	6-2018	Prepare feasibility study report.	21,3	4 785.35	919.41
16	Cao Bang Construction Material Production Joint Stock Company.	Group 8, Ngoc Xuan Ward, Cao Bang City - Cao Bang Province.	35 cho 02 dây chuyền	12-2018	Optimization of materials proportion to improve the quality and reduce the cost of concrete	5,5	11 165.83	2 145.29

					bricks			
17	The project of manufacturing aggregate cement raw materials factory of Tan Phu Xuan Cement Joint Stock Company	Lien Khe Commune - Thuy Nguyen District - Hai Phong City.	32	3- 2018	Prepare feasibility study report.	13	10 208.75	1 961.41
18	Bao Lam Service JSC - Thong Nhat Industrial Park, Hoanh Bo Commune, Ha Long City, Quang Ninh	-Tour 5 zones 4 C-P, Hong Hai, Ha Long City, Quang Ninh	30	12/2018	Prepare feasibility study report.	28,65	9 570.71	1 838.82
19	Factory manufacturing NFB Tan Ky - Tri Ton - An Giang.	An Tuc commune, Tri Ton district, An Giang province.	30	In process	- Prepare feasibility study report. - Completing FS - End of year will report the results.	24,567	9 570.71	1 838.82
20	Son Tay NFB Puzzolan factory.	N° 56, Thanh Vi, Son Lộc Ward, TX. Son Tay, Hanoi.	25	12/2019	- Current status survey - Testing optimum	14,8	7975,59	1532,35

					proportion of samples - Optimize the coordination and technology process. - Technology transfer training			
21	Duc Thuy Construction and Trading Co., Ltd, Thai Binh.	+ No. 51, Area 2, Diem Dien town, Thai Thuy district, Thai Binh + Thai Ha brick factory, Thai Thuy Thai Binh	30	12/2019	- Prepare feasibility study report. - Completing FS - End of year will report the results.	20,1	9 570.71	1 838.82
22	Thinh Dat Construction and Trading Joint Stock Company, Hai Duong.	+ Village 4, Tan Huong commune, Ninh Giang district, Hai Duong + Brick factory: Hamlet 1, Van Phuc commune, Ninh Giang district, Hai Duong.	30	12/2019	- Completing FS - End of year will report the results.	22,2	9 570.71	1 838,82
	Total capacity of 22 factories.		926.5		-	692,057	295 575,35	56 788, 91

1	Luu Xa Cement Factory, Thai Nguyen		40	2016	Prepare a feasibility study report and prepare a preferential loan dossier of Vietnam Environment Protection Fund.	6,7	12 760,94	2 451,76
2	Hong Hoang Hong Joint Stock Company, Hoa Vang, Da Nang.		30	2016	Prepare feasibility study report.	8,6	9 570,71	1 838,82
3	Thanh Phuc Mechanical and Construction Material Joint Stock Company	160 Hoang Quoc Viet, Kien An District, Hai Phong City	55	2016	Prepare feasibility study report.	25	17 546,30	3 371,17
4	Viglacera Autoclaved Aerated Concrete Joint Stock Company, Bac Ninh.	Yen Phong Industrial Zone, Yen Phong District, Bac Ninh	140	2017	+ Auditing technology and energy + Implementing solutions to upgrade technology	135		
	Total of 4 demonstration projects (million SBU)		265			175,35	84 541,25	16 242,91

	Total of 26 Demo demonstration and replication projects		1,191			867,407 billion VND	380,116.60 Tonns CO2	73,031.82 TOE
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5.3 Annex 3 – List of main technical reports and outputs produced by the Project and transferred to relevant stakeholders

No.	Titles of reports/outputs	Agencies/Entity who received the project's products	Date of completion/hand-over
<i>1</i>	<i>Component 1</i>		
1.1	Technical inputs to the drafting of the chapter on green building materials of the Decree No. 24a/2016/ND-CP on the management of building materials which was approved by the Government on 5 Apr 2016	MOC	2016
1.2	Technial report and proposal as inputs on the provisions of NFBMs utilization of the Decree No. 139/2017/ND-CP on administrative sanctions related to construction operations which were approved by the Government on 27 Nov 2017	MOC	2017
1.3	Technical report on using NFBs in the construction projects was submitted to MOC as inputs the drafting of the Circular No. 13/TT-BXD regulating the use of NFBMs for construction works which was approved on 8 Dec 2017	MOC	2017
1.4	Technical report on the domestic manufacturing capacity of NFB equipment line up to 20 milion SBUs provided as inputs to the drafting to the Circular No. 01/2018/TT-BKHDT to remove incentive for imported NFB equipment for production lines of less than 20 million SBUs/year which was approved on 30 Mar 2018	MPI	2018

No.	Titles of reports/outputs	Agencies/Entity who received the project's products	Date of completion/hand-over
1.5	Report on the results of the survey, analysis and assessment of the state of manual brick plants, vertical shaft brick kilns, round kilns, tunnel kilns of 63 provinces/cities across the country	MOC	2016
1.6	Report on summary and evaluation of the development of the roadmap to retire manual brick kilns, improved manual kilns, vertical shaft brick kilns and round kilns in all provinces / cities during the 2013-2015 period	MOC	2016
1.7	Report on the results of issuance of the strategy / planning / policy / roadmap to retire manual brick kilns, to develop technologies for manufacturing NFBs of at least 10 provinces/cities	MOC	2017
1.8	Evaluation report based on prepared criteria with a list of 6 manufacturing companies having the localization level of over 70% and being accepted by the market for equipment lines manufactured by these companies	MOC	2017
1.9	Report on result of supporting Thanh Phuc Company (Hai Phong) to upgrade the technology of annealing NFB mould to improve the quality and reduce the cost compared to the same equipment from China	Consultants & Thanh Phuc Company	2018
1.10	Report on result of supporting Thanh Phuc Company to formulate and announce the quality standard of NFB mould production Jul 2019.	Consultants, Thanh Phuc Company	Jul 2019
1.11	Report on result of supporting Duc Thanh Investment and Technology Company in designing and manufacturing technology of automatic brick machine with the capacity of 80 million bricks/year according to the design of Harex (South Korea). The machine has been tested and put into production lines at Tuy Phuoc NFB Company (Binh Dinh)	R&D TECH HCM City, Duc Thanh Company	Dec 2019
1.12	The proposal of the development of the standards were submitted to MOC and MOST as inputs to the drafting of the TCVN which was adopted by the MOST: i) TCVN 7959:2017	MOC and MOST	2017

No.	Titles of reports/outputs	Agencies/Entity who received the project's products	Date of completion/hand-over
	Lightweight concrete - AAC product - Technical requirements; ii) TCVN 9029:2017 Lightweight concrete - Foam concrete and non AAC products - Technical requirements; iii) TCVN 9030:2017 Lightweight concrete - Test methods		
1.13	Technical proposal and the draft version of 3 TCVNs on AAC wall panels were submitted to MOC and MOST for for approval	MOC and MOST	2019
1.14	Comparison of energy consumption and GHG emissions between concrete brick production and fired brick production in Viet Nam	MOC, MOST	May 2019
1.15	Standards of concrete brick products on energy efficiency and GHG emissions in Viet Nam	MOC, MOST	May 2019
1.16	Report on the Viet Nam's NFBM market development strategy was shared to the VIBM as inputs to the preparation of the Building materials development strategy to 2030 with a vision to 2050" which was submitted to the Prime Minister for approval to increase the proportion of NFBMs to expectedly 40% of the total building materials by 2030	MOST, MOC	Dec 2019
2	<i>Component 2</i>		
2.1	Module 1: Introduction to NFBs, policies and standards	MOC, MOST	2016
2.2	Module 2: Design and construction of buildings using NFBs	MOC, MOST	2016
2.3	Module 3: Production technology of AAC bricks	MOC, MOST	2016
2.4	Module 4: Production technology of concrete block bricks (CBB)	MOC, MOST	2016
2.5	Module 5: Investment planning for NFB projects.	MOC, MOST	2016

No.	Titles of reports/outputs	Agencies/Entity who received the project's products	Date of completion/hand-over
2.6	26 report on results of training courses 2016-2019 on satisfaction level of trainee on training course performances	MOC, MOST	2016-2018
2.7	Technology for manufacturing NFBMs and components. Curriculum used for construction universities and colleges	MOC, MOST, NUCE	Oct 2019
2.8	25 workshops organized across the country with the participation of 2,000 officials of construction companies, architects, builders and buildings, and local construction management officials on advantages of NFBs. These workshops have presented NFB production technology, domestic equipment manufacturing, benefit of using NFB and construction technique.	MOST	2016-2019
2.9	Hard copies of 5 leaflets were distributed (Over 50,000 copies) to 63 provinces and cities to disseminate information about the benefits of NFBs.	MOST, MOC, DOC of 63 provinces	2016-2018
2.10	3000 hard copies of training materials were distributed to 63 provinces and cities to disseminate information and knowledge about NFBs.	MOST, MOC, DOC of 63 provinces	2019.
3	<i>Component 3</i>		
3.1	Report on study of viable financing sources for NFB investments for introduction to NFB investors to get the finance source.	MOST	2016
3.2	Report on technical assistance to 12 enterprises borrowing loans from VEPF	MOST. 12 factories	2017-2018
3.3	Technical inputs to the drafting of the regulations on application and procedures for loan	VEPF, MOST	2016

No.	Titles of reports/outputs	Agencies/Entity who received the project's products	Date of completion/hand-over
	guarantee from the VEPF		
3.4	Technical inputs to the drafting of the regulations on application and procedures for loan guarantee from the NAFOSTED	NAFOSTED, MOST	2016
4	<i>Component 4</i>		
4.1	1 report on criteria for evaluating the technological level of NFB production equipment/line	MOST	2016
4.2	1 report on selection criteria of a feasible demonstration project on NFB production line	MOST	2016
4.3	3 feasibility reports for NFB production projects which are eligible for investment bank loans	MOST, 3 factories	2016
4.4	3 consultancy reports on NFB production equipment procurement, installation supervision, operation instruction and acceptance	MOST, 3 factories	2016
4.5	3 M&E reports on trial operational results	MOST, 3 factories	2016
4.6	3 workshops to present the results of 3 demonstration projects with the participation of 450 representatives	MOST, 3 factories	2016
4.7	3 leaflets on results of 3 demonstration projects	MOST, 3 factories	2016
4.8	1 energy audit report with 3 most feasible solutions selected for the plant	Viglacera, MOST	2017
4.9	1 report on technical design and an investment project with 3 selected technical solutions	Viglacera, MOST	2017
4.10	1 M&E report on results of 3 energy efficiency solutions	Viglacera, MOST	2018

No.	Titles of reports/outputs	Agencies/Entity who received the project's products	Date of completion/hand-over
4.11	1 audit report on production technology with proposed production technology solutions for upgrading	Viglacera, MOST	2017
4.12	1 report on research results of material mix using waste and fly ash of Pha Lai Thermal Power Plant	Viglacera, MOST	2018
4.13	Lectures for technical staff and supervisors on CBBs building technique	MOC, MOST, IBST	2018
4.14	Lectures for building workers on CBB building technique	MOC, MOST, IBST	2018
4.15	Video script to train on CBB building technique	MOC, MOST, IBST	2018
4.16	Lecture video on CBB building technique	MOC, MOST, IBST	2019
4.17	Report on evaluation of the effectiveness of using NFBMs for construction works	MOC, MOST, IBST	2019
4.18	22 reports on the results of the implementation of 22 replication projects with a total design capacity of 926.5 million of SBUs/year	22 factories and MOST	2017-2019
4.19	Strategy and plan on communication and awareness raising to promote the Government's NFBMs development program	MOST, MOC	2017
4.21	International Conference on "Science and technology of building materials for sustainable development" with the participation of more than 300 researchers, scholars, experts and policy	MOC, VIBM	2019

No.	Titles of reports/outputs	Agencies/Entity who received the project's products	Date of completion/hand-over
	makers from about 15 countries in the world. About 30 television and newspaper agencies have published more than 30 news, articles and reports on the event		
4.22	Proceedings of the Building Materials Forum 2019 and the event “Honour the best practices in the production and utilization of NFBMs”, 51 enterprises were honoured for their best practices	MOST, VABM	2019
4.23	4 video clips including: Introduction of NFBs, Benefits of NFBs, Construction and acceptance of works using NFBs, Talk show about NFBs	MOST, MOC	
4.24	Copies of 50,000 leaflets and posters on the benefits of using NFBs has been provided to 63 provinces and cities	63 DOCs of Provinces	2017-2018
4.25	42 thematic articles (31 Vietnamese articles, 11 English articles), 39 news about the Project's activities (31 Vietnamese news and 08 English news); broadcasted news on Voice of Viet Nam (VOV) including 05 news about the Project's activities and 02 thematic reports.	Centre for Communication, MOST	2018-2019