

# SMART LOW CARBON CITY DEVELOPMENT in NORTH SULAWESI eastern part of Indonesia

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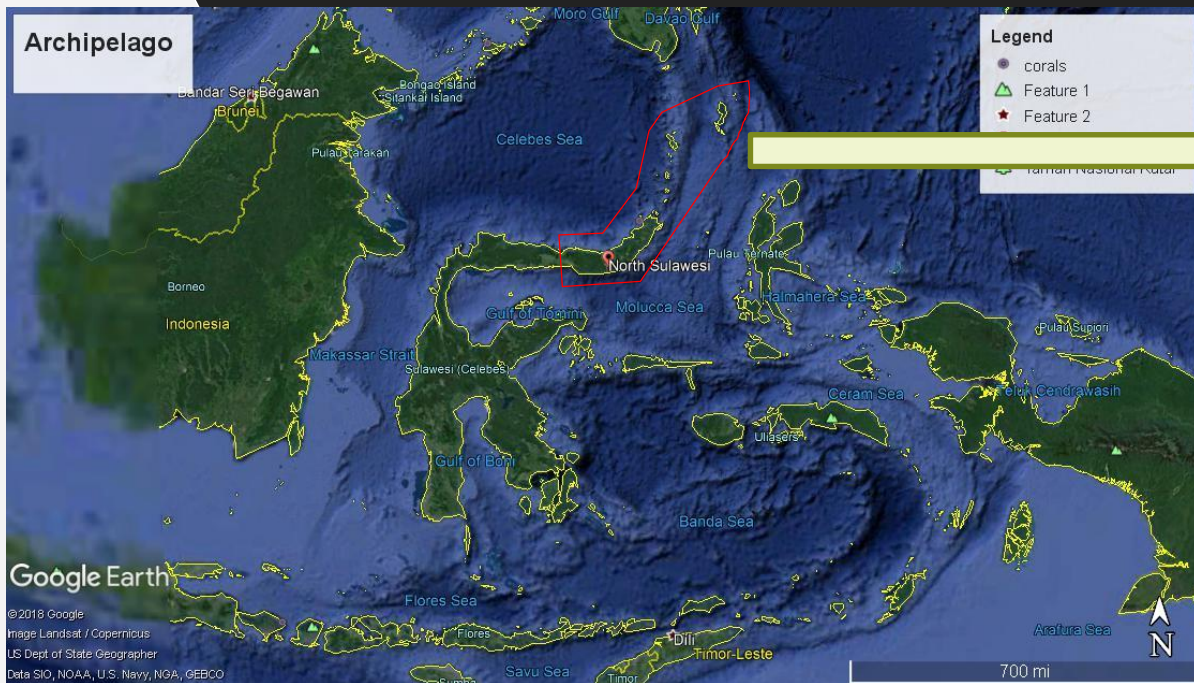


Ministry of Research, Technology and Higher Education Republic of Indonesia  
**University of Sam Ratulangi**  
Manado, North Sulawesi

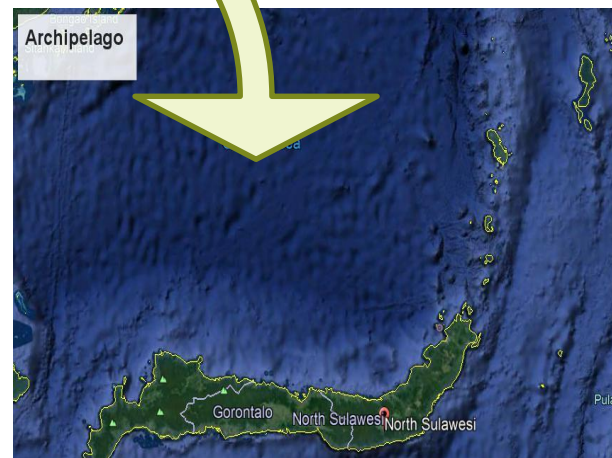
# Outline

- **Overview North Sulawesi Province**
- **Energy Potent in North Sulawesi**
- **Projection up to 2032**
- **Planning**
- **Conclusion**

# Archipelago Country

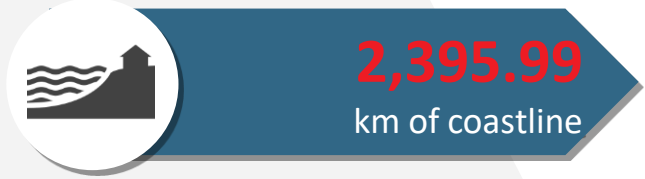
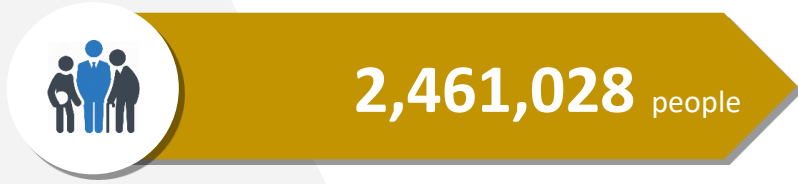


**Eastern Part:  
NORTH SULAWESI**

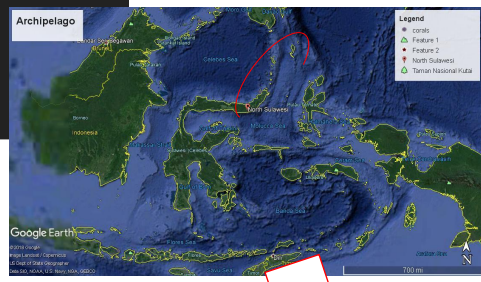


# Indonesia

# North Sulawesi's Geographic and Administrative Area



Data source:  
- BPS North Sulawesi  
- BAPPEDA North Sulawesi





# North Sulawesi's Rivers



**Bolaang Mongondow**

**21**

176.7802 m<sup>3</sup>/s

**Minahasa**

**23**

86.4318 m<sup>3</sup>/s

**Sangihe Talaud**

**4**

11.5397 m<sup>3</sup>/s

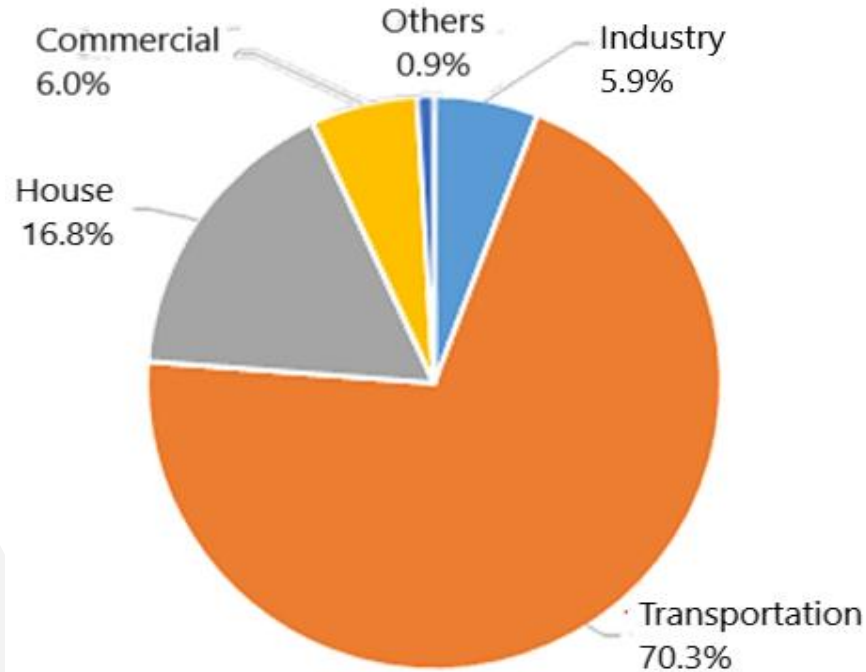
TOTAL **48** rivers

# Energy Potent Resources in North Sulawesi

TOTAL **5386 MW** + unplanned

No,	Energy	Unit	Capacity
1	Marine Energy	MW	<i>unplanned</i>
2	Wind Energy	MW	1214
3	Biogas	MW	13,8
4	Biomass	MW	150,2
5	Solar	MW	2113
6	Hydro	MW	888,6
7	Geothermal (used)	MW	128
	Geothermal (Reserve)	MW	768
8	Minihydro/Microhydro	MW	111

# Energy Utilization in North Sulawesi



**Total: 774,000 TOE**

TOE: Tonnes of Oil Equivalent

# Energy Indicator in North Sulawesi

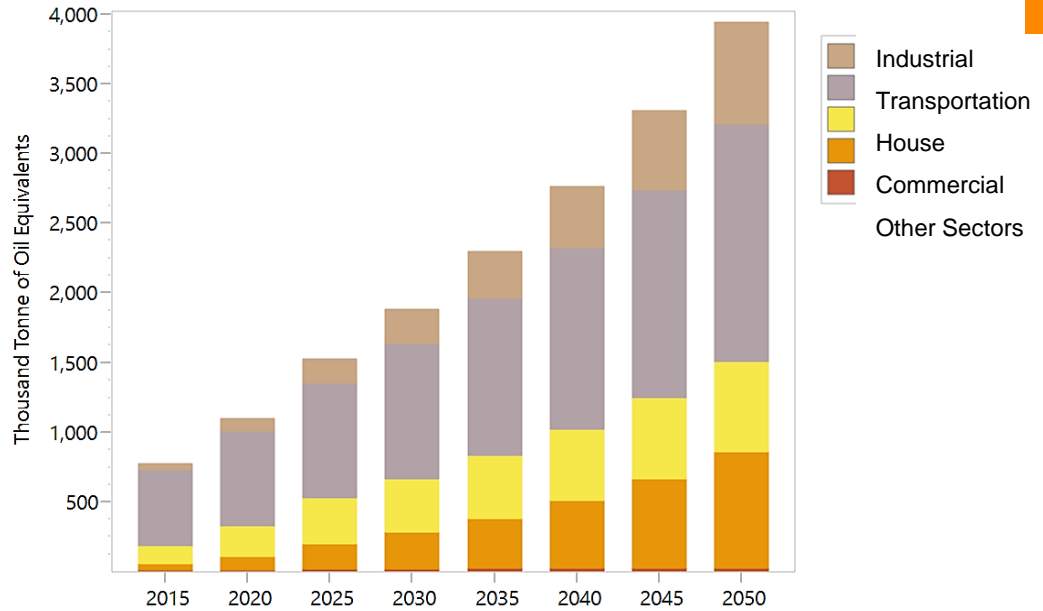
Indicator	Year			
	2015	2020	2025	2050
Energy use elasticity	1,25	0,99	0,91	0,58
Energy use per GRDP (TOE/Billion Rupiah)	11,00	11,25	10,90	5,63
Energy use per capita (TOE/capita/year)	0,32	0,43	0,58	1,26
Electricity usage per capita (kWh/capita/year)	540	1.135	1.968	5,837
Electrification ratio (Percent)	89,17	100	100	100

Data Source: National Energy Planning, 2017



# Projection of Energy Needs

Based on  
TYPE of  
SECTOR



Branches	2015	2020	2025	2030	2035	2040	2045	2050
<b>Industrial</b>	45	90	174	245	334	442	572	729
<b>Transportation</b>	545	675	822	969	1.128	1.300	1.489	1.706
<b>House</b>	130	223	328	387	451	515	582	648
<b>Commercial</b>	47	95	184	262	361	486	640	834
<b>Other Sectors</b>	7	9	12	15	17	19	21	22
<b>Total</b>	774	1.093	1.520	1.877	2.291	2.763	3.305	3.939

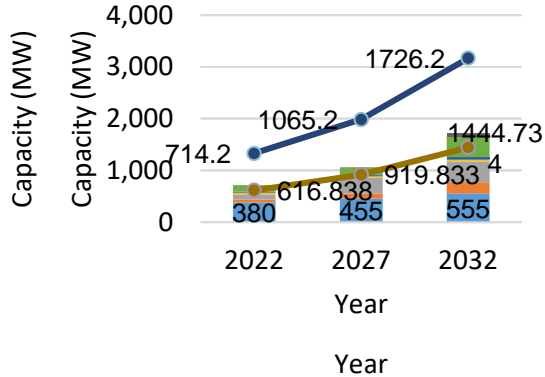
# Projection of Power Plant Capacity



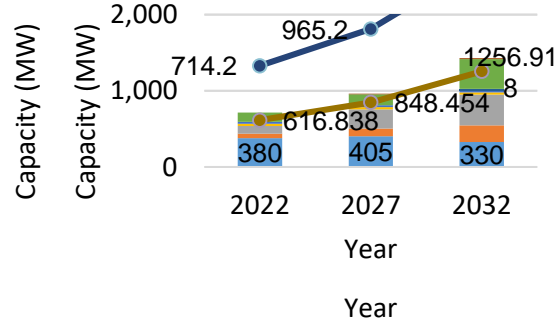
BRANCHES	2015	2020	2025	2030	2035	2040	2045	2050
Coal Steam Power Plant	33	225	300	600	725	850	1.150	1.400
Gas and Steam Power Plant	-	-	150	150	150	150	150	150
Gas Power Plant	-	150	150	150	150	150	150	150
Gas Engine Power Plant	-	20	30	60	60	90	90	90
Diesel Power Plant (Oil)	146	122	61	-	-	-	-	-
Hydroelectric Power Plant	51	63	118	150	175	200	300	400
Mini Microhydro Power Plant	0,2	9	18	18	18	18	18	18
Geothermal Power Plant	75	100	175	225	275	300	350	400
Biomass Power Plant	-	-	-	20	40	60	80	100
Solar Power Plant	0,7	15	35	100	150	200	300	500
Wind Power Plant	-	4	25	40	55	70	85	100
<b>TOTAL</b>	<b>306</b>	<b>708</b>	<b>1.062</b>	<b>1.513</b>	<b>1.798</b>	<b>2.088</b>	<b>2.673</b>	<b>3.308</b>

# Power Balance Projection in North Sulawesi

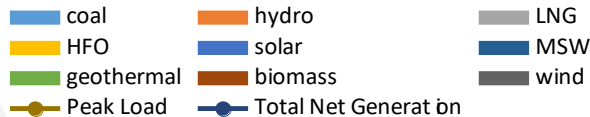
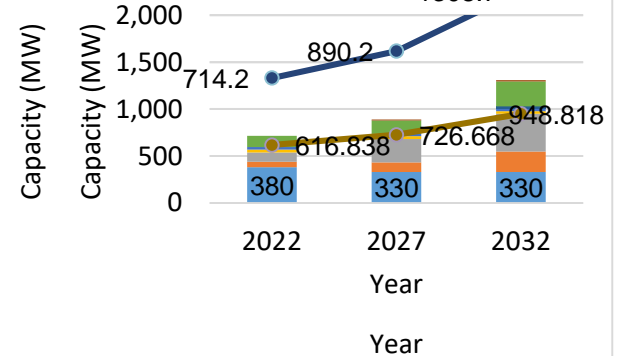
### Business As Usual (Normal)



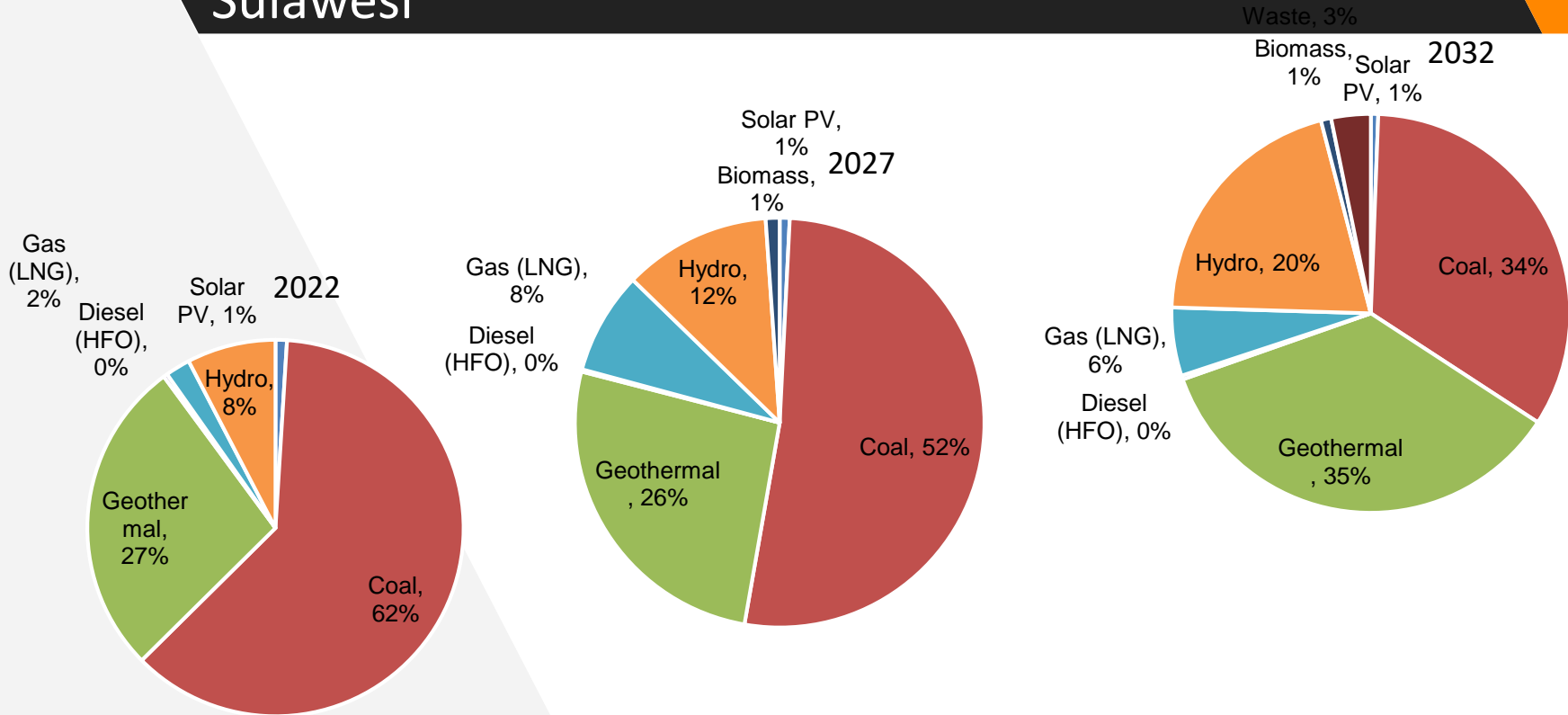
### Business As Usual (with EE CEP)



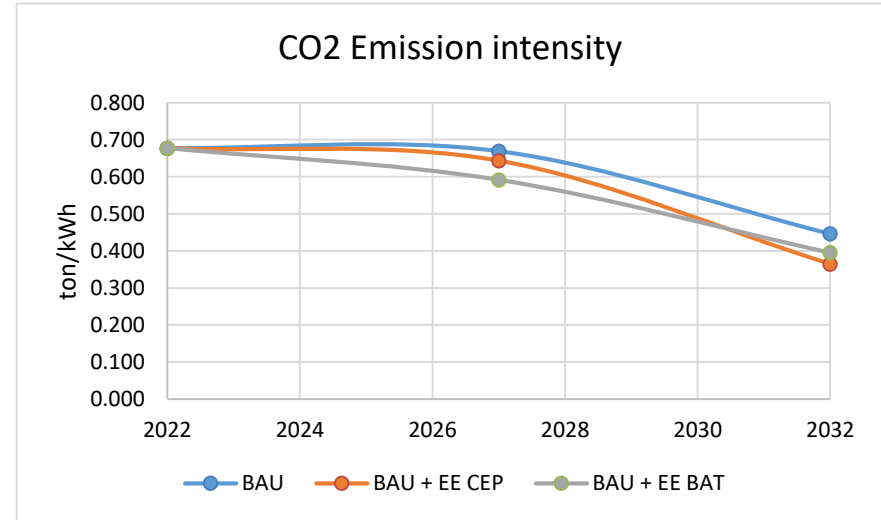
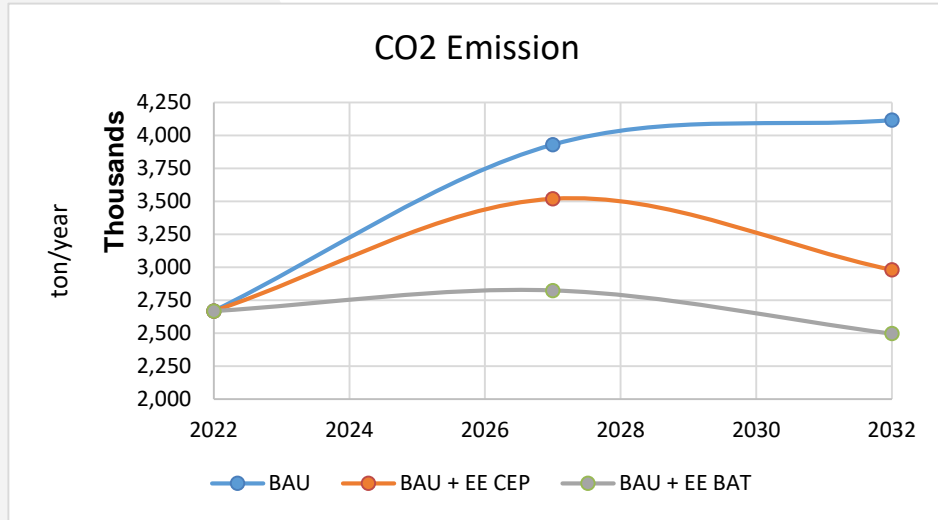
### Business As Usual (with EE BAT)



# Projection of Power Plant Generation in North Sulawesi



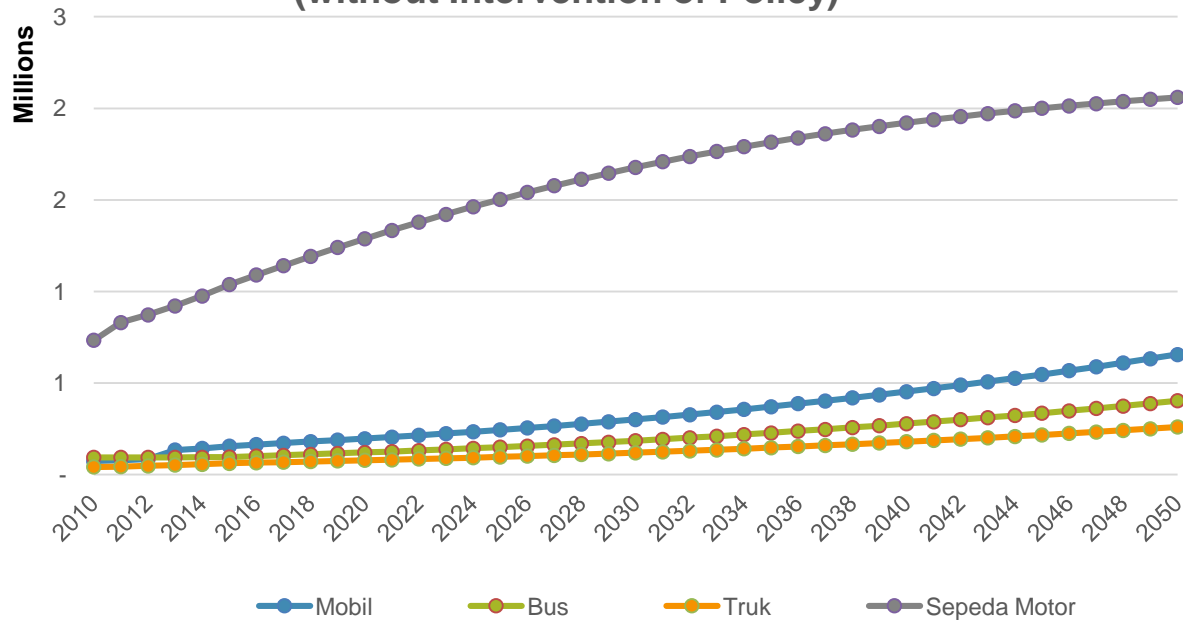
# Projection of Carbon Emission in North Sulawesi





# VEHICLE GROWTH in North Sulawesi

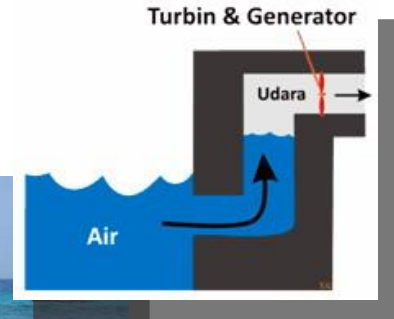
### Projection of Vehicle Growth (without Intervention of Policy)



# Micro Hydro Power Plant



# Marine Energy





# Geothermal Power Plant



Clove



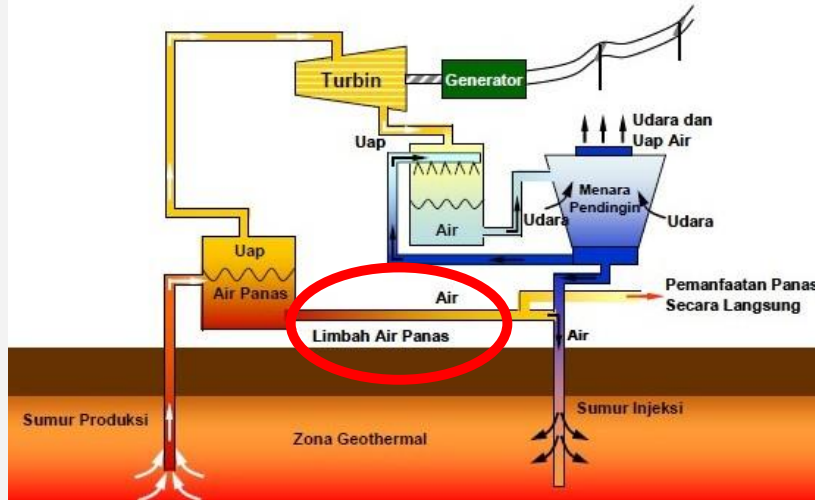
Red onion



Coconut



Utilizing Geothermal  
BRINE as thermal source  
for drying  
AGRICULTURAL  
PRODUCT



# Conclusion

1. Support to Government for Preparing regulations for acceleration of the use of Renewable Energy
2. An Increase in Partnerships between government and universities, especially in developing the potential of renewable energy in North Sulawesi
3. Several regents and cities in North Sulawesi have start to develop low carbon regional, green building and renewable energy usage ( in case New Manado City, and Special Economic Zone, Bitung)
4. Sam Ratulangi University and DTU have collaborated to develop new and renewable energy to solve energy needs in North Sulawesi





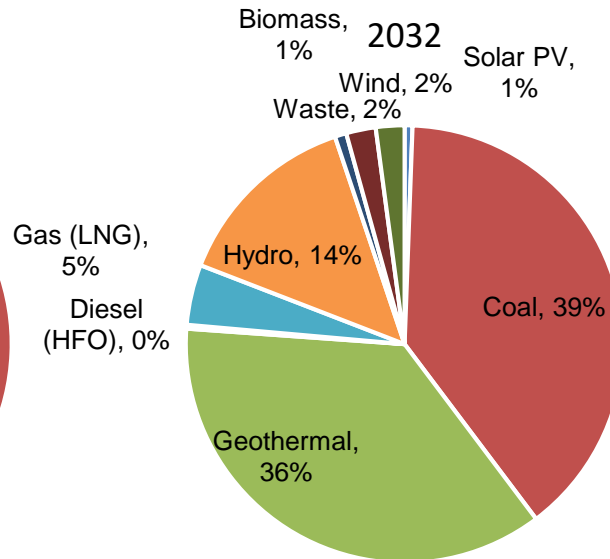
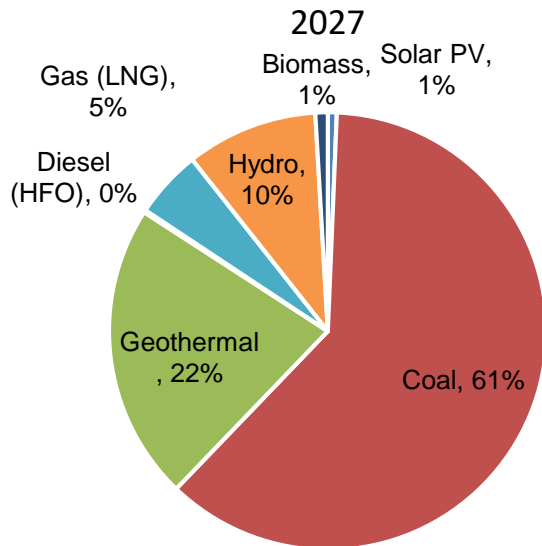
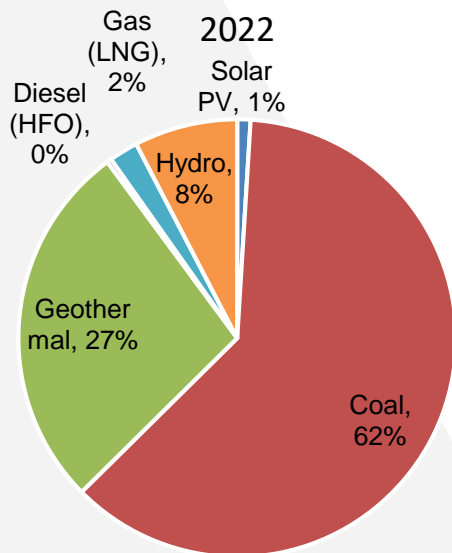
TAK  
THANKS!  
Terima Kasih



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# Projection of Power Plant Generation in North Sulawesi

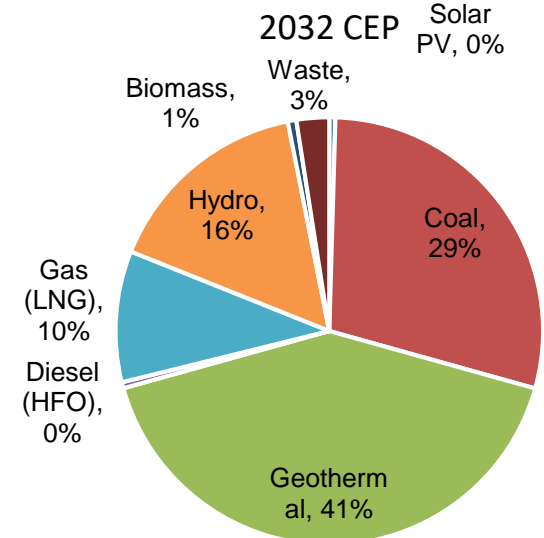
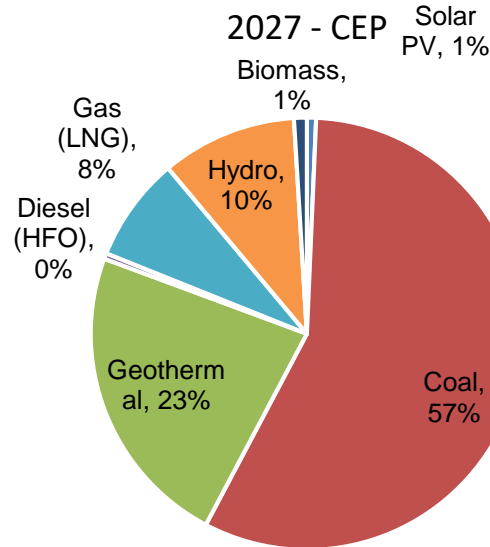
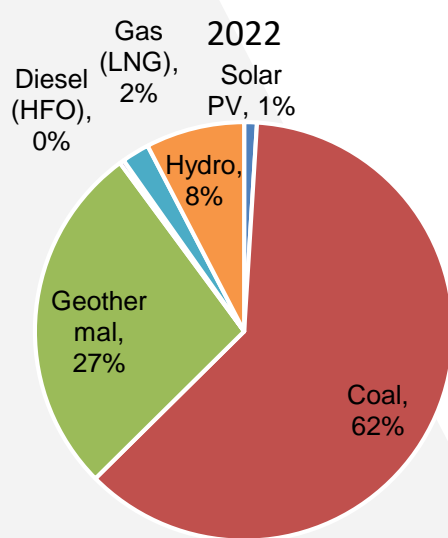
## Business as Usual (Normal)



Draft Energy Planning of North Sulawesi

# Projection of Power Plant Generation in North Sulawesi

## EE-CEP



HFO: Heavy Fuel Oil

Draft of Energy Planning of North Sulawesi

BAU: Business as Usual

CEP: Cost Efficient Performance

BAT: Best Available Technology

# NORTH SULAWESI BASIC ASSUMPTION in 2015 – 2050

No	Indicator	UNIT	Year							
			2015	2020	2025	2030	2035	2040	2045	2050
1	GRDP	Trillion Rupiah	70	97	139	200	281	386	521	699
2	GRDP Growth	%	6,12	7,00	7,50	7,50	7,00	6,54	6,21	6,06
3	GRDP per Capita	Million Rupiah	29	38	53	73	98	131	171	223
4	GRDP Growth per Capita	%	4,85	5,94	6,65	6,69	6,24	5,82	5,54	5,43
5	Population	Million people	2,41	2,55	2,65	2,75	2,85	2,95	3,05	3,14
6	Population Growth	%	1,22	1,00	0,80	0,76	0,72	0,68	0,64	0,60







## Projection of Energy Needs

Based on  
TYPE of  
Energy

Fuels	2015	2020	2025	2030	2035	2040	2045	2050
<b>Electricity</b>	112	247	446	598	783	1.002	1.260	1.569
<b>Natural Gas</b>	-	-	-	-	-	-	-	-
<b>Premium</b>	287	261	198	189	173	152	127	101
<b>Avtur</b>	37	49	34	37	37	32	21	-
<b>Kerosene</b>	15	9	1	1	1	0,5	0,2	-
<b>Diesel Oil / HSD</b>	63	64	59	57	52	41	23	-
<b>MFO</b>	5	5	4	4	4	4	4	4
<b>LPG</b>	55	76	93	96	100	104	109	114
<b>Coal</b>	1	2	5	7	9	13	17	22
<b>Briquette</b>	3	7	14	20	27	37	49	65
<b>Biogas</b>	-	2	4	7	8	10	12	13
<b>Avgas</b>	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03
<b>BioSolar</b>	170	236	329	420	527	647	780	927
<b>Bio Premium</b>	-	83	195	238	281	323	363	403
<b>Industrial Diesel Oil</b>	3	3	1	1	1	0,4	0,2	-

Data Source:

National Energy Planning, 2017

# Fuels Energy Utilization in North Sulawesi

Fuels	Industry	Transportation	House	commercials	Others	Total (TTOE)
Electricity	10,09	-	63,25	38,74	-	<b>112</b>
Gas	-	-	-	-	-	-
Premium	-	287,12	-	-	-	<b>287.12</b>
Avtur	-	36,90	-	-	-	<b>36.90</b>
Kerosene	0,76	0,09	13,51	0,71	0,18	<b>15.25</b>
Industrial Diesel Oil	4,50	49,89	-	4,50	4,50	<b>63.39</b>
Marine Fuel Oil	2,29	0,60	-	-	2,07	<b>4.96</b>
LPG	0,13	-	53,63	1,10	-	<b>54.86</b>
Coal	1,08	-	-	-	-	<b>1.08</b>
Briquette	3,06	-	-	-	-	<b>3.06</b>
Biogas	-	-	-	-	-	-
Avgas	-	0,02	-	-	-	<b>0.02</b>
BioSolar	-	169,78	-	-	-	<b>169.78</b>
BioPremium	-	-	-	-	-	-

TTOE:  
Thousand Tonnes of  
Oil Equivalent

