

GEOGRAPHIC INFORMATION SYSTEM (GIS): A Preliminary Study for the AES of May 2010

This report presents the major challenges in building an effective GIS architecture for national elections; and how the research had to create effective methodology with the data limitations in a start-up AES-GIS study.

I. Introduction and Study Objectives

The Geographic Information System (GIS) initiative of CenPEG for the AES study is an attempt to mirror and make parallel studies on the GIS infrastructure that should have been established and pursued by the Commission on Elections (Comelec) for automated elections (AE) planning and management. As early as 2006, about 4 years prior to the 2010 National elections, Comelec was granted at least Php 2 million to start planning the automated elections through GIS or GIS-like info-structure. However since 2006, the poll body never disclosed any successful or organized planning system for the 2010 AE. No installed intensive information system for election management was shared or referred to for public information, and no preparatory “automation management or planning study” was ever discussed with the public to justify and prove the feasibility of any particular type of automated election system nationwide.

In 2001, Comelec through its website (<http://www.comelec.gov.ph/precinctfinder/precinctfinder.aspx>) provided registered voters an avenue to check assigned voting precinct online. This database could have been developed further and loaded into a GIS environment. The first visible “test” for 2010 automated elections was done on August 11, 2008 in the special elections for the Autonomous Region for Muslim Mindanao (ARMM). The experience showcased various difficulties in conducting automated election in the Philippines. Although Comelec projected an “illusion of credible and honest” election results, the Center for People Empowerment in Governance (CenPEG) reported several incidents of election irregularities (CenPEG Report, September 2008) The report provided a snapshot of what could happen on a national scale during the 2010 national automated elections.

Thus, at the very beginning, this AES-GIS study by CenPEG may be the only “shot” of civil society to 1) have a broader (pre) view of how the national elections could be like for the May 2010 national automated elections; 2) demonstrate that the national AE could be guided and planned more carefully and systematically with information, research networks, and technologies; and 3) that elections planning and management can be more participatory and transparent.

A. AES GIS Resource People

In January 2010 CenPEG's preliminary AES-GIS under the EU-CenPEG Project 3030 began forming the core researchers and resource people who will build the initial geographic database of fundamental information most relevant to automated elections. Two faculty members from the Department of Geography in the College of Social Sciences and Philosophy (CSSP) of the University of the Philippines in Diliman, shared their expertise in database building. Similarly, undergraduate Political Science majors from UP Manila taking up their required summer practicum under CenPEG's Volunteer Integration Program (VIP) were tapped for the database as a research component.

Specifically for the preliminary GIS, student volunteers were involved in data encoding and data editing, a task that proves to be tedious but could have been easier if only the public information was designed with

inter-institutional sharing in mind. Meaning to say, despite determined efforts by Project 3030 GIS Research election-related data was hardly accessible – or was scant – from government agencies like the Department of Education (DepEd), Department of Environment and Natural Resources (DENR), and even Comelec. This relatively small team of data gatherers and database builders proved that the database building process although challenging and involved rigor, can be done. With more volunteers and data access, the database can be more and more useful and accurate.

In some regions such as Cagayan Valley, Bicol, Central Visayas, and provinces in Mindanao participants in voter education, poll watch training, and forums where CenPEG Fellows and researchers served as resource persons were also tapped for basic community mapping to augment GIS data gathering.

B. Developing the GIS Data

The basic information to start the AES GIS database with includes information on schools or voting centers to be used. Other basic data layers are on physical and basic voting demographic attributes of schools or voting centers, such as power reliability, telecommunications connectivity, road accessibility, voting population and number of clustered precincts. Such information may take different criteria, indicators, and sources. The data plot is provided in Table 1.

In February 2010 the AES-GIS researchers gathered requested albeit limited data from Comelec and DepEd on schools/voting centers' locations, power and telecommunication conditions. Quantitative data on power reliability and telecommunications connectivity from direct service providers and/ or distributors (TransCo., Globe and Smart Telecommunications) were inaccessible. The AES-GIS had to select proxy information from available sources and through its partner networks and field volunteers. (See Table 1)

This report presents the major challenges in building an effective GIS architecture for national elections; and how the research had to create effective methodology with the data limitations in a start-up AES-GIS study. The challenges on database building for public information infringe ultimately on issues of 1) public data sharing and access, 2) *the* lack of updated data and 3) Comelec's erratic and reactive approach in election management and implementation. These issues would have to be addressed before GIS and AES can be truly effective.

In April 2010 or barely one month before election day, the Comelec finally released the Project of Precincts (POPs) for the 2010 national elections. The data available online were collected and encoded by student volunteers from U.P. Diliman and U.P. Manila. The data line for each school then, includes: 1) GPS location (if available), 2) voting population as of 2010 POP, 3) reviewed power reliability based on 2008 Comelec report, and 4) reviewed telecommunications connection based on 2008 Comelec report. Until May 6th 2010, data on voting population were being encoded. The encoding had to be distributed to volunteer students and outputs were shared through google.docs. Major editing job had to be done to verify and match correct names and addresses of schools.

Other data layers that could be useful for projecting scenarios and aiding analyses of the automated elections include 1) municipal canvassing centers (Municipal / City halls), 2) automated elections paraphernalia designated storage areas, and 3) comprehensive road quality assessment report. None of the three mentioned data layers were provided or accessible to the public, or possibly none exists.

One of the crucial information that can be collected to add on to the data layers in GIS is the review of delivery and transmission from different local research counterparts and key person respondents. AES-GIS is beginning to display in maps the different irregularities and events prior to and during the elections through case interviews of selected municipalities. Comelec specified private couriers to deliver PCOS machines and other election paraphernalia from the contracted Smartmatic TIM headquarters in Cabuyao, Laguna to each designated municipal store rooms in the entire country. In March 2010 the couriers contracted for ballots delivery (Air21 company) were announced; and the following month, subcontracted logistics for election paraphernalia deliveries. The selected hubs were apparently disclosed only to the PPCRV and local Comelec offices.

None of the location and track information of ballot and PCOS deliveries was shared to the public and thus no participation and public monitoring was possible except when local officials announce receipt of PCOS machines. In general, this practice obscured what could have been a transparent election planning process. The Project 3030 AES GIS requested delivery reports from Comelec and its contracted couriers to recreate the conduct of deliveries and local management of automated election paraphernalia. No such data was released from either Comelec or the couriers. The AES GIS study together with case studies conducted in different parts of the country, tried to verify irregular events before, during, and after the May 10 elections.

In conjunction with the Project 3030 Research desk, the following sites all over the country were selected and were visited for interviews and mapping.

Case Study sites	
Municipality	Field Mapped Schools
Tacloban City, Leyte	San Fernando Central School, Rizal Central School, Sto Nino SPED Center, Panalaron Elementary School, Kapangian Central School, Eastern Visayas State University, Leyte National High School, B. Bulante Elementary School
Kawayan, Biliran Islands	Balacson Community School, Gabaldon Building (Brgy. Balete)
Almeria, Biliran Islands	Caucab Elementary School, Kansanoc Elementary School, Tubig Guinoo Elementary School, Kawayan Elementary School
Iloilo City, Iloilo	Iloilo Central Elementary School, Apolinario Mabini Elementary School
Cagayan de Oro City, Misamis Oriental	City Central Elementary School
Surigao City, Surigao del Norte	Canlanipa Elementary School, Mariano Espina Elementary School, Surigao City Elementary School, Surigao City Pilot School, Surigao del Norte National High School, Clementino V. Diez Memorial Central Elementary School, Margarita Memorial Central Elementary School, Surigao City National High School, Surigao West Central Elementary School, Sabang Elementary School, Lipata Elementary School, Punta Bilar Elementary School, Ipil Elementary School, Nabua Elementary School, Sukailang Elementary School, Anomar Elementary School, Emerico G. Borja Memorial Elementary School, Quezon Elementary School, Bonifacio Elementary School
Davao City	Daniel R. Aguinaldo National High School, Don Manuel H. Gutierrez Elementary School, Matina Central Special Science Pilot Elementary School, Kawayan Elementary School
Caloocan City, NCR	A. Mabini Elementary School, Amparo High School, Baesa Elementary School, Baesa High School, Baesa High School, Bagbaguin Elementary School, Bagong Silang High School, Bagong Silang Elem School, Camarin Elementary School, Camarin High School, Caybiga Elem School, Cielito Zamora Memorial School, Deparo Elem School, Congress Elem school, Horacio dela Costa Elem school, Pangarap Elem school, Caloocan ES, Phil. Cultural High School, Macario Asistio High School, Gomburza Elementary School
Aringay, La Union	Aringay West Elementary School, Aringay East Elementary School, Sta. Lucia Elementary School, San Benito Elementary School
Bauang, La Union	Bauang North Central School, Quinavite Elementary School, Bauang Public Market
Naguilian, La Union	Cabaritan Elementary School, Naguilian National High School, Naguilian Elementary School, Lioac Elementary School, Paaralang Elementary ng Gusing
Masbate City, Masbate	Amancio Aguilar Elementary School, Restituta Z. Mendina Elementary School, Bagumbayan Elementary School, Paaralang Elementary ng Jose Zurbito, Sr., Masbate Comprehensive National High School, Paaralang Elementary ng Nursery, Kinamaligan Elementary School

Table 1. Data Description and remarks			
Data	Description	Data Sources	Remarks
1) School locations	<p>Contains addresses and absolute locations of designated schools and voting centers (VC's)</p> <p>Schools will be the geographic unit for and from which, spatial analyses can be done.</p>	<p>Department of Education (DepEd)</p> <p>COMELEC</p>	<p>DepEd available and existing data includes only 23 Provinces with completed list and official coordinates in their database. No date and other metadata were included in the report/ data shared.</p> <p>COMELEC released the official Project of Precincts, 1 month (April 2010) prior to the elections. Names of schools/ voting centers (VC's) do not correspond to the DepEd list and would have to be edited and validated.</p>
<p>Implications on research:</p> <p>Much of the tabulated data from COMELEC and DepEd had to be reviewed and verified. There is obvious advantage in making public data format consistent for merging and information exchange. The very basic information on schools such as names and addresses, must be made standard and updated, especially if schools will function as regular voting centers for elections or other purposes i.e. evacuation centers.</p>			
2) Power reliability assessment	<p>Power reliability assessment of schools/ VC's.</p>	<p>COMELEC</p> <p>Power transmission companies</p>	<p>The latest report on power reliability of schools/ VC's published by COMELEC was dated 2008. No descriptions on assessment (Stable/ None) methodology or assessment parameters/ criteria were discussed in the document.</p> <p>Other information on local school conditions were solicited from research partners, e.g., local school teachers or researchers.</p> <p>Private electric distribution company and their mapped assessments were not accessible.</p>
<p>Implications on research:</p> <p>Power reliability assessments will have to be solicited solely from local teachers of schools and will have to be self-assessed and verified. The assessment criterion most often used for the assessment is the frequency of brownouts experienced in the past 6 months to 1 year in the area. Since brownouts may have different causes and schedules in different areas, local researcher assessments will be arbitrary according to their set standards of brownout/ power disruption impacts.</p>			

Data	Description	Data Sources	Remarks
3)Telecommunications Infrastructure Assessment	Verified assessment on signal strength or reliability of telecommunications signal from schools/ VC's.	<p>COMELEC</p> <p>National Telecommunications Commission</p> <p>Private telecommunications services companies (Smart-PLDT, Globe)</p>	<p>COMELEC data on available telecommunication providers in schools or VC's was published in 2008. No updated report since then was disclosed. SmartMatic TIM was contracted to make the national assessment of telecommunications connection in April 2010. Their methodologies and limitations were not publicly disclosed. The company claims that some of the schools/ VC's have "poor" telecommunications connection.</p> <p>The NTC data was claimed to be proprietary by private telecommunication services providers/ corporations. Data had to be solicited from the private providers.</p> <p>Private "telcom" providers cannot share mapped assets and assessments of their facilities. Data sharing arrangements must be explored further.</p>
<p>Implications on research:</p> <p>Information on local school sites' telecommunications connectivity had to be solicited from local teachers and research partners. A 3-degree rating (None/ Bad - Average - Good) was used. Due to limited engagements of local research partners in the provinces, their ratings would be based mostly on stability of signal used and detected by their personal mobile phones on the sites. The number of available telecommunication providers reported by COMELEC in 2008 was also mapped.</p>			
4)Road Accessibility Assessment	Local assessment of road conditions going to schools/ VC's.	<p>Local field research partners e.g. local teachers and local poll watchers</p> <p>Department of Public Works and Highways (DPWH) and Local Government Unit (LGU) assessment on national and local roads.</p>	<p>No maps representing conditions of roads around schools or VC's have been published comprehensively for free. Maps of roads from open source GIS users are available for editing from Open Street map. This map was used as layer and is expected to be updated in the future.</p>
<p>Implications on research:</p> <p>Base map from Open Street map is the only available data layer for initial maps. Local information from local partners, e.g., flooding conditions of roads to schools/ VC's will be integrated in open sourced maps.</p>			

C. Database Methodology

To fill in the data gaps especially in the school locations and basic conditions, CenPEG AES - GIS partnered with other people's and community organizations, school institutions, church groups, poll watchers, and other for participatory online mapping. The AES-GIS conducted series of trainings and sharing to invite different partners to plot and substantiate the data base of GIS. Trainings and modules on filling out AES and AES-GIS were shared and hard copies of instructions and questionnaires (In English and Filipino) were distributed. Trainings, briefings and networking sessions from January-April 2010 listed in **Table 2** included AES-GIS database building in their programs.

	Date and Venue	Host	Number of Participants
1. Forum	January 8, 2010 St. Therese's College	St. Therese' College	40-50 Teachers and School Admin
2. Briefing	January 11, 2010 Miriam College	Miriam College	100+ Teachers, students, etc
3. Forum	January 11, 2010 Adamson University, Manila	Adamson University	
4. Briefing	January 11, 2010	Office of Sen. Nene Pimentel	
5. Event	January 18, 2010 Club Filipino	AES Watch Launch	
6. Briefing	January 21, 2010 Pope Pius Center, Manila	CBCP	40 Bishops and Archbishops
7. Forum	January 26, 2010 University of the Philippines Diliman-CMC	UP Mass Com	
8. Forum	January 27, 2010 University of the Philippines Manila	UP Manila	200 Students
9. JCOC Hearing	January 27, 2010 Senate	JCOC	
10. Briefing	January 28, 2010 University of the Philippines Diliman- CAL	Philippine Collegian	10-15 Students journalists
11. Training	January 30-February 1, 2010 Cotabato	Sisters' Association of Mindanao (SAMIN)	150+ nuns, priests, poll watchers, etc
12. JCOC 13. Hearing	February 5, 2010	JCOC	
14. Event	February 9, 2010 Ilustrado Restaurant, Manila	AES Watch	

	Date and Venue	Host	Number of Participants
15. Forum	February 9, 2010 Intramuros, Manila	CBCP-NASSA	
16. Training	February 10, 2010 UCCP	Task Force Poll Watch (TFPW)	
17. Briefing	February 11, 2010 QC	Center for Trade Union and Human Rights (CTUHR)	20-30 Trade Union Leaders
18. Briefing	February 15, 2010 Batangas	St. Bridget University	
19. Forum	February 16, 2010 Miriam College, QC	Miriam College	
20. Forum	February 17, 2010 Baguio	University of Cordilleras	
21. Forum	February 18, 2010	Mary hill School of Theology	
22. Training	February 19-21, 2010 Bohol	NASSA	
23. Briefing	February 22, 2010 Tagaytay	St. Jude Archdiocese	50+ Priests
24. Forum	February 22, 2010 Intramuros, Manila	EILER	80 from different unions, media
25. Briefing	February 25, 2010 GMA News, QC	GMA.net	15 GMAnews.TV editorial and IT staff
26. Training	February 25-27, 2010 Marawi City	Concorde	20-30 Students, Moro- Christian leaders
27. Event- EU Website Launch	March 10, 2010 Balay Kalinaw, UP Diliman	Project 3030	
28. Briefing	March 13, 2010 Christ the King Parish, QC	AMRSP	
29. Training	March 16, 2010 Bacolod, Negros Occidental	TFPW	
30. Briefing	March 20, 2010 Cauayan, Isabela	Social Action Center of Gamu, Isabela (St. Ferdinand)	130+ priests, church and lay workers
31. Training (Panay-wide)	March 20, 2010 Iloilo	TFPW	20-30 Poll Watch leaders
32. Training	March 21, 2010 Bukidnon	TFPW	50 members of Gabriela, Kabataan, Makabayan

	Date and Venue	Host	Number of Participants
33. Briefing	March 23, 2010 La Union	Ecumenical Bishop's Forum (EBF)	30-40 Pastors, Church Workers
34. Event- Round Table Discussion on the RMA	March 29, 2010 UP Alumni Association Board Room	AES Watch	
35. Training	April 7, 2010 Bicol	NASSA	100 NASSA directors and lay leaders
36. Forum	April 8, 2010 Redemptorist Church, Pasay City	Redemptorist Church	100 Priests
37. Training (Luzon-wide)	April 12, 2010 ACT HQ, QC	TFPW National	
38. Forum	April 13, 2010 GMA News, QC	GMAnews.tv	50 student leaders from Universities in metro manila
39. Training (Visayas-wide)	April 14, 2010 Cebu	TFPW National	
40. Briefing	April 14, 2010 UP College of Law	Center for Women Studies (CWS) WOWVOTE	20 members of CWS
41. Forum	April 16, 2010 AMA Computer University through GMAnews.TV	AMA Computer University	150 students
42. Training (Mindanao- wide)	April 17, 2010 Misamis Oriental	TFPW National	30-50 Poll Watch Leaders
43. Events (Round Table Discussion)	April 17, 2010	AES Watch	
44. Briefing	April 19, 2010 UCCP	TFPW NCR	20-30 Poll Watch Leaders
45. Training	April 20, 2010 Isabela	TFPW Cagayan Valley	50+ Poll Watchers
46. Briefing	April 20, 2010 QC	Citizens' Disaster Response Center (CDRC)	
47. Briefing	April 20, 2010 Batangas	EBF	
48. Forum	April 23, 2010 Negros Occidental	CEGP	200 College Editors

The biggest challenge of this participatory mapping is the lack of internet access of participants especially in remote areas. Some participants were not confident to do the actual Google earth mapping and KML file sharing themselves. One of the long term solutions for promoting and sustaining the participatory data base building is to partner with local schools for regular workshops on Google earth mapping.

Data and returned questionnaires (although incomplete) from the following areas were shared by local network partners of CenPEG:

1) Cagayan Valley	2) Masbate	3) Cebu City	4) Bohol	5) Cotabato City
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The AES-GIS in the next months will have to promote and prepare community partners in contributing and using the public database (especially on election related activities) and tools like Google earth. This will build stronger and informed communities with rich data and information accessible through the internet. In the next months, AES-GIS should partner with local IT schools and encourage the youth in participating in such participatory mapping program. Once the basic data layer has been created, more data and information can be solicited or shared to the public.

II. Summary of Findings Based on the Preliminary Data

The second part of this report presents partial results and summaries of collected data from different sources. This part is being continually updated as data becomes available. The first batch released in May 7th 2010 (being updated) was shared in the website: <http://www.eu-cenpeg.com/KML/gis-page/map.html>

As of May 7th 2010 the database of the following regions were encoded.

Regions	Number of reported schools in file	Number of schools with GPS	Number of Schools with data encoded	Encoder/s
Region I				Isabel Della
Ilocos Sur	866	0	865	
La Union	716	0	716	
Region II				Isabel Della
Batanes	20	20	0	
Cagayan	593	0	575	
Nueva Vizcaya	18	0	7	
Quirino	138	0	138	
Region III				Louise Carreon
Aurora	350	193	157	
Bataan	229	0	229	
Bulacan	616	0	616	
Nueva Ecija	860	0	860	
Pampanga	45	0	45	
Tarlac	18	0	18	
Region IV				Louise Carreon
Cavite	84	0	84	
Romblon	194	194	0	
Batangas	25	0	25	

Region V				Louise Carreon
Albay	58	0	56	
Camarines Norte	289	0	288	
Camarines Sur	165	161	161	
Catanduanes	320	0	320	
Masbate	570	570	0	
Region VI				Maribel Javillana
Antique	448	448	0	
Capiz	406	406	0	
Guimaras	90	90	0	
Aklan	281	0	279	
Region VII				Maribel Javillana/ Marj Aias
Nezros Oriental	607	607	0	
Siquijor	138	0	138	
Region VIII				Mari Aias
Biliran	118	118	0	
Levte	1084	1084	0	
Southern Levte	319	319	0	
Eastern Samar	433	433	0	
Region IX				Michelle Hernandez
Zamboanga del Sur	2042	986	779	
Zamboanga Sibugav	535	0	390	
Zamboanga del Norte	712	0	712	
Region X				Michelle Hernandez
Misamis Oriental	558	0	558	
Misamis Occidental	495	0	495	
Lanao del Norte	516	0	516	
Camiguin	58	0	58	
Bukidnon	1075	0	1075	
Region XI				Michelle Hernandez
Davao del Norte	265	4	257	
Davao Oriental	245	0	245	
Davao del Sur	685	0	685	
Compostela Vallev	208	0	208	

Region XII				Brian Puerto
Sarangani	193	3	0	
North Cotabato	1174	1174	0	
South Cotabato	289	0	0	
Sultan Kudarat	302	0	0	
Region XIII				Brian Puerto
Agusan del Sur	764	764	0	
Surigao del Sur	748	0	215	
Surigao del Norte	343	0	343	
Dinagat Islands	99	0	0	
CAR				Louise Carreon
Abra	254	254	0	
Apayao	128	128	0	
Benguet	312	312	0	
Ifugao	196	196	0	
Kalinga	207	207	0	
Mountain Province	117	117	0	
ARMM				Brian Puerto
Basilan	252	0	0	
Sulu	437	0	0	
Tawi Tawi	215	0	0	
Lanao del Sur	779	0	0	
NCR	925	925		Isabel Della

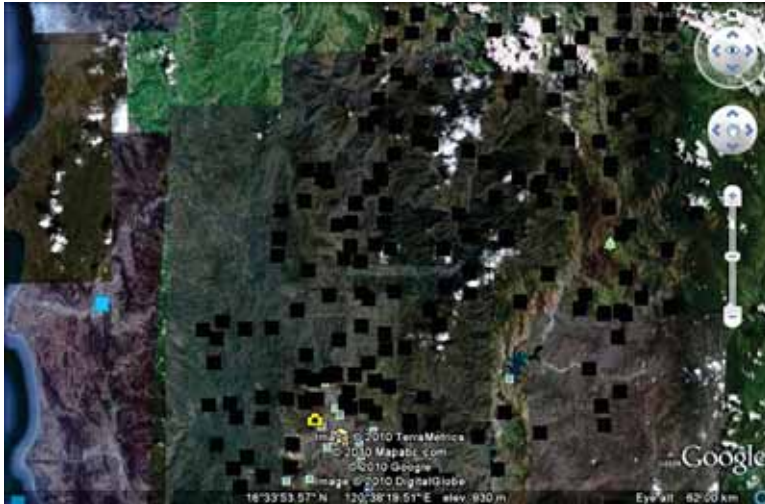
The GIS research set schools or voting centers as the basic spatial units (Geographic coordinates/ POINTS) to which selected attributes on physical conditions of infrastructures for AE e.g. 1) road networks 2) power assessment of schools and 3) telecommunications connectivity assessment, can be linked.

Provinces with partially mapped (schools with GPS coordinates) and encoded schools identified as voting centers for the May 2010 elections include (Data mapped released in the website, May 7, 2010):

Province	Number of Schools/ VC's with GPS data	Power Reliability Data	Telecom Infra Connectivity Data	Road Infra Assessment Data
Benguet	245	With data COMELEC	With data COMELEC	No data
Pangasinan	114	With data COMELEC	With data COMELEC	No data
Negros Oriental	147	With data COMELEC	No data (incomplete encoded data)	No data
North Cotabato	171	With data COMELEC	With data COMELEC	No data
Zamboanga del Sur	563	With data COMELEC	With data COMELEC	No data

The following images were lifted from the KML uploaded files in Google earth. The same data layers were shared in the <http://www.eu-cenpeg.com/KML/gis-page/map.html> website in May 7th 2010.

Displayed maps May 7th 2010: Ambuklao, Benguet (Luzon)



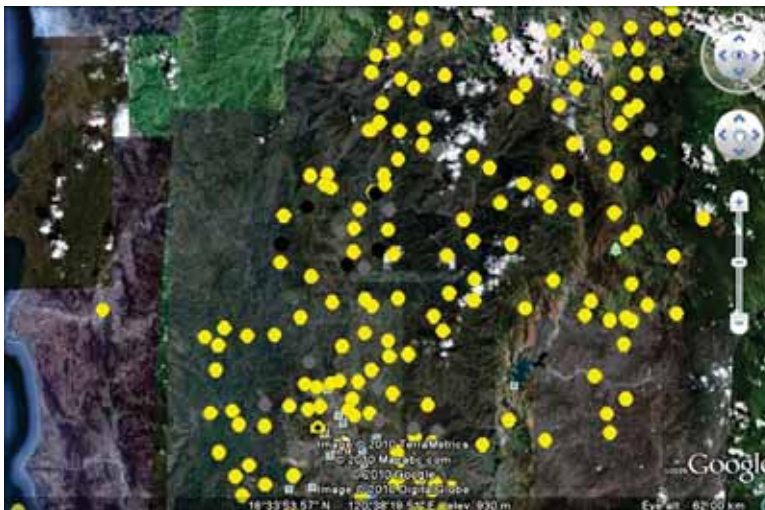
Ambuklao, Benguet
Telecommunications
(No Data - ND)

Layers

Connectivity

NO. OF TELECOM CONNECTIONS

- 1
- 2
- 3
- ND



Ambuklao, Benguet
Power (Stable/ None/No
Data - ND)

Layers

Power Supply

POWER

- Stable
- None
- No Report
- ND

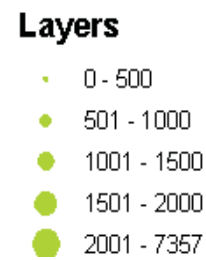
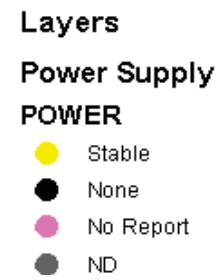
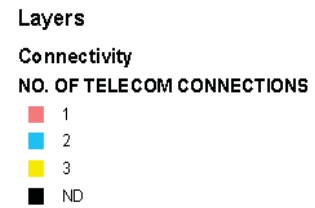


Ambuklao, Benguet
Voting Population
(number of registered
voters, 2010)

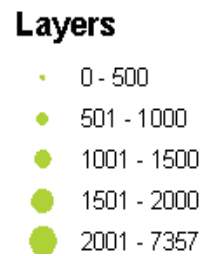
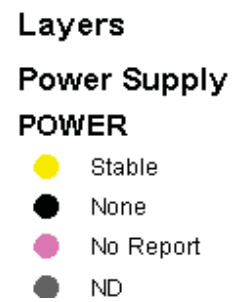
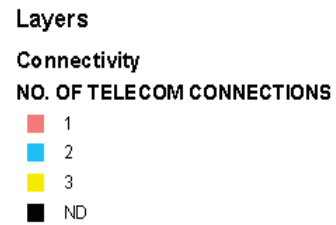
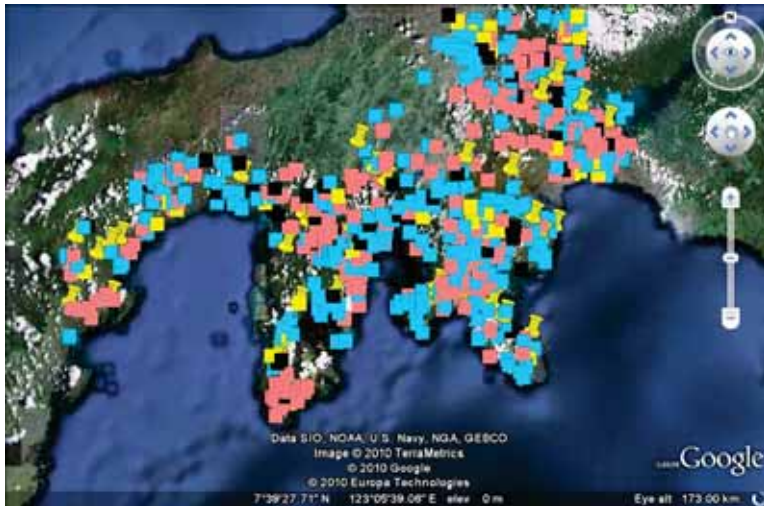
Layers

- 0 - 500
- 501 - 1000
- 1001 - 1500
- 1501 - 2000
- 2001 - 7357

Displayed maps: Dagupan, Pangasinan (Luzon)



Displayed maps: Zamboanga del Sur (Mindanao)



From the list of the pre election selected and mapped provinces (data source: COMELEC 2008): schools reviewed to have Power: "NONE", translate to at least 96,796 affected voters for 2010. This figure represents possible disenfranchised voters without even counting the other possible schools without power, which were not included in this batch of tally and mapping. Vote disenfranchisement is the potential risk unless the technology provider, Smartmatic-TIM, succeeds in putting a functional satellite data transmitter system.

Province	Number of schools with Power = NONE	Total Number of schools/ VC's	Number of Precincts in affected schools/ VC's
Benguet	10	245	26
North Cotabato	21	171	86
Zamboanga del Norte	97	563	559

*Other provinces have zero (0) reported schools/ VC's with Power = none.

Telecommunication connectivity by Number of providers

Province	Number of schools with Telecom Provider = NONE	Total Number of schools/ VC's	Number of Precincts in affected schools/ VC's
Benguet	No data	245	No data
North Cotabato	22	171	117
Zamboanga del Norte	941	563	194

*Other provinces have zero (0) reported schools/ VC's with Telecom Provider number = none.

Election Day Database application

The existing database (unedited) collected, (including all schools/ voting centers without GPS coordinates) includes about 21,668 schools with partial data on voting populations and number of precincts. On May 10th 2010 morning, the rate of voting per person was estimated to be 1 minute or on the average 60 persons/ hour, in Metro Manila. Assuming the rate is true for other places and throughout the day (1 minute for each voter to confirm, get voting materials, write and submit ballots into the PCOS machines), AES-GIS conservatively estimated the number of voters at risk of disenfranchisement if Comelec will not extend the official voting hours on Election Day. If only 720 voters will be able to vote until 6 p.m. on Election day, there will be at least 280 voters for every 1000 (assigned) voters of each PCOS machine who will be at risk of disenfranchisement. The number from about 130 schools in the AES-GIS database alone, can total to at least 26,077 voters. The official poll closing time was eventually extended by Comelec: Polls closed at 7 p.m. The number of voters who left and decided not to vote later in the day is not known, but is believed to be quite high.

III. Post Election Research Components

This last part enumerates activities for the next 6 to 12 months of continuing the public information elections map and database building in GIS.

- 1) Data collection on case study sites
- 2) Data encoding and verification
 - 2.1) Data sources conference
- 3) Data base editing and mapping
- 4) Data summary and Reporting