

**COMPETENCY-BASED
TRAINING (CBT)
PROGRAMME
OCCUPATIONAL
STANDARDS FOR BIOGAS
TRAINING FOR ARTISANS
NATIONAL PROFICIENCY II**

PREAMBLE

The Ghana National Cleaner Production Centre (GNPCPC) received funding from the European Union (EU) through the United Nations Environment Programme (UNEP) under the SWITCH Africa Green Programme to implement the project Promoting Biogas Technologies. The project as part of its implementation developed a curriculum for the training of artisans in the construction of a biogas plant. The Centre camped a team of experts from the GNPCPC, Energy Commission and Council for Technical and Vocational Education and Training (COTVET) and consultants to develop the curriculum and training materials for approval and accreditation by the Council for Technical and Vocational Education and Training (COTVET). This will be nationally recognised as a curriculum for training in biogas construction in Ghana.

The Council for Technical and Vocational Education and Training (COTVET) was established by ACT 718 of August 2006 to co-ordinate and oversee technical and vocational education and training in Ghana. The Industrial Training Advisory Committee (ITAC) which is the COTVET's standing committee is charged to oversee the development of Occupational Standards for the development of Competency-Based Training Programmes has been involved in the generation and validation of this occupational standards to make sure that the procedures used meet the requirement for registration on the National Technical Vocation Education Training Qualification Framework (NTVETQF).

Occupational Standards are the relevant sets of knowledge, skills, attitudes and values that have to be acquired by the CBT learner to make him/her work effectively at a particular level on the National TVET Qualification Framework (NTVETQF) in a chosen trade or occupation.

ACKNOWLEDGEMENTS

The Ghana National Cleaner Production Centre (GNPCPC) wishes to express their appreciation to the European Union for funding this project and the UN Agencies i.e. UNEP, UNOPS and the UNDP for all the support they have given the Centre for a successful implementation. The team from the Centre, led by Ing. Daniel Digber (Project Manager) with Mr. Edmund Owusu-Nyarko worked tirelessly The GNPCPC would like to express their appreciation to the Environmental Protection Agency and the Ministry of Environment Science Technology and Innovation for the support the Centre has received from them. The Centre would also like to express their appreciation to the Energy Commission and John Afari Idan of the Biogas Technologies Africa Limited for the support and the input they have made in the implementation of the project. The Centre would like to deeply appreciate the following members for their active involvement towards the development of Biogas Technology Occupational Standards for the CBT programme. The Centre wishes to thank Mr. David Prah a Quality Assurance Officer and Mr. Sampson Damptey, Director of

Competency Based Training at COTVET for the support in the development of this curriculum. The generation of this occupational standard would not have been possible without their help and dedication.

Approval of Validated Occupational Standards

The Industrial Training and Advisory Committee (ITAC) of the Council for Technical and Vocational Education and Training (COTVET) has approved the validated occupational standards on the February 25, 2016. These approved occupational standards will be used to develop the learning packages for the construction of biogas plant at the Level II of the National TVET Qualification Framework leading to National Proficiency II on the framework.

Life span of the approved occupational standards

In order to keep pace with changes in the Construction of Biogas plant industry and to make the standards relevant to the changing skills needs of the industry, these validated standards are approved for a period of five years and **must not** be used after December 2021.

List of persons who were involved in the generation of the Occupational Standards

Name	Organisation/Institution	Designation	Contact
Ing. Daniel Digber	Ghana National Cleaner Production Centre	Programme Officer	0501301514
Ms. Dorothy Adjei	Energy Commission	Programme Officer (Bioenergy)	0207609808
Dr. John Afari Idan	Biogas Technologies Africa Limited	Chief Executive Officer	0244461959
Dr. Henry Akplu	Private Consultant	Educationist/Senior Lecturer	0202856748

The table below provides list of sampled companies visited for standards generation.

SAMPLED COMPANIES VISITED FOR STANDARDS GENERATION			
Name	Name of Company	Division	Telephone
Dr. John Afari Idan	Biogas Technologies Africa Limited	Chief Executive Officer	0244461959
Mr. Moses Pumpuni	VULPEC Ghana Ltd	Managing Director	0244838674

List of persons who were involved in the validation of the Occupational Standards

Name	Organisation/Institution	Designation	Contact
Dr. Elias Aklaku	Biogas Engineering Ltd	Chief Executive Officer	0208138451
Mr. Lambert Faabeluon	Ghana National Cleaner Production Centre	Acting Director	0501301406
Dr. Kwame Ampofo	Energy Commission	Board Chairman	0243312497
Rev. Dr. Ing. Eric Ankrah	ITAC, COTVET, Institution of Engineering and Technology	Chairman	0244678644
Mr. Theophilus Zogblah	COTVET	Coordinator, Occupational Standards	0501297934
Mr. Sampson Dampsey	COTVET	Director, Competency Based Training	0242027262
Mr. David Prah	COTVET	Quality Assurance Officer	0243536617
Mr. Samuel Love K. Doe	Technical Examinations Unit, Ghana Education Service	Head Test Development	0208466677

GENERATED OCCUPATIONAL STANDARDS FOR BIOGAS TECHNOLOGY

NATIONAL PROFICIENCY II

	General Area of Competence (Duty Area - Unit)	Skills (LO)	Sub-Skills (Performance Criteria)
1.0	Basic principles and development of biogas technology	1.1 Demonstrate knowledge of the concept of biogas technology	1.1.1 Explain biogas 1.1.2 State the uses of biogas 1.1.3 State the composition of biogas 1.1.4 Describe the basic biogas technology 1.1.5 Describe the biogas plant 1.1.6 State conditions that affect proper functioning of a biogas plant
		1.2 Demonstrate knowledge of types of biogas plants/digesters	1.2.1 List the various types of biogas digesters. 1.2.2 State the basic components of the various types of biogas plant 1.2.3 State the functions of the basic components of the various types of biogas plant 1.2.4 State the basic difference between a biogas plant and a septic tank

		<p>1.3 Demonstrate knowledge of the benefits and barriers of biogas technology use</p>	<p>1.3.1 Explain health and sanitation benefits of biogas technology</p> <p>1.3.2 Explain environmental benefits of biogas technology</p> <p>1.3.3 Explain social benefits of biogas technology</p> <p>1.3.4 Explain economic benefits of biogas technology</p> <p>1.3.5 Explain possible barriers to biogas technology use</p>
		<p>1.4 Demonstrate knowledge of policy and regulatory frameworks on biogas technology</p>	<p>1.4.1 Explain policies, strategies and regulatory frameworks on biogas technology</p> <p>1.4.2 List the policies or regulatory requirements in Ghana for the biogas technology in the energy sector</p> <p>1.4.3 Mention the environmental regulations for biogas development</p> <p>1.4.4 Explain the implications of the policies and regulations on biogas technology in Ghana</p>
2.0	Health, Safety and Environment	<p>2.1 Demonstrate knowledge in health, safety and environment (HSE) in the construction of a fixed-dome biogas plant for brick layers</p>	<p>2.1.1 Define health, safety and environment for fixed-dome biogas construction</p> <p>2.1.2 Identify the health, safety and environmental measures in the</p>

			<p>construction of a fixed-dome biogas plant</p> <p>2.1.3 Demonstrate the use of the various health, safety and Personal Protective Equipment(PPEs)</p> <p>2.1.4 State accidents that can occur for not observing HSE measures.</p> <p>2.1.5 Demonstrate adherence to HSE measures in the construction of a fixed-dome biogas plant</p>
		2.2 Demonstrate knowledge in the health, safety and environment (HSE) in the construction of a biogas plant for carpenters	<p>2.2.1 Define health, safety and environment for fixed- dome biogas construction</p> <p>2.2.2 Identify the health, safety and environment measures in the construction of a fixed-dome biogas plant</p> <p>2.2.3 Demonstrate the use of the various health, safety and environment Personal Protective Equipment(PPEs)</p> <p>2.2.4 States accidents that can occur for not observing HSE measures.</p> <p>2.2.5 Demonstrate adherence to HSE measures in the construction of fixed-dome biogas plant</p>
		2.3 Demonstrate knowledge in the health, safety and environment (HSE) in the construction of a biogas plant for steel bender	<p>2.3.1 Define health, safety and environment for fixed-dome biogas construction</p> <p>2.3.2 Identify the health, safety and environment measures in the construction of a fixed-dome biogas plant</p>

			<p>2.3.3 Demonstrate the use of the various health, safety and environment Personal Protective Equipment(PPEs)</p> <p>2.3.4 States accidents that can occur for not observing HSE measures</p> <p>2.3.5 Demonstrate adherence to HSE measures in the construction of a fixed-dome biogas plant</p>
		<p>2.4 Demonstrate knowledge in the health, safety and environment (HSE) in the construction of a biogas plant for plumber</p>	<p>2.4.1 Define health, safety and environment for fixed-dome biogas construction</p> <p>2.4.2 Identify the health, safety and environment measures in the construction of a fixed-dome biogas plant</p> <p>2.4.3 Demonstrate the use of the various health, safety and environment Personal Protective Equipment(PPEs)</p> <p>2.4.4 States accidents that can occur for not observing HSE measures.</p> <p>2.4.5 Demonstrate adherence to HSE measures in the construction of a fixed-dome biogas plant</p>
3.0	<p>Construction and installation of biogas digester base for brick layers</p>	<p>3.1 Demonstrate understanding in tools and equipment for the construction of a fixed-dome biogas plant</p>	<p>3.1.1 Identify the tools and equipment for the construction of a fixed-dome biogas digester plant</p> <p>3.1.2 State the use of the different tools and equipment for the construction of of a fixed-dome biogas plant</p> <p>3.1.3 Care and maintain the tools and equipment for the construction of a fixed-dome biogas plant</p>

			3.1.4 Store the tools and equipment for the construction of a fixed-dome biogas plant
		3.2 Demonstrate understanding in materials for constructing a fixed-dome biogas plant	<p>3.2.1 Identify the appropriate materials for the construction of a fixed-dome biogas plant</p> <p>3.2.2 Describe the characteristics of the various materials required for the construction of a fixed-dome biogas plant</p> <p>3.2.3 State the uses of the various materials in the construction of a fixed-dome biogas plant</p> <p>3.2.4 Measure materials for the construction of a fixed-dome biogas plant</p> <p>3.2.5 Use the materials for construction of a fixed-dome biogas plant</p>
		<p>3.3 Demonstrate understanding of the construction of a fixed-dome bio-digester base</p> <p>** There are other types of biogas digesters and can be treated as electives</p>	<p>3.3.1 Dig the foundation ring</p> <p>3.3.2 Cast the foundation slab</p> <p>3.3.3 Lay the bricks to the fourth course</p> <p>3.3.4 Fix the outlet pipe</p> <p>3.3.5 Lay the remaining bricks to the weak ring level</p> <p>3.3.6 Plaster the exterior part of the digester base</p> <p>3.3.7 Fill the back of the digester base with the appropriate material</p>

4.0	Construction and installation of the dome of a fixed-dome biogas plant for brick layers	4.1 Demonstrate understanding of the construction of the dome of a fixed-dome biogas digester	4.1.1 Cast the weak ring concrete 4.1.2 Fix a wire mesh and inlet pipe on the weak ring 4.1.3 Lay three courses of bricks above the weak ring 4.1.4 Fold wire mesh around the three courses 4.1.5 Cast concrete reinforcement 4.1.6 Lay the remaining blocks to complete the dome leaving an opening of 60cm.
		4.2 Demonstrate understanding of plastering the biogas digester	4.2.1 Mix the mortar for plastering 4.2.2 Plaster the inside of the base of the digester 4.2.3 Plaster the inside of the gas dome 4.2.4 Plaster the outside of the gas dome
		4.3 Demonstrate understanding and construction of the gas neck	4.3.1 Lay three course anchored brick 4.3.2 Plaster the neck 4.3.3 Carry out clay works 4.3.4 Fix the cone appropriately
5.0	Installation works for plumbers in the construction of a fixed-dome biogas plant	5.1 Demonstrate knowledge in tools and equipment for the construction of a fixed-dome biogas plant	5.1.1 Identify the tools and equipment for plumbing works in the construction of fixed-dome biogas plant 5.1.2 State the uses of the tools and equipment for plumbing works in the construction of fixed-dome biogas plant 5.1.3 Demonstrate how to care and maintain the tools and equipment for plumbing works in the construction of a fixed-dome biogas plant 5.1.4 demonstrate how to store the tools and equipment for plumbing works in

			the construction of a fixed-dome biogas plant
		5.2 Demonstrate knowledge in materials for constructing a fixed-dome biogas plant	<p>5.2.1 Identify the appropriate materials for the construction of a fixed-dome biogas plant</p> <p>5.2.2 Describe the characteristics of the various materials required for the construction of a fixed-dome biogas plant</p> <p>5.2.3 State the uses of the various materials in the construction of a fixed-dome biogas plant</p> <p>5.2.4 Demonstrate the use of the various plumbing materials</p>
		5.3 Demonstrate understanding in the sequence for plumbing works in the construction of a fixed-dome biogas plant	<p>5.3.1 Set up working bench</p> <p>5.3.2 Locate the layout of the pipe network</p> <p>5.3.3 Measure and prepare materials</p> <p>5.3.4 Lay the pipes to the end use</p>
6.0	Installation works for steel-benders in the construction of a fixed-dome biogas plant	6.1 Demonstrate knowledge in tools and equipment for the construction of a fixed-dome biogas plant	<p>6.1.1 Identify the tools and equipment for steel-bending works in the construction of a fixed-dome biogas plant</p> <p>6.1.2 State the uses of the tools and equipment for steel-bending works in the construction of a fixed-dome biogas plant</p> <p>6.1.3 state how to care and maintain the tools and equipment for steel-bending</p>

			works in the construction of a fixed-dome biogas plant 6.1.4 Store the tools and equipment for steel-bending works in the construction of a fixed-dome biogas plant
		6.2 Demonstrate knowledge in materials for constructing a fixed-dome biogas plant	6.2.1 Identify the appropriate materials for the construction of a fixed-dome biogas plant 6.2.2 Describe the characteristics of the various materials required for the construction of a fixed-dome biogas plant 6.2.3 State the uses of the various materials in the construction of a fixed-dome biogas plant 6.2.4 Demonstrate the use of the materials
		6.3 Demonstrate understanding in the sequence for steel bending works in the construction of a fixed-dome biogas plant	6.3.1 Set up the materials for the steel bending works 6.3.2 Determine the layout for the steel bending works 6.3.3 Measure the various sizes of steel for the work 6.3.4 Cut the steel to the various sizes required 6.3.5 Fix the materials together
7.0	Construction works for carpenters in the installation of	7.1 Demonstrate knowledge in tools and equipment for the construction of a fixed-dome biogas plant	7.1.1 Identify the tools and equipment for carpentry works in the construction of affixed-dome biogas plant 7.1.2 State the uses of the tools and equipment for carpentry works in the

	a fixed-dome biogas plant		<p>construction of a fixed-dome biogas plant</p> <p>7.1.3 Demonstrate how to care and maintain the tools and equipment for carpentry works in the construction of a fixed-dome biogas plant</p> <p>7.1.4 Store the tools and equipment for carpentry works in the construction of a fixed-dome biogas plant</p>
		7.2 Demonstrate knowledge in materials for constructing a fixed-dome biogas plant	<p>7.2.1 Identify the various materials for the construction of a fixed-dome biogas plant</p> <p>7.2.2 Describe the characteristics of the various materials required for the construction of a fixed-dome biogas plant</p> <p>7.2.3 State the uses of the various materials in the construction of a fixed-dome biogas plant</p> <p>7.2.4 Demonstrate the use of the materials</p>
		7.3 Demonstrate understanding in the sequence for carpentry works in the construction of a fixed-dome biogas plant	<p>7.3.1 Measure the pieces of wood to the required sizes</p> <p>7.3.2 Cut the pieces of wood to the required sizes</p> <p>7.3.3 Join the pieces of wood together</p> <p>7.3.4 Brace the various pieces together</p>
8.0	Biogas business development	8.1 Demonstrate knowledge in assessing business opportunities for biogas	<p>8.1.1 Explain business opportunities</p> <p>8.1.2 Explain market survey</p> <p>8.1.3 Explain purpose of market survey</p> <p>8.1.4 Describe how to conduct a simple market survey for biogas</p>

			8.1.5 Conduct a simple market survey for biogas uptake in the community
		8.2 Demonstrate the understanding in the preparation of a simple business plan for biogas	8.2.1 Explain a business plan 8.2.2 Explain the purpose of a business plan. 8.2.3 Outline the main parts of a simple business plan 8.2.4 Prepare simple financial estimates for the biogas business 8.2.1 Prepare a simple business plan for biogas
		8.3 Demonstrate knowledge in mobilizing resources for start-up	8.3.1 Identify potential sources of resources needed for start-up. 8.3.2 Prioritize resource needs for start-up. 8.3.3 Describe strategies for mobilizing resources from various sources at minimum cost.
		8.4 Demonstrate knowledge for the Implementation of a business plan	8.4.1 Prepare simple written agreement for the formation of a partnership 8.4.2 Locate the biogas business 8.4.3 Register business with appropriate authorities. 8.4.4 Advertise for customers in biogas construction and installation business.