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Javier presents at Oxford, United Kingdom

Dr. Marie Melanie J. Javier , a professor from the Department of Languages, Mass Communication and Humanities and the College of Education Graduate Studies, presented a research paper in the Oxford Women's Leadership Symposium on August 5-7, 2015. This was held at the Margaret Thatcher Centre, Somerville College, Oxford University, England, United Kingdom. Dr. Javier is the primary author of the study "A Gender-based Demography of a Most-at-Risk Population (MARP) of the Philippines" while Dr. Maria Jade Opulencia of the Canadian University of Dubai is the secondary author. The study specifically focused on Commercial Sex Workers (CSWS) as a part of a population at risk of acquiring AIDS. It re-aggregated the six demographic characteristics of age, educational attainment, civil status, number of children, vocational training and migration

behaviour according to gender. The findings of this research, together with the other papers presented in the symposium aimed to highlight the marginalized experiences of women around the world and consequently improve policies and practices to make them gender equitable.

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Dr. Reynaldo N. Dusaran in Center for Rural Development

Dr. Reynaldo N Dusaran, Director of the University Research Center joined the preparation phase of the study, "Improving Market Access of Smallholder Rice Farmers in the Philippines" at the Center for Rural Development (SLE) in Humboldt University-Berlin, Germany last June 13-18, 2015. This study was implemented as a support project to Better Rice Initiative Asia (BRIA-FARMERS) in collaboration with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the International Rice Research Institute (IRRI), Department of Agriculture, Agricultural Training Institute, PhilRICE and private sectors. The objective of the study is to develop implementation strategies for the BRIA project "to improve the market access for smallholder rice farmers".

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In particular, Dr. Dusaran together with Dr. Aurora Corales of the Philippine Rice Research Institute (PhilRice) participated in meetings and workshops on the module, "Planning and Execution of Action- and Decision-Oriented Research" to jointly prepare the collaborative study at SLE Berlin. The data gathering for this will be in Iloilo and Central Philippine University will play host for the team Headed by Dr. Ekkehard Kürschner and five other members. The team is expected to be here in the University from August 9 to October 3, 2015. The team will be supported by five CPU graduate student partners in their field work. The Research Team will be conducting interviews with government officials, barangay and municipality (LGU) representatives, farmers, millers, agents, traders, retailers and other concerned stake-

Dr. Javier…. From page 1

In this symposium, presenters came from universities and government agencies from the United States of America, United Kingdom, United Arab Emirates, Israel, Pakistan, Czech Republic, Cyprus, Taiwan and Macau. Dr. Javier was the lone presenter from the Philippines.

Currently, Dr. Javier is also the Coordinator for the CPU Open University.

Dusaran and three others attend the AUDRN international conference

The Asian University Digital Resource Network (AUDRN) celebrated its 6th year with an international conference on local knowledge amidst the challenges of the ASEAN integration initiative that is expected to impact member nations by the end of 2015. This was held last July 23-25, 2015 at the University of St. La Salle, Bacolod City, Negros Occidental. This was participated by Dr. Reynaldo N. Dusaran, Dr. Margen A. Java, Prof. Janet P. Jaco and Mr. Edwin Laru-an as participants while Rev. Joniel Howard H. Gico attended the meeting of the Board of Directors in behalf of the president. Meanwhile Dr. Irving Domingo L. Rio, presented their paper on local knowledge "Conflict Resolution among the Indigenous People in Central Panay" in one of the parallel sessions on July 24.

This conference, through the different speeches and sessions, raised important issues and discussed challenges affecting students, teachers and academic institutions in their pursuit of opportunities to competitively engage and actively contribute to the global economy and a more integrated international community. This meeting of minds also emphasized the need for the integration of local knowledge in the academic curriculum and the matter of building national identity and pride as well as creating an ASEAN socio-cultural community in the face of this regional integration.

Dusaran Attended CARES-M&D

Dr. Reynaldo N. Dusaran, URC Director, attended the Capacity-Building of Research Institutions and Personnel on Migration and Development (CARES-M&D) in Maria Paz Royale Resort, San Pablo City, Laguna last September 8-9, 2015. CARES-M&D is a joint undertaking of the Scalabrini Migration Center, the Migration and Development Network, the Regional Development Council IV-A and the Laguna State Polytechnic University, with the support of the Joint Migration and Development Initiative (JMDI).

The 2-day activity have the following objectives: 1) To build the capacity of academic institutions and research personnel in the regions, particularly those in the JMDI sites, to conduct migration-related researches; 2) To strengthen academic institutions as a key stakeholder in migration and development discussions and actions in the regions; and 3) To encourage partnership between academic institutions and LGUs in researched-based policy-making, developing programs, and monitoring and evaluation.

The topics/activities included The JMDI Global Programme and the CARES-M&D Activity, Overview of the Capacity-Building Programme, International Migration: An Introduction to Migration-Related Concepts, the Multi-Level Governance of Migration and the Philippine Experience, International Migration and Development in the Philippines, Mapping of Existing Research on Migration and Development, Migration Research: Key Issues to Consider, Using Existing Data Sets: Possibilities and Limitations, Migration Journals and Other Dissemination Strategies and Identifying Research Priorities.

Region VI was represented by personnel from the National Economic and Development Authority (NEDA), Provincial Planning and Development Office (PPDO) of the Province of Iloilo, Central Philippine University (CPU), Uni-

CPU is once again the CSIS partner LRI

Central Philippine University is once again the partner Local Resource Institution for Citizen Satisfaction Index System (CSIS) this 2015. The area this time is Passi City. The CSIS, newly developed initiative of the Department of the Interior and Local Government, is an assessment tool designed to collect and generate relevant citizen's feedback on local governments' service delivery performance from the point of view of citizens as recepients. It covers service delivery areas such as education, health, social services, peace and order, environmental management, good governance and civil society participation.

Passi City has been chosen as one of the target cities of the CSIS this year and the only one in the province of Iloilo. CPU has been chosen to be the partner LRI for its track record in the last 2 years on the implementation of the CSIS in the City of Iloilo. As partner LRI, CPU is responsible for the fieldwork implementation which include data gathering, data processing and preparation of required reports.

The Project Coordinator is the director of the University Research Center, Dr. Reynaldo N. Dusaran, being supported by two field supervisors in the persons of Dr. Margen A. Java and Prof. Carolyn L. Yoro, both members of the University Research Committee (URESCOM). They were helped by 10 field interviewers who are Bachelor of Science in Agriculture graduates of Iloilo State College of Fisheries (ISCOF), San

Enrique Campus. The orientation and meeting with the Passi City Mayor as well as the orientation and briefing on the conduct of the CSIS with the field interviewers was conducted last June 29, 2015. In spite of the inclement weather, the survey followed immediately from June 30 to July 12, 2015 in the selected 30 barangays of the City. The respondents and how the households were selected by the field interviewers were backchecked by the field suprvisors and the project coordinator. The data collected were processed by the data processor, Ms. Ligaya Villarias-Caniel, the secretary of the University Research Center.

URC targets to finalize research report form and style guidelines

A Seminar-Workshop on Research Report Form and Style was called for with the objective to finalize the guidelines for the University Research Report Form and Style. Research teachers and advisers completing an attendance of 34, participated in the seminar-workshop held on August 28, 2015 at the Knowledge for Development Center (KDC), Henry Luce III Library.

A review and discussion of the General Guidelines, Documenting Resources and Structure and Format of Reference Lists were among the topics in the seminar-workshop.

Deemed significant in this seminar-workshop is to present, discuss and revise the present research report form and style guidelines and come up with a University Research Report Form and Style which will be used by research teachers and advisers of the University.

This endeavor is a target goal of the University Research Center (URC) and is on its evaluation and approval stage at present.

URC extends technical advise

Technical advise from the University Research Committee (URESCOM) has been extended almost every school year upon request from the Sta. Barbara National Comprehensive High School-Special Science Class.

Dr. Ilda G. Borlongan, Engr. Aries Roda D. Romallosa, Prof. Hope G. Patricio, Engr. Ramon A. Alguidano, Jr., Engr. Bernie C. Cangrejo and Engr. Caesar Rico S. Acanto joined the pool of panelists during the final defense of the SSC student researches.

These researches, upon revision based on the advise and suggestions of the panelists, are submitted as entries for the Division Level Competitions.

The following researches won in the Division and Regional Levels:

1. Design, Construction and Evaluation of Improvised Desalinator (First Place, Division Level, Regional Qualifier)
2. Improvised Distillation Unit for the Conversion of Plastic to Fuel (First Place, Division Level, Third Place, Regional Level)
3. Portable Wind Operated Mini Gadget Charger (First Place, Division Level, Fourth Place, Regional Level)
4. Improvised Muffler Filter on Public Utility Jeepneys (Second Place, Division Level, Second Place, Regional Level)

Four of their researches made it as Fourth Placers in their respective categories, three researches were included in the top 6 and one won the Best Poster.

"Education is not the learning of facts, but the the training of the mind to think."

Albert Einstein

Dusaran Attended AUDRN Teambuilding and Planning Workshop

Dr. Reynaldo N. Dusaran, URC Director, as the Coordinator for the Asian Universities Digital Resource Network (AUDRN) attended the network's Teambuilding and Planning Workshop with the theme: Revitalizing Our Shared Mission, in Marco Polo Hotel, Davao City last September 1-3, 2015. For its mission, AUDRN commits to enhancing the capacity of Asian higher education institutions in rediscovering, documenting, co-creating and sharing local knowledge using digital tools. The meeting was hosted by the Ateneo de Davao University and supported by Ateneo de Zamboanga University and Fr. Saturnino Urios University.

The 3-day activity hopes to achieve the following objectives: 1) Cherish and affirm the uniqueness and commonalities of colleagues in AUDRN; 2) Deepen bonding and camaraderie among new and current colleagues; 3) Be inspired to work professionally and strengthen commitment to AUDRN; and 4) Plan for SY 2015-2016 programs and activities.

Activities included teambuilding sessions, planning for UBCHEA funded projects (mother tongue primary education, contextualized senior high school, revitalized GE curriculum of higher education), presentation of funded projects; grouping of schools who will work on each project and planning for other activities – program niche, pool of experts, new or revised name of AUDRN, theorizing LK, graduate programs on LK (master and PhD), and #USWAG.

Among others, the planning workshop suggested the need to hold a coordination meeting of the different point persons for each United Board funded project, namely, the (1) mother tongue-based primary education, (2) contextualized senior high school, and the (3) revitalized general education curriculum of higher education. The Coordination meeting was scheduled on September 18, 2015 at Miriam College, Diliman, Quezon City.

University Research and Outreach conduct joint planning

Before the academic year 2015-2016 started, a joint planning workshop for the University Research and Outreach was conducted. This strategy aimed to review and revitalize the programs and activities of both centers.

The joint planning-workshop included the presentation and review of research outputs for outreach considerations. Assessment of needs for both centers as well as of the Outreach partner institutions were discussed and researchable areas in outreach were identified.

Dr. Reynaldo N. Dusaran, Director of URC presided the session for the University Research Committee Members and Prof. Levi O. Delos Santos, Jr., Director of the University Outreach Center led the Outreach Committee Members in revisiting the Outreach Process and also presented the Center's Accomplishment Report. The afternoon session of

The University Research Committee

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URC pushes for more faculty researches

Fifty-four faculty representing the colleges and departments of the University attended the Seminar-Workshop on Research Proposal Preparation. Some of these faculty members are in the process of completing their research proposals while the others are interested to come-up with their research proposals.

Among the topics discussed in the said seminar-workshop are: 1) Research Agenda and Proposal Format, 2) Problem Identification, 3) Objectives and Hypotheses, 4) Research Methods, and 5) Zotero-Referencing of which Dr. Florence P. Bogacia, Vice President for Finance & Administration was the speaker. Other speakers of the seminar-workshop were Dr. Reynaldo N. Dusaran, URC Director, Prof. Carolyn L. Yoro and Prof. Janet P. Jaco.

The workshops given after the discussion of the aforementioned topics target to produce a draft of a research

proposal which could be submitted to the University Research Center for evaluation. The seminar-workshop commenced on the 20th of August at the Knowledge for Development Center (KDC), Henry Luce III Library.

Research and Outreach joint planning... From page 5

The University Outreach Committee

the first day also included the URC director's report on the URC updates followed by a review of the URC guidelines in the Operations Manual.

Day 2 of the joint planning workshop included the following undertakings: 1) Strengthening of the Research Agenda; 2) Identification of Sub-Committees; 3) Action Plan (Forum on Research Publication) and future plans of action.

The Outreach Committee on the other hand also had their Action Planning for the afternoon session.

"And we know that for those who love God ALL things wokr together for good, for those who are called according to HIS purpose."

Romans 8:28 (ESV)

CPU STUDENTS'AWARENESS OF, ATTITUDE TOWARDS, AND INVOLVEMENT IN THE SPIRITUAL PROGRAMS OF THE UNIVERSITY AND THEIR PERCEIVED IMPACT ON THEIR LIVES

Alberto A. Java and Margen A. Java

ABSTRACT

Paper presented during the 12th Research & Development Week, 16th CPU Faculty Research Symposium (March 6, 2015)

This study was conducted to determine the students' awareness of, attitude towards, and involvement in the spiritual programs of the university and their perceived impact on their lives. The one-shot survey was used in the collection of data among the 292 graduating college students in 2010. Data collected were processed and analyzed using Statistical Package for Social Sciences (SPSS). For the descriptive part, the major variables were described using frequency distribution and percentages. The z-test was used to determine significant differences between variables and Chi-square and Cramer's V were used to determine the relationship between specified variables. Results of the study showed that the respondents are generally female, aged 20 years old and younger, belong to the Colleges of Nursing and Business and Accountancy, graduates of public high schools located either in the cities or towns and living with their parents or staying in boarding houses while studying at CPU. The University Church, respective College of the respondents, Department of Religion and Ethics, College of Theology, and, Chaplain's Office were the offices that offer spiritual programs as perceived by students. Bible study, Christ Emphasis Week Convocations and Devotionals are the major spiritual programs done by the University. Emergency Response Team, CPU Pastor's Kids, Campus Crusade for Christ, Student Nurses Association of the Philippines, and, Campus Bible Fellowship are the campus organizations which help the students in their spiritual life. The respondents' awareness of spiritual programs is determined by their sex, age, and college to which they belong. The students have favorable attitude towards the spiritual programs of the university in all areas, namely, role of faculty and staff, role of religious activity, necessity of the program and role of CPU as a whole. Irrespective of their sex, age, college, type and location of high school where they graduated and living arrangement while studying at Central Philippine University, students are more likely to have a favorable attitude towards spiritual programs offered by the university. The location of high school where respondents graduated and college to which the respondents belong determined their involvement in campus organizations while their sex, age, and college determined their involvement in spiritual activities. Majority of the respondents believed that their spiritual life had been changed because of exposure to the different spiritual programs and activities in the university. Only location of high school where respondents graduated is significantly associated with the perceived impact of spiritual programs on their lives. The attitude of the respondents is a determinant of the perceived impact of these spiritual programs on their lives.

TECHNICAL AND ECONOMIC EVALUATION OF THE JACK-DRIVEN BRIQUETTING MACHINE

Aries Roda D. Romallosa

ABSTRACT

Paper presented during the 12th Research & Development Week, 16th CPU Faculty Research Symposium (March 6, 2015)
Knowledge for Development Center (KDC), Henry Luce III Library, Central Philippine University

This study was conducted to evaluate the technical and economic performance of the designed briquetting machine that utilizesa hydraulic-type bottle-jack for better compression in producing briquettes. The machine can compact 16 cylindrical (with a hole at the center) briquettes in one pressing or about 200 to 240 pcs/hr. The jack creates the needed pressure by thrusting the molders up to fully compact the materials. With the aid of one spring each on both sides, which jointly holds together the molder and jack flooring supports, the piston of the jack when loosened is pulled back to its normal position allowing a semi-automatic type of operation.The briquettes produced by the machine functioned well as fuel when subjected to cooking and boiling tests indicating its potential as alternative source of energy. This was also highlighted by a higher percentage (81%) of willingness by waste reclaimer-respondents to buy them as fuelfor various cooking and heat applications. The production cost per hour for briquettes ranged from about Php32 to Php34 or Php0.13 to Php0.16 per briquette.Leveling-up of operation may even increase production giving an annual potential earnings of about Php29,000.00 to Php69,000.00. The quality of the three briquettes produced slightly varied and some of the parameters analyzed like bulk density, heating value, moisture, N and S closely met or have met the requirements of DIN 51731.

CPU ENTRANCE SCHOLARS: WHERE AND HOW ARE THEY NOW?

Margen A. Java

ABSTRACT

Paper presented during the 12th Research & Development Week, 16th CPU Faculty Research Symposium (March 6, 2015)
Knowledge for Development Center (KDC), Henry Luce III Library, Central Philippine University

This study was conducted to determine the present status of the entrance scholars of Central Philippine University for school year 1999-2000 until school year 2008-2009. The one-shot survey was used in the collection of data. There were 295 respondents who participated in the study out of the total population of 1,349. Data were collected using a researcher made questionnaire and were sent through e-mail, facebook, walk ins and drop and pick up points. Results of the study showed that the respondents are generally females, in their mid-25's, and single. Most are nurses, accountants and engineers, at present. Majority of them came from barangays and graduated from public high schools. Majority of them did not graduate with honors and for those who graduated as such, most of them graduated as cum laude. As entrance scholars, majority of them were Valedictorians with free tuition privilege, three thousand peso book allowance and had either availed their scholarship for one or two years. At present, majority of them are working in private companies and have regular/permanent employment status. Present age, sex, college and year graduated from of the respondents are determinants of the length of their availment of scholarship. The place of origin, college graduated from and type of high school graduated from of the respondents are determinants of the honors they received during their college graduation. The present age, civil status, sex, college and year graduated from of the respondents are determinants of their ability to pass the licensure examination they had taken. The type of scholarship coverage availed by the respondents, whether valedictorian, salutatorian or with honors during their student days determine their capability to land a regular/ permanent job after graduation. The college and year graduated from of the respondents are determinants of their ability to land a regular job/permanent job in either a private or public institution after graduation.

A NEEDS ASSESSMENT SURVEY FOR A PROPOSED SPEECH DEVELOPMENT PROGRAM FOR THE FACULTY OF CENTRAL PHILIPPINE UNIVERSITY

Marie Melanie J. Javier

ABSTRACT

Paper presented during the 12th Research & Development Week, 16th CPU Faculty Research Symposium (March 6, 2015)
Knowledge for Development Center (KDC), Henry Luce III Library, Central Philippine University

This study surveyed the oral communication skills of the faculty of Central Philippine University and to determine their perceived skills and need levels. It also determined any significant relationships between certain personal and CPU- related demographics and their need levels and willingness to participate in the speech improvement program. A take-all approach was done of all fulltime faculty members and 87.2% participated. The instrument was a questionnaire of three parts covering demography, oral communication skills and training preferences. The results showed that the faculty members of Central Philippine University for the second semester of the school year 2013-2014 were largely females, married and middle aged. They had master's degrees, Assistant Professor ranks, and earned a modest basic salary of Php15,000.00 to 19,999.00 a month. They perceived themselves to have very good speaking skills but considered themselves to have moderate to high need for specific speaking skills. They were willing to participate in a speech development program for two working days. Among the variables, none was significantly related to speech need level but age, academic rank and basic monthly salary were significantly related to the willingness to participate in the speech program. However, need level was significantly related to willingness to participate. In conclusion, the faculty of CPU is ready and enthusiastic for an intervention program to improve their speech skills and the probability of success is high if the results of this research shall be used in designing the program.

LEVEL OF HARMONICS PRODUCED BY THE VARIABLE FREQUENCY DRIVE CONTROLLER USED IN THE INDUCTION TYPE WATER PUMP MOTOR OF CENTRAL PHILIPPINE UNIVERSITY

Vitini Edhard O. Idemne, Ramon A. Alguidano Jr., Alberto A. Java,
Ruben M. Armadillo, Gelvie C. Lagos, Babylou G. Nava,
Yeisel S. Sacramento and Caesar Rico S. Acanto

ABSTRACT

Paper presented during the 12th Research & Development Week, 16th CPU Faculty Research Symposium (March 6, 2015)
Knowledge for Development Center (KDC), Henry Luce III Library, Central Philippine University

The determination of the level of harmonics produced by the variable frequency drive (VFD) controller used to adjust the induction-type water pump motor at the water pumping station of Central Philippine University (CPU) was focused specifically on the electrical noise or harmonic level generated by the controller in terms of its amplitude and frequency. The level of harmonic content was acceptable based on the IEEE Std 519-1992 of no more than 5% with the use of the controller and its effects on electronics and electrical systems connected in the same pick off point. It was also determined whether the system would significantly improve motor performance. Lastly, it was determined whether the system would significantly reduce energy consumption. Based on the results of the tests, the harmonics of the supply voltage at no load was 2.25%. During the system operation where a five (5) Hp induction type motor load was controlled direct-on-line (DOL), the harmonics generated was about 2.10%. However, by using the controller, it was found out that there was an increase in the amplitude and the number of harmonics present in the system. The harmonics produced at the source terminal with controller was about 3.93%, showing an increase of 1.83% compared to without the use of the controller. However, the increase is minimal because 3.93% is within the acceptable limits of 5% for electronics circuits and systems. However, this is not acceptable for medical and other related highly sensitive instruments, which require a THD of not more than 3%. In contrast to this, the harmonics generated at the load terminal was about 8.42%, which was higher compared to the THD at the input terminal and was very much higher than the required allowable level. The controller produced a significant level of harmonics that could cause interference to nearby electronic appliances that are sensitive to electrical noise within very close proximity. Nevertheless, this noise or harmonic generated was not significantly induced at the source terminal. Furthermore, there was no reduction on the energy consumption with the use of the controller over the DOL control mode. In contrast, the use of the controller gave the following benefits: it eliminated the very high current surges and sudden high starting torque during the motor start up; balanced the motor supply between phases; and, caused an increase in the revolution-per-minute (rpm) of the motor thereby improving the performance of the motor. The same controller could be put to good use with some of the other pump motors around the campus.

E-LEARNING SYSTEM FOR THE GRADUATE PROGRAM OF CENTRAL PHILIPPINE UNIVERSITY

Pedro Peter Rhys B. Cambronero, Jr.

ABSTRACT

The Graduate Program of Central Philippine University currently applies the traditional method in teaching students such as discussing lessons inside the classroom most of the time, requiring students to submit term papers, manually assessing students' performance, and manually posting announcements in the bulletin board. Moreover, the availability of online course materials for lessons and classroom activities is limited. Hence, this study aimed to develop an E-learning system for the Graduate Program to address these teaching-learning issues. E-Learning System is a tool that will enhance the learning process for the Graduate-Program. Basically, the system include, course management, monitoring message board for communication, course feedback for instructors, students and department heads as they can manage and monitor classess online with facility, effectiveness and efficiency. RAD (Rapid Application Development) was applied in developing this system. This method is best suited and more focused on web application development. Thus, the system would be implemented in the Graduate Program of Central Philippine University.

LEVEL OF HARMONICS PRODUCED BY THE VARIABLE FREQUENCY DRIVE CONTROLLER USED IN THE INDUCTION TYPE WATER PUMP MOTOR OF CENTRAL PHILIPPINE UNIVERSITY

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Paper presented during the 12th Research & Development Week, 16th CPU Faculty Research Symposium (March 6, 2015)
Knowledge for Development Center (KDC), Henry Luce III Library, Central Philippine University
And 37th Annual National Physics Seminar-Workshop Convention-Philippine Physics Society
University of Northern Philippines), Vigan, Ilocos Sur

ABSTRACT

The determination of the level of harmonics produced by the variable frequency drive (VFD) controller used to adjust the induction-type water pump motor at the water pumping station of Central Philippine University (CPU) was focused specifically on the electrical noise or harmonic level generated by the controller in terms of its amplitude and frequency. The level of harmonic content was acceptable based on the IEEE Std 519-1992 of no more than 5% with the use of the controller and its effects on electronics and electrical systems connected in the same pick off point. It was also determined whether the system would significantly improve motor performance. Lastly, it was determined whether the system would significantly reduce energy consumption. Based on the results of the tests, the harmonics of the supply voltage produce was 2.25%. Running the 5-Hp motor produces lower harmonics 2.10%. However, by using the controller, the harmonics produced at the source terminal with controller was about 3.93%, showing an increase of 1.83% compared to without the use of the controller. The value is within the acceptable limits of 5% for electronics circuits and systems, but not acceptable for medical and other related highly sensitive instruments, which require a THD of not more than 3%. The controller produced a significant level of harmonics of 8.42%, enough to interference with nearby electronic appliances within very close proximity. Using the controller gave the following benefits: it eliminated the very high current surges and sudden high starting torque during the motor start up; balanced the motor supply between phases; and, caused an increase in the revolution-per-minute (rpm) of the motor thereby improving its performance. The same controller could be put to good use with some of the other pump motors around the campus.

INTRODUCTION

Central Philippine University (CPU) is a non-stock, non-profit, Christian, private institution of higher learning founded by American Baptist missionaries in 1905 at Jaro, Iloilo City. Its 24-hectare campus is well laid out with plenty of beautiful trees, lawns and big fields that enhance the stately buildings that serve as classrooms, laboratories, libraries, or offices for administration, finance, student services and many more.

The water needed by the school has been supplied by the local water utility Metro Iloilo Water District (MIWD) as well as deep wells within the grounds, to have an ample, continuous supply even when the water from the MIWD at times is not available. The University has also put up a 91.13 m^3 water tower that is 21.72 m high. Water is raised to that height by a pump that is driven by three 3-phase 5-Hp 220-V electric motors. It is controlled (started and stopped) directly across the line.

The main area of concern is the effect on the power quality of the electrical system of CPU at the point of the pump-motor equipment, more specifically about harmonics. Harmonics are any "non-linear" current or voltage in an electrical distribution system (Stephen David Hearn, PE). According to the SQUARE D Product Data Bulletin, harmonics is a component of a periodic wave having a frequency that is an integral multiple of the fundamental power line frequency of 60 Hz and the total harmonic distortion is the contribution of all the harmonics frequency currents to the fundamental frequency. Harmonics are the by-products of modern electronics. The common harmonic producing devices are VFDs (Variable Frequency Drive), Lighting and Computers. It can interfere with the normal operation of an electrical system. High levels of harmonics can reduce the efficiency of the facility's wiring and electrical equipment and increase the amount of interference in the electrical/electronic system. (from, Bulletin No. 8803PD9402 August 1994 Raleigh, NC, U.S.A)

Determining the quality of any given circuit or systems and knowing what is behind any signal power quality is very critical. This will include the critical measurements of voltage and current and analyzing the harmonic content to evaluate whether the controller, the loads or the external environment produces that harmonic (from, Bulletin No. 8803PD9402 August 1994 Raleigh, NC, U.S.A).

Level of Harmonics…

A big concern today is the conservation of electrical energy as most of its production is fueled by diesel oil (DO) and heavy fuel oil (HFO) and carbon-based resources, which are non-renewable as it takes hundreds of years to produce them from decaying matter under intense heat and pressure. This diminishing supply is still widely used today as there are many DO/HFO generating plants in existence and operating worldwide today. The demand is increasing as can be gleaned from the 2012 "Philippine Energy Situationer" presented by Director Antonio E. Labios of the Department of Energy (DOE), Visayas Field Office Coupled to the use of these fuels is the increasing CO_2 emission that leads to more greenhouse gas effects. Thus, any means to reduce fuel/energy consumption could help minimize these harmful effects.

The proposed utilization of the VFD controller specifically GPD515 introduced some concerns especially on the electrical power quality at CPU and its energy efficiency or energy usage. The use of a controller, specifically VFDs will produce harmonics because of the nature of the front-end rectifier design of the most pulse width modulated VFDs. In addition to that, this will render additional cost since most VFD controllers are expensive. On the other hand, the use of this device to control the induction type motor can possibly reduce energy consumption by controlling its speed. Moreover, it can minimize current surges during the motor start; lessen the wear and tear of the parts specifically the moving and rotating components, prolong the life of the motor, smoothen the response by maintaining the speed and balance the supply voltage
(from http://www.vfds.org/vfd-basic-theory-271552.html).

The said device has been designed to control loads, specifically three phase induction type motors up to 5 Hp. The controller can be programmed and reprogrammed for specific applications to smoothen the response of the system.

The GDP515 comes with one of the easiest to install mounting systems in the industry. Each unit comes with a customized program from the factory for maximum performance when used with the C-4 Card Drive, utilizes state-of-the-art 32 bit processing, motor algorithms, auto-tuning, and other benefit-laden technologies creating the cutting edge in AC drive design. The most spectacular achievement is the flexibility provided customer, with a single drive platform offering traditional V/Hz, sensorless vector, and flux vector control performance.

Moreover, tests were applied to determine if there were additional harmonics present in the electrical system (before the GPD515 controller is used). Should there be such distortions in the quality of power, it will then be determined if it is within the permissible levels, and if the use of the device would add to the system harmonics, or if it would be able to reduce the harmonics.

The overriding concern for current waveform distortion is the Total Harmonic Distortion (THD) versus the actual loading of the equipment power source. As with voltage waveform distortion, the best location to measure current waveform distortion is at the power source that feeds the equipment location (i.e., isolation transformer or main service entrance). This gives the best representation of the overall current waveform distortion. "Computers and allied equipment, such as programmable controllers, frequently require AC sources that have no more than 5% harmonic voltage distortion factor, with the largest single harmonic being no more than 3% of the fundamental voltage. Higher levels of harmonics result in erratic, sometimes subtle, malfunctions of the equipment that in some cases, have serious consequences. Instruments can be affected similarly, giving erroneous data or otherwise perform unpredictably. Perhaps the most serious of these are malfunctions in medical instruments" (from IEEE Std 519-1992).

The GPD515 controller is an example of a programmable VFD controller that is intended to be utilized in the existing water pumping station of CPU campus. Because of this, the study tested the performance of the GPD515 Controller that was used to regulate the operation of 5-Hp, three-phase induction motor.

The concerns in the use of the GPD515 are; the degree of harmonics produced by the controller that might cause interference in the public address system of CPU and other related equipment and appliances; the suppression of current surges; the possibility of significantly conserving energy; and finally, the future development of an assembly system that would be used in the Electrical and Electronics Laboratory at CPU College of Engineering.

The general objective of the study was to determine the level of harmonics produced by the VFD controller used in the water pump motor at CPU.

Specifically, the study aimed to construct, and test the function and operation of the system for harmonics content. Then to evaluate the level of harmonics content with and without the VFD. Thirdly, was to determine whether or not the system significantly improved the motor performance, and has acceptable level of harmonics in terms of its amplitude and number of components present in the system. Lastly, to determine whether the system significantly reduces energy consumption when a controller was used.

This study was designed to assess and possibly improve the voltage stability as well as the

efficiency in the usage of electrical energy in running the motor, and to determine the degree of harmonics produced by the device whether it will significantly interfere with the electrical and electronic systems of the university. The result of this could be a prelude to the use of controllers with other electric motors in the campus. In addition, it could improve the operating efficiency of the motor and prolong its usage or life span. Furthermore, it could help protect the electrical system from early damage.

Lastly, the possible development of the design of a radio frequency interference filter (RFI) circuit, based on the harmonics in the existing electrical system or that which was produced even by the controller itself contributed to minimize the effect on appliances like sound systems, computers, radio and other related devices. The result of the study could also be utilized as a laboratory equipment that will be used to perform experiments on related topics and subjects.

This study was limited only to the testing of the harmonics present in the utilization of the VFD controller, which included the construction of the testing board. The testing and evaluation included measurements of harmonics present in the system, harmonics generated by the controller, energy consumption and the calculation of the total harmonics distortion (THD). The testing was conducted specifically for GPD515 controller with a load of a 5-Hp, three phase induction type motor. The pre-testing was performed by the researchers at CPU College of Engineering EE Power Lab and the final testing was undertaken at the CPU Water Pumping Station.

METHODOLOGY

The testing of the system included the following: the performance of the system with and without the controller by measuring the energy consumption with a specific fixed load of 3-phase 5-Hp induction type motor and the measurement of the degree of harmonics present in the system.

The block diagram shown in Figure 2 was the set-up needed for the testing of the system. It was composed of eight building blocks which were properly labeled with their corresponding function and operation: The 220 Vac, 60 Hz three phase line voltage was the main source of the system that supplies power to each of the blocks. Two single-phase kW-hr meter was used to measure the energy consumption of the entire system. The GPD515 is the VFD controller that can be programmed and reprogrammed to control the operation of the motor. The magnetic contactors were used to switch on and off the system. The selector switch was used to select the mode of operation of the system, with or without the controller. The combiner circuit was used to combine the output circuit of the two magnetic contactor for the specific mode of operation. Lastly, the 3-phase AC motors acted as an inductive load of the system.

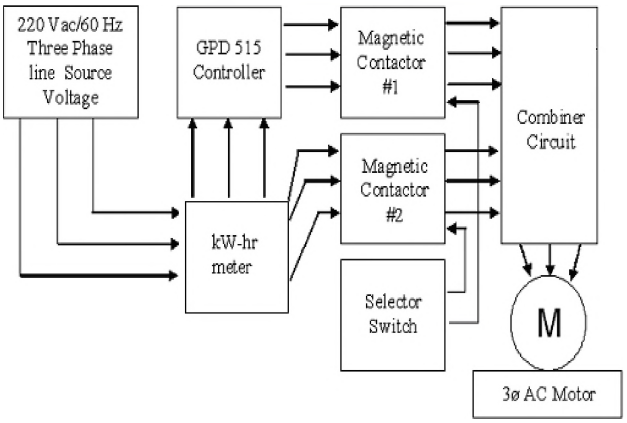

Figure 1. Block diagram for testing of the system

The system functions as follows: the supply voltage coming out from the source enters into the kW-hr meter, wherein its output is then connected to the GPD515 controller and on to magnetic contactor #1 while the other branch circuit is directly connected to the magnetic contactor #2. The purpose of this is to select the mode of operation via the selector switch. The selector switch is labeled with the following: bypassed and controller "ON". When the selector switch is set to controller "ON" mode, the controller which can be programmed and reprogrammed by the user, drives the motor to operate. If the selector switch is on the bypassed mode, the controller is not used and the motor is directly connected to the source voltage, making the motor run without the controller. The energy consumption is measured based on this condition and the data will be compared for the testing of the performance of the system with and without the controller. In addition, the harmonics produced by the system were measured based on the two modes of operation. The spectrum analyzer was used to plot the harmonics generated by the system and the amount of harmonics produced was determined by using the THD.

During testing, the following data were gathered: voltage per phase, current per phase, the energy consumed per hour and the harmonics' amplitude and frequency, both with and without the controller.

The percent total harmonic distortion (%THD) of the harmonics with and without the controller. The percent total harmonic distortion (%THD) is computed using the

formula: $\%THD = \sqrt{\frac{V_2^2}{V_1^2} + \frac{V_3^2}{V_1^2} + \frac{V_4^2}{V_1^2} + \ldots \frac{V_n^2}{V_1^2}}$ X 100 %

Where: V_1 = fundamental signal
V_2 = second harmonics
V_3 = third harmonics
Vn = the n^{th} harmonics

RESULTS

The specifications of each component were determined based on the ratings of the 3-phase induction motor that is currently being used in the Water Pumping Station of CPU. The pump motor being used is a 5-Hp, 220 V AC, three phase induction type. Based on these ratings, the following components were used; 3-phase 30-A circuit breaker, 30-A magnetic contactor with over current protection for direct-on-line connection without the controller, and 20-A magnetic contactor with over current protection at the output of the controller. The line current was measured using the current transformer with a 50/5 ratio. The panel board is shown in Figure 3 below. As can be seen, power can be supplied to a motor load either through direct starting via the 30-A contactor or using the controller passing the 20-A contactor.

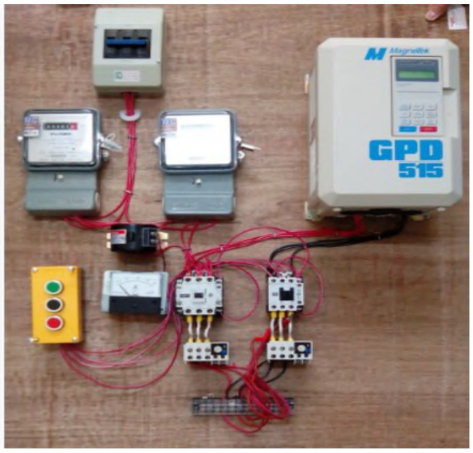

Figure 2. Panel board

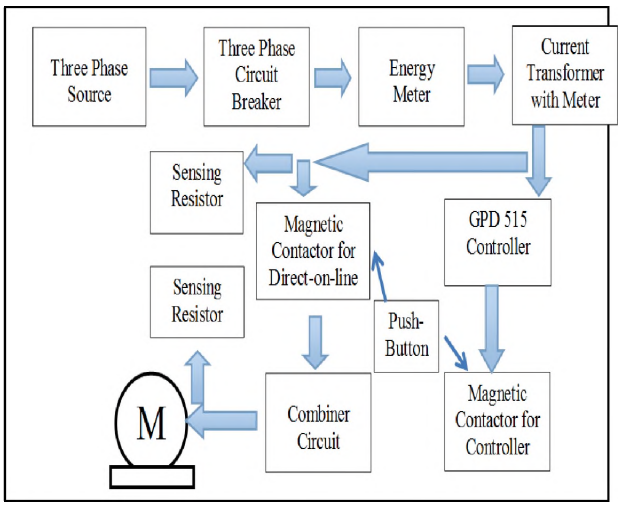

Figure 3. Block diagram for harmonic testing

In measuring the circuit parameters, there were two conditions considered; first, the motor was directly connected to source (Direct-on-line), and secondly, the motor was controlled by the GPD515 controller.

Measuring the source voltage, the DMM was set to AC voltage and the probe was connected to one phase at a time. Pressing the black colored pushbutton enabled the direct-on line connection. Results presented in Figure 5 show the reading of the DMM to be 232.3 VAC and 8.6-A, respectively. This test was used to determine whether the source supplied the desired voltage to the system and the current measurement was used to determine the normal operation of the induction motor. The other phase voltage was 232.5 V as shown in Figure 5, the system supply voltage is almost balanced, indicating that the supply voltage was ideal for testing.

System Testing with GPD 515 Controller

The result of the source voltage reading was similar to that of DOL testing shown in Figure 4, as the output voltage using the controller was 233.7 VAC with 9.52-A at 60.00 Hz frequency as shown in Figure 9 and 10. The output voltage reading of the controller was used because the DMM could not read the output voltage due to the characteristics of the output signal produced by the controller. This will indicate that the system operates normally and is ideal for testing the degree of harmonics produced.

Testing the Harmonic Content of the System

In testing the harmonic content of the system, there were two conditions considered; (1) test the harmonics with direct-on-line connection with the motor directly connected to the source, (2) test the harmonics content with the motor controlled by the GPD515 controller. The harmonics were measured using the PC based spectrum analyzer.

Testing the Harmonic Content of the System Using Direct-on-line

Prior to testing the harmonics produced by the system, that of the source voltage were determined first, and these served as the reference data in determining the harmonic content of the system. The results of the harmonics at the source are shown below in Figure11a. Initially with the load OFF, there were a number of significant harmonics present at the source terminal. The highest peak was the fundamental frequency which was the line frequency of 60.55 Hz, 0.7126 V. The second peak was the first significant harmonics or the dominant harmonics, with a frequency of 301.8 Hz, and the amplitude of 0.01486 V and the third peak was

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the second harmonics present with frequency of 422.9 Hz, 0.006037 V, and the rest of the peaks were insignificant because the amplitudes were very low. There were no significant bands of frequency at the higher frequency range. Figure 11b is the zoom version of Figure 11a, used for a clearer view of the small peaks shown in the previous figure.

The percent total harmonics distortion (%THD) was calculated to be equal to 2.25% which was below the required limit of the IEEE standard of 5%. This means that the source noise is at acceptable level and therefore a good power source.

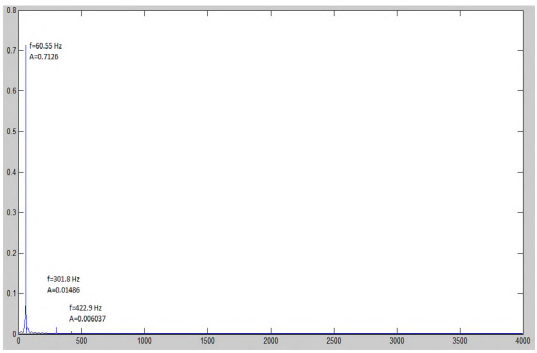

Figure 11a. Frequency spectrum of the source voltage with load OFF

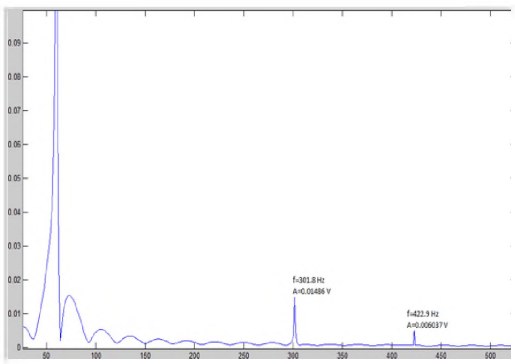

Figure 11b. Frequency spectrum of the source voltage with load OFF, zoom-in version

Pressing the color black pushbutton enabled the direct-online connection, and the motor was connected directly to the source terminal without the controller as shown in Figure 12. To measure the harmonics content at the source terminal, the Spectrum Analyzer was connected to the sensing resistor installed at one of the phases of the source. The instruments automatically plotted the harmonics and saved the data, as shown in the graph of Figure 13a below. The same procedure was followed to get the data at the load side terminal.

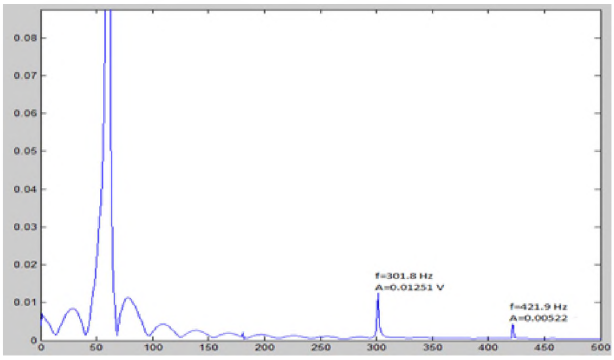

Figure 13b. The zoom-in version of Figure 11.

Figure 13a and 13b shows the frequency spectrum of the source and load terminal, which are very similar to the previous results in Figure 11a. The highest peak still was the fundamental frequency of 60.55 Hz with amplitude of 0.6445 V, the next peak was the second highest significant harmonics in the system with frequency of 301.8 Hz, 0.01251 V while the third highest was at 421.9 Hz, 0.00522 V. The other harmonics were insignificant. This showed that the three-phase, 5 Hp, 220 V AC induction motor did not produce significant harmonics when it was in use. This was not a harmonically generated load. Based on the data shown from the frequency spectrum the % THD is 2.10% which was lesser than the previous values without load.

Testing the Harmonic Generated by a GPD515 Controller

Pressing the color green pushbutton enabled the controller to regulate the load as shown in Figure 14. The harmonics was measured first at the load side with the same procedure followed by the measurements of harmonics at the source side. The result was shown in Figure 15a.

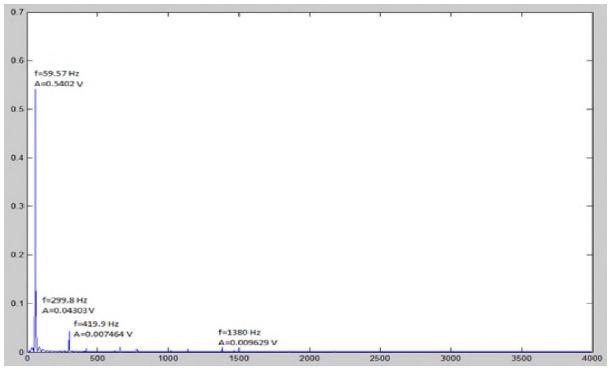

Figure 15a. Frequency Spectrum of the Load Voltage of GPD 515 Controller

Level of Harmonics…

In Figure 15a the highest peak is at 59.57 Hz with amplitude of 0.5402 V, followed by the 299.8 Hz at 0.04303 V, many smaller peaks were produced within the band of 500Hz to 4000Hz. The data show that when the controller was used it generated a %THD of 8.42%, The value is much higher compared to the standard limits sets by IEEE. This indicates that the output of the controller produces significant number of unwanted signals/harmonics/noise. These harmonics may interfere with electronic appliances, equipment and systems if not properly shielded and grounded. The harmonic or noise coming from the output of the controller were caused by the following: the output of the controller were not pure sine waves; and the controller utilizes active devices to regulate the load which generates harmonics. These harmonics generated by this controller do not pose a problem with induction type motors because such harmonics have very small amplitudes. However, the presence of these may cause interference with the nearby equipment specifically audio and other related appliances, equipment and systems if these are not properly installed and are in very close proximity with the controller. Figures 15b and 15c are the zoom-in versions of Figure 15a to highlight the smaller peaks from 300Hz to 2000 Hz.

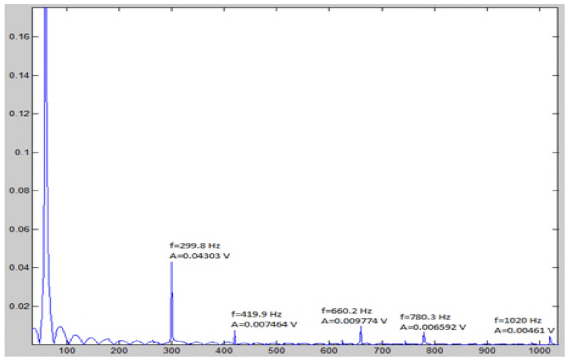

Figure 15b. Magnified frequency spectrum of the load voltage of the GPD515 controller at a frequency band ranges from 100 Hz-to-1000 Hz

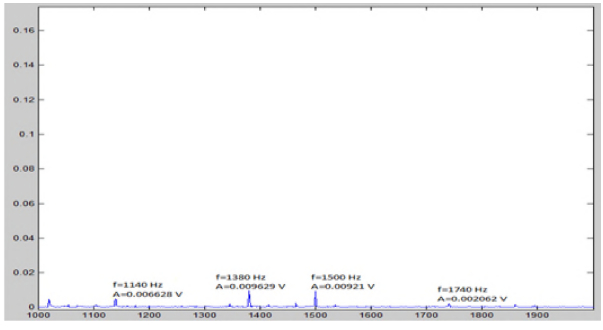

Figure 15c. Frequency spectrum of the load voltage of the GPD515 controller with a frequency band ranges from 1000 Hz-to-1900 Hz

The resulting Figure 16a, shows the frequency spectrum at the source side, with the highest peak at 60.55 Hz having an amplitude of 0.5331 V, which was the source frequency. The next highest peak was the 300.8 Hz, with 0.01681 V which was the first significant harmonics present followed by the 420.9 Hz, with 0.007966 V. The other peaks of very low amplitude were not considered significant.

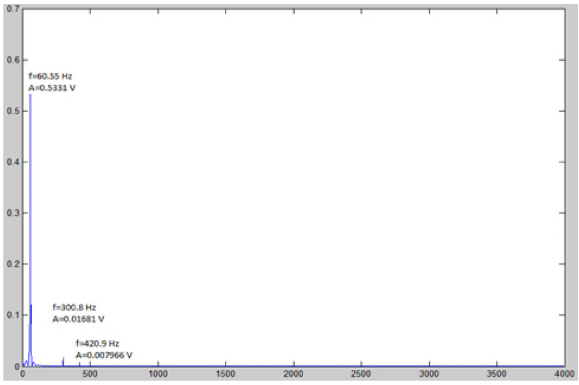

Figure 16a. Frequency spectrum of the source voltage of the GPD515 controller

Based from Figure 16b the total harmonics distortion (THD) of the system with controller is 3.93%. It was shown that there were significant increases in the number of harmonics and the amplitude, but the harmonic content was still within the acceptable level. It only shows that the harmonics at the output of the controller were also present at the source terminal. However, the bigger harmonics at the output side of the controller were significantly reduced because the controller has a built-in mechanism that suppresses the harmonics, thereby, minimizing these electronic noises induced that would otherwise revert back to the system. Figure 16b shows the clearer view of the small peaks in Figure 16a.

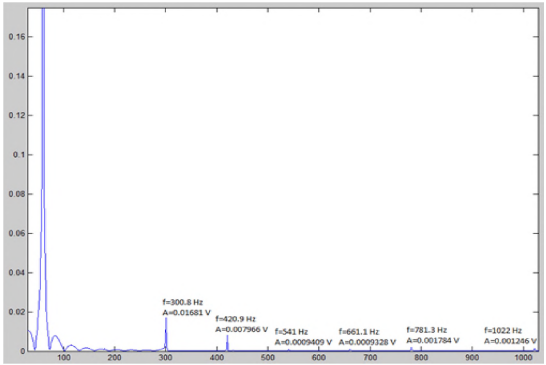

Figure 16b. Magnified frequency spectrum of the source voltage of the GPD515 controller.

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Figure 17 shows the output waveform of the GPD515 controller in the time domain. The waveform is a modified sine wave, which is an acceptable supply voltage for the operation of the system. This waveform consists of harmonics, which was the integral multiple of fundamental frequency from 300.8 Hz, 420.9 Hz, 541 Hz, 661.1 Hz, 781.3 Hz and 1022 Hz as shown in Figure 16b. The harmonics shown were only that can be viewed significantly by the spectrum analyzer.

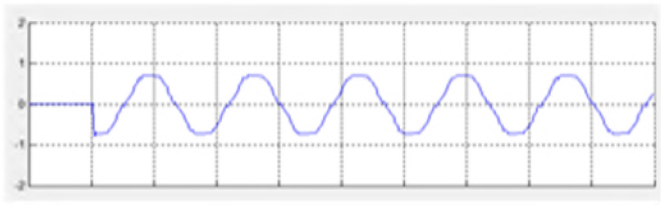

Figure 17. Output waveform of the GPD515 controller in the time domain with a load 5-HP three phase induction motor.

Figure 18 shows the smooth sine wave signal coming from the electrical power supply. This is an ideal signal for the source to run the load smoothly. Nevertheless, there were still small amounts of peaks or irregular shapes caused by electronic noise or electromagnetic interference.

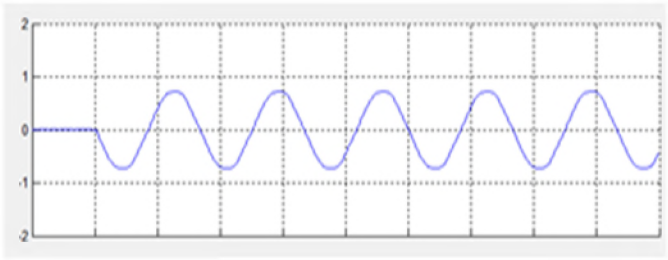

Figure 18. The waveform of the output voltage without controller

Testing the Energy Consumption of the System

The two-watt meter method of measuring the energy consumption utilized two single phase energy meters. The readings of the two meters were added to obtain the total energy consumed by the three-phase system. The initial readings of the meters were recorded prior to the actual testing. In this case the initial reading with GPD515 controller for meter 1 was 400.75 kW-hr and for meter 2 was 556.6 kW-hr. After an hour of operation, the meters were read and meter 1 indicated 401.17 kW-hr while meter 2 reads 558.55 kW-hr. The actual energy consumption is the sum of the differences between the initial readings and the readings after one-hour. The reading of the meter was calculated by subtracting the initial reading of the meter and the reading after an hour. The results of reading in meter 1 (M1) is 1.5 kW-hr and meter 2 (M2) is 1.55 kW-hr and the total energy consumption is the sum of M1 and M2 equal to 3.05 kW-hr.

For DOL, the initial reading for meter 1 was 400.75 kW-hr and for meter 2 it was 556.6 kW-hr. The final readings were taken an hour after the initial readings and meter 1 showed 401.17 kW-hr and meter 2 indicated 558.55 kW-hr. The actual energy consumption obtained which was the summation of the differences between the initial readings and the readings after one-hour were 0.95 kW-hr and 1.95 kW-hr, respectively, giving a total energy consumption of 2.9 kW-hr.

No. of Trials	Revolution/ minute (RPM)	Initial Reading		Reading After 1 hour		M1 Diff (kW-hr)	M2 Diff (kW-hr	Energy Used (kW-hr)
		Meter 1 (kW-hr)	Meter 2 (kW-hr)	Meter 1 (kW-hr)	Meter 2 (kW-hr)			
1	3514	400.75	556.6	401.7	558.55	0.95	1.95	2.9
2	3514	403.15	560.05	404.08	562	0.93	1.95	2.88
3	3514	405.6	563.43	406.55	565.33	0.95	1.9	2.85
4	3514	408.15	566.75	409.05	568.6	0.9	1.85	2.75
5	3513	426.23	598.1	427.79	599.5	1.56	1.4	2.96
6	3518	429.15	601.05	430.12	603.02	0.97	1.97	2.94
7	3514	450.12	641.98	451.11	643.9	0.99	1.92	2.91
8	3514	452.53	645.51	453.54	647.42	1.01	1.91	2.92
9	3516	455.07	648.97	456.02	650.85	0.95	1.88	2.83
10	3514	456.02	650.85	457	652.8	0.98	1.95	2.93

The average energy consumed is the sum of the usage in kW-hr divided by the number of trials. For M1 the average reading was 1.019 kW-hr while M2 was 1.868 kW-hr, giving the overall average difference of two meters of 0.849 kW-hr.

The average difference in readings between the meters was about 0.849 kW-hr and this value shows that the system using the DOL was unbalanced. The energy consumed per line had a large discrepancy; therefore, the power delivered per line was not equal. This will affect the performance of the motor as well as its mechanical parts and components.

The same procedure was used to acquire the data in Table 2. The average energy consumed by the system after ten (10) trials is about 3.029 kW-hr with GPD515 controller. This means that the system with controller will consume an average energy of 3.029 kW-hr in one hour of continuous operation while the DOL will consume around 2.887 kW-hr. In addition to that the average difference between meter 1 (M1) and meter 2 (M2) was about 0.007 indicating that, the system

was almost balanced in terms of the energy consumption per line. This means that the controller deliver almost the same power per line and these will further improve the performance of the motor.

Table 2. System data with GPD 515 controller

No. of Trials	Revolution/ minute (RPM)	Initial Reading		Reading After 1 hour		M1 Diff (kW-hr)	M2 Diff (kW-hr)	Energy Usage (kW-hr)
		Meter 1(kW-hr)	Meter 2(kW-hr)	Meter 1 (kW-hr)	Meter 2(kW-hr)			
1	3523	399.25	555.05	400.75	556.6	1.5	1.55	3.05
2	3523	401.7	558.55	403.15	560.05	1.45	1.5	2.95
3	3524	404.08	562	405.6	563.43	1.52	1.43	2.95
4	3523	406.55	565.33	408.15	566.75	1.6	1.42	3.02
5	3525	427.6	599.5	429.15	601.05	1.55	1.55	3.1
6	3523	430.12	603.02	431.58	604.54	1.46	1.52	2.98
7	3523	451.11	643.9	452.53	645.51	1.42	1.61	3.03
8	3523	453.54	647.42	455.07	648.97	1.53	1.55	3.08
9	3523	456.02	650.85	457.58	652.35	1.56	1.5	3.06
10	3523	457.58	652.35	459.1	653.9	1.52	1.5	3.07

The percent difference between the consumption of the two systems is shown in Table 3. There was a 4.67% difference in energy consumption which shows that there was a 4.671% of power consumed in excess when using the controller as compared to using without it. This means that there were no power savings in using the controller, however, the effect of using it is the balanced power consumption of the motor, which in effect, makes the motor more efficient and minimizes the wear and tear of the mechanical components of the motor. Moreover, even if there was no power savings with the use of controller, the revolution- per-minute (rpm) of the motor is higher compared to without the use of controller as shown in Table 2 and 3. This shows that the efficiency of the motor increases with the use of the controller.

Table 3. Percent Difference of the energy consumed between DOL and GPD515

No. of Trials	DOL	W/ GPD 515	Diff	% Diff
	Energy Consumed (kW-hr)	Energy Consumed (kW-hr)		
1	2.9	3.05	0.15	4.918
2	2.88	2.95	0.07	2.373
3	2.85	2.95	0.1	3.39
4	2.75	3.02	0.27	8.94
5	2.96	3.1	0.14	4.516
6	2.94	2.98	0.04	1.342
7	2.91	3.03	0.12	3.96
8	2.92	3.08	0.16	5.195
9	2.83	3.06	0.23	7.516
10	2.93	3.07	0.14	4.56

There were no energy savings when the controller was used in the system. Nevertheless, with the aid of a controller, the energy consumed by both meters was nearly balanced as indicated by a 0.007 average "meter reading difference" which was better as compared to running the pump motor without the controller, where the readings were more unbalanced as evidence by a 0.849 average meter reading difference. Furthermore, the use of the controller regulates the starting current to rise gradually until full load current is achieved which negates a high starting current found in using DOL control. This prevents current spikes that could otherwise damage the connections of contactors, thereby prolonging their use. High starting torque is also minimized which contributes to the protection of the motor from wear and tear and results in prolonged life of the mechanical parts.

The determination of the level of harmonics produced by the variable frequency drive controller used to control the induction type water pump motor at the Water Pumping Station of Central Philippine University was determined specifically on the electrical noise or harmonic level generated by the controller. Also, the research tested whether or not the use of the controller could reduce the power consumption of the system. The test system was constructed with its specific components along with its needed tools and instruments for testing. The PC virtual spectrum analyzer was utilized to test the harmonics of the system which include the initial reading of the harmonics without and with the aid of a controller. The DMM was used to measure the voltage, while a clamp ammeter was used to measure the operating current of the motor and two single-phase kW-hr meters were used to measure the power consumption of the system. To determine the degree of harmonics present in the system the researchers used the equation given by the percent total harmonics distortion (%THD) and the reference data was based on the IEEE standard of not more than 5% allowable total harmonic distortion for the normal operation of the system. The reduction of the power consumption was calculated using the difference between the power consumption of the motor, first with the controller and then without the controller.

Based on the results of the tests using the PC virtual spectrum analyzer, the harmonics of the supply voltage at no load was 2.25% which was within the acceptable 5% standard limit prescribed by the IEEE. During the system operation using a 5 Hp induction type motor load, the harmonics generated was about 2.10%. This value showed that the motor did not generate harmonics; rather the good thing was that using the use of this type of motor reduced the

harmonics of the supply voltage. However, by using the controller to regulate the motor, it was found out that there was a minor increase in the amplitude and the number of harmonics present in the system. The harmonics produced at the source terminal with controller is about 3.93% which was still within the acceptable level. In contrast to this, the harmonics generated at the load terminal was about 8.42% which was higher when compared to the THD at the input terminal and was also very much higher than the required allowable level. This showed that the controller produced a significant level of harmonics that can cause interference to nearby electronic appliances which are sensitive to electrical noise specifically computers, radios, public address systems and other related electronic circuits and systems if they are within very close proximity. However, these noise or harmonic generated was not significantly induced at the source terminal because the controller has a built-in filter circuit that will substantially reduce its amplitude and the number of harmonic components within the acceptable range at the source terminal. Thus, there was acceptable "throw back" of significant harmonics to the power system. Lastly, there were no reduction on the energy consumption with the use of the controller over the DOL using open loop control mode.

CONCLUSION

Conclusion

The determination of the level of harmonics produced by the variable frequency drive controller used to control the induction type water pump motor at the Water Pumping Station of Central Philippine University was successfully conducted by designing the block diagram for testing of the system. The researchers were able to construct, and test the function and operation of the system for harmonics content. The level of harmonics content was also evaluated using THD and it was found out that there was an increase of 1.83% in the THD of the system when using the controller as compared to without using it. There was no reduction in the energy consumption of the system when using the controller but there were significant increases in amplitude and the number of harmonics produced in the system. The harmonics produced at the source terminal was within the acceptable level but at the load terminal, it was above the maximum allowable value. However, this will only affect nearby sensitive electronic appliances, system and circuits, but, not on the system which are connected far from the same peak-off point. The controller provides a balanced supply voltage, which improved the motor performance.

Recommendations

It is recommended that when installing this system, it should be located far from noise sensitive electronic devices or systems. When installing the controller and load, the wiring must be as short as possible and must be shielded to minimize electromagnetic induction or interference.

To further improve the installation of the system, an input filter and reactor circuit must be installed at the source terminal to further reduce the noise or harmonics induced by the controller. In spite of a significant number of harmonics produced by the controller, it is recommended that this controller must be installed with an induction type motor for the reason that it will minimize the wear and tear of the mechanical component of the motor thereby prolonging the life of the mechanical devices specifically the mechanical motor components and parts. Moreover, it will eliminate current surges during start-up, which will result in the smoother operation of the motor and improvement of its performance.

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1. **Title:** Production Capacity and Commercialization of Lemongrass (*Cymbopogon citratus* Stapf.) Ready-to-Drink Beverage Product (Kalamansi-Ginger Flavor) Geared Towards Commercialization of the Lemongrass Ready-To-Drink (RTD Products)
   Researchers: Evelyn R. Ybarzabal, Emma T. Gico, Jet R. Nillos, Bernie C. Cangrejo and Mizpah C. Villalobos

2. **Title**: Impact Survey on the CPU Integrated Outreach Activity for Barangay Ilongbukid, San Rafael, Iloilo
   Researchers: Aries Roda D. Romallosa, Hope G. Patricio and Margen A. Java

COMPLETED EXTERNALLY FUNDED RESEARCHES

1. **Development of Meat-Type Native Chicken Breed**
   -By Jaime C. Cabarles, Jr.
   (Funded by Department of Science and Technology - Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD)) and Department of Agriculture – RFU VI (completed July 2015)
2. **Standardization of "Jolo" Genetic Group into Malay Chicken as Potential Male Parental Lines for the Development of Philippine Meat-Type Native Chicken Breed (Phase II)**
   -By Jaime C. Cabarles, Jr. (completed July2015)
3. **Crude Protein Requirements of the Different Genetic Groups of Free-Range Native Chickens in Western Visayas, Philippines**
   -By Jaime C. Cabarles, Jr. (completed July 2015)
4. **Organic Native Chicken Production: A Techno-demo on Commercial Scale Production**
   -By Jaime C. Cabarles, Jr.
5. **Performance Evaluation of Selected "Jolo" Chickens as Potential Breeding Stocks**
   -By Jaime C. Cabarles, Jr.
6. **Performance Evaluation of Selected "Bisaya" Chickens as Potential Breeding Stocks**
   -By Jaime C. Cabarles, Jr.
7. **Citizen Satisfaction Index System (Iloilo City – 2015)**
   -By Reynaldo N. Dusaran
   Carolyn L. Yoro and Margen A. Java (Field Supervisors)
   (Completed July 2015)
   In partnership with the Department of Interior and Local Government, Region VI

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   -By Reynaldo N. Dusaran
   (Funded by Department of Agriculture, RFO 6)
2. **Monitoring and Evaluating the Impact of Teen Centers Among Adolescents in the Province of Capiz**
   -By Margen A. Java, Raquel L. Polec-eo, Reynaldo N. Dusaran and Gift D. Tragico
   Funded by Local Government Unit of Capiz, Population Commission (PopCom)
3. **Identification, Collection, Propagation and Processing of Herbal Plant for Organic Native Chicken, Flock Health Management**
   -By Jaime C. Cabarles, Jr.
   (Funded by Central Philippine University-Department of Agriculture RO6 & WESVIARRC)
4. **Development of Natural Source as Alternative to Synthetic Methaionine for Native Chicken Organic Supplemental Feeds Production**
   -By Jaime C. Cabarles, Jr.
   (Funded by Central Philippine University-Department of Agriculture RO6 & BARR)

Director's Desk

By Dr. Reynaldo N. Dusaran

K-12: An Opportunity for Research

Beginning this school year (2016-2017), the country will be implementing the K-12 program of the Department of Education (DepEd). Although it is a program for basic education, that is requiring the present high school graduates, and thereafter, to enroll in senior high school for two years (Grade 11 and Grade 12), but this will have serious implications in higher education institutions (HEIs). This means that for the first two years (2016-2018), HEIs will not have their usual first year enrollees. This will also have its snow ball effect in the following three years of very low enrollment for second, third and fourth year, respectively. With very low enrollment during these years, this will also mean limited teaching loads for faculty members. With minimum or limited teaching loads, faculty members could explore other scholarly activities to keep themselves busy, one of these can be research.

Many faculty members, most particularly those with advanced degrees, were interested, capable and willing to do research but expressed to have limited time because of prioritizing teaching overloads rather than research considering its immediate financial rewards. With these developments, since the faculty members will have more free time, they should be motivated to propose research projects for internal or even external funding, either individually or collaboratively. Considering the research goals of the University, this will mean higher involvement of faculty members in research, more research outputs, more research papers for presentation and more research papers for publication. Indeed, the implementation of K-12 could be considered as an opportunity for advancing the research initiatives of HEIs in general, and for Central Philippine University in particular in its research pursuit as an Autonomous University.