EnerGaia

Project Objectives

- Create an alternative livelihood to fishing (dugong hunting, seagrass destruction) through spirulina farming
- Also creates an additional source of nutrition for communities
- Any participants found to be violating the law related to the protection of dugongs (or any other law) will be no longer be allowed to be part of the contract farming program

- Countries: Indonesia and Solomon Islands

EnerGaia

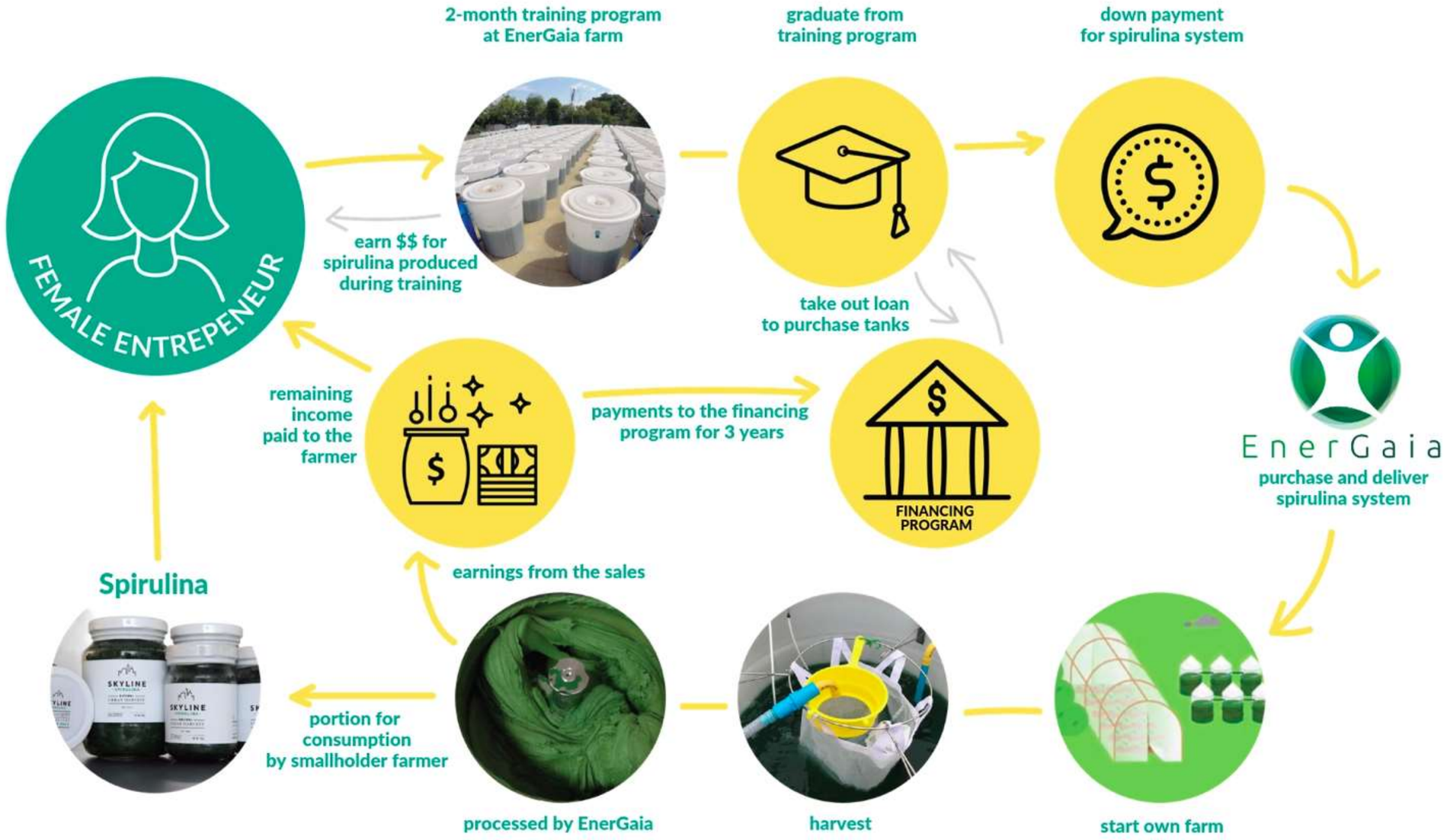
What is spirulina?

1 tbsp/10g of Skyline Spirulina by EnerGaia contains:

5.4g	8.72mg	4.14mg	3.45mg	21.8mg	108.3mg
protein	calcium	magnesium	iron	beta carotene	potassium
= 22g / 0.78oz of steak	= 5.5oz of milk		= 128g of spinach	= 2/3 large banana	= 1.1kg of carrots	= 17.5 g of tomato

EnerGaia

Spirulina smallholder farming program



Income creation with guaranteed buyer (EnerGaia)

SYSTEM		PRODUCTIVITY		CONTRACTED PURCHASE		ANNUAL REVENUE
						
30 EnerGaia Bioreactors	x	**3.0 kg** Spirulina per year	x	**$10** per kg	=	**$900** per farmer

EnerGaia

Teluk Bogam, Central Kalimantan, Indonesia

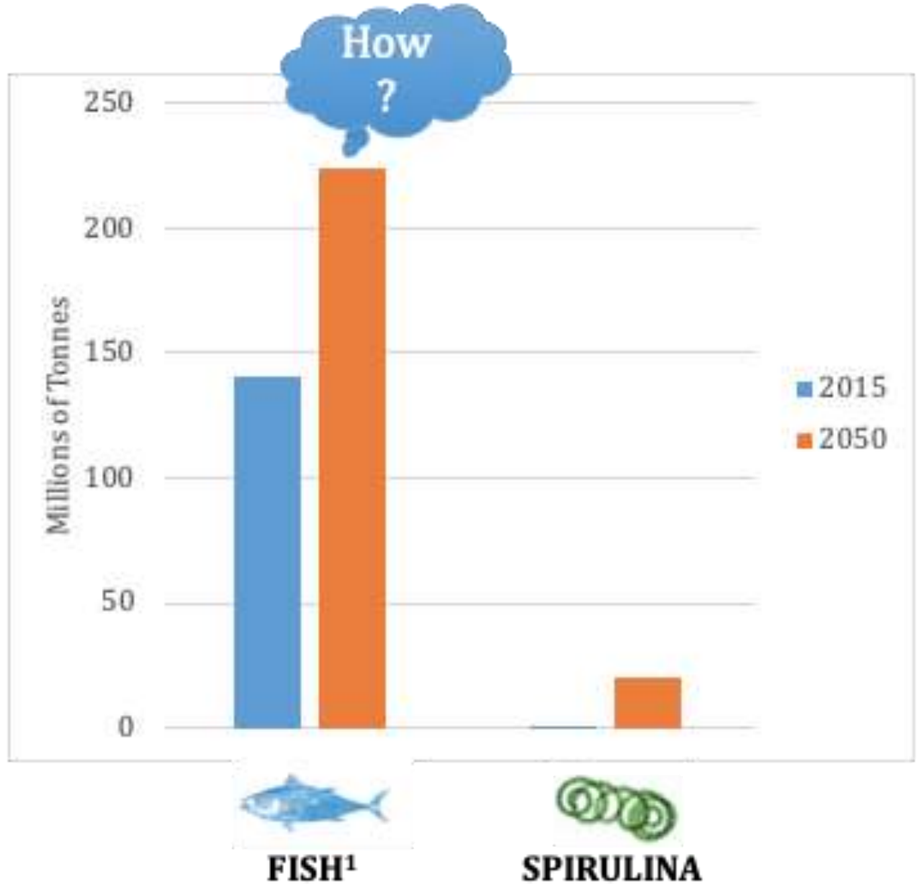
Situation on the ground

- Bogam is one of four villages in Central Kalimantan well known for dugong sightings & hunters
- WWF created a group called Pokmaswas to help protect the dugong
- Since 2017, dugong hunting seems to have stopped, but no official declaration from the former hunters
- WWF 2018 feasibility study determined an alternative livelihood was needed
- Coordination with EnerGaia started in 2018
- Bogam was chosen to be the pilot site

What has been achieved

EnerGaia

Prepared detailed business plan and financial model



1: Source: Food and Agriculture Organization of the United Nations, "World Agriculture: Towards 2015/2030. An FAO perspective..."

- Indonesian Population: 261 Million
- Estimated local spirulina demand:
  - 1400 tons short term
  - 600,000 tons by 2050
- Growing Season: Year Round
- Operational Costs: Low
- Sell price: USD $20 - $30 kg for fresh spirulina
  USD $40 - $60 for dry spirulina
- Export Markets: USA, Europe, Australia

EnerGaia

Understanding local costs and supply availability

Supplier Name		Thai compari	PT Synergi Tangguh Perkasa	Central Kimia	PT Harapan Kemika	PT Mada Putera Perkasa
Nutrients	**Common name**	**USD/kg**				
(NH4)2MoO4	ammonium molybdate					
(NH4)2SO4	Ammonium Sulfate					$0.53
C6H8O7	Citric Acid	$1.09	$1.48	$2.14	$0.94	$1.28
Ca(OCl2)	calcium hypochlorite			$0.47		$2.81
CaCl2	Calcium Chloride	$0.28	$0.74			$0.64
FeCl2	Iron chloride or iron (ii) chloride					
FeSO4	Iron Sulphate	$0.44	$2.31			$0.68
H3PO4	phosphoric acid					$1.74
K2HPO4	Potassium Phosphate	$2.59	$0.00	$6.41		
K2SO4	Potassium Sulphate	$1.19	$3.53			
KCl	potassium chloride					$1.07
KH2PO4	mono potassium phosphate or potassium phosphate dibasic					$2.10
MgSO4	Magnesium Sulphate	$0.38	$0.46	$0.51		$0.53
MnCl2	Manganese chloride or Manganese (II) chloride					
MnSO4	Manganese sulfate or Manganese (II) sulfate					$1.53
MoO3	Molybdic acid					
Na2EDTA	Di-sodium Ethylenediaminetetraacetic acid	$4.38	$13.42			$8.55

EnerGaia

Training center and training spirulina farm

Abandoned Fisheries Department Building

Current State of EnerGaia's Training Center (Lab, Processing)

EnerGaia

Hiring and training local EnerGaia support team

Idham (WWF); Paul (Indonesia Country Manager); Rahma (Microbiologist); Thoni (Microbiologist)

Rektarini (Onsite Project Manager)

EnerGaia

Preparing first training class

31 community members have signed up for the first EnerGaia training class:

- 9 = Pokmaswas
- 8 = former hunters
- Rest = family members of former hunters

No	Name	Gender	Pokmaswas	ex Hunter	ex Assistant Hunter	Family exHunter/ Pokmaswas
1	Hairusalam	M				
2	Muliadi	M				
3	Sawaludin	M				
4	Tarmidi	M				
5	Ardiansyah	M				
6	Arsad. J	M				
7	Ahmad Ghozali Rahman	M				
8	Jailani	M				
9	Nafriansyah	M				
10	Erna	F				
11	Hairuni	M				
12	Arbayati	F				
13	Sahminan	M				
14	A. Saharman	M				
15	Umis	F				
16	Anang Husni	M				
17	Rinto	M				
18	Salmiah	F				
19	Nasrin	M				
20	Arliyani	F				
21	Salasiah	F				
22	Sarwani Abdan	M				
23	A.Syahbari	M				
24	Sampurna	M				
25	Suriyadi	M				
26	Riduansyah	M				
27	Alpiannoor	M				
28	Mursalim	M				
29	Rina Wati	F				
30	Syahminan	M				
31	Anang Godong	M				

EnerGaia

Cooking Competition to add Spirulina to Local Dishes

WINNER !!!

EnerGaia

Local Acceptance: Spirulina dishes well received and enjoyed




EnerGaia

Solomon Islands

Prepared detailed business plan and financial model

Items	Amount
Capital Investments (Equipment for Farmers)	$67,700
Operating Expenses (Tech Support, Processing, Fertilizers)	$288,354
SG&A (Country team, Office)	$163,296
Other Expenses (Bad Debts, Misc)	$9,028
Total Expenses	**$528,378**
Less GEF Funds	- $38,466
Less Farmer Equipment 10% downpayment	-$6,770
Less Farmer Equipment Microfinancing (Assumption)	- $60,930
Less Revenues from Operations	-$236,638
Funds Needed	**$185,574**
Contingency	$14,426
Funds Sought	**$200,000**

- Population: 600,000
- Estimated local spirulina demand: very low
  - Business case built around export to Australia
- Growing Season: Year Round
- Operational Costs: High compared to Thailand
  - Electricity cost 6x
  - Phone and internet much more expensive
  - Labor a bit more expensive for skilled positions
  - Local transport much more expensive
- Assumed nutrient costs would be similar to Thailand

EnerGaia

Understanding local costs vs. business model assumptions

	Solomon Islands	
Thailand equivalent	Nutrients	
USD/kg		USD/kg
$0.38	NaHCO3	$3.10
$0.91	NaNO3	$61.22
$0.20	NaCl	$23.53
$1.19	K2SO4	$1.84
$0.38	MgSO4 * 7 H2O	$129.02
$0.28	CaCl2	$11.38
$2.59	K2HPO4	$1.84
$0.44	FeSO4 * 7 H2O	$121.43
$4.38	Na2EDTA * 2 H2O	$316.22
$1.09	Citric acid	$56.92

- Electricity costs 6x that of Thailand
- Nutrient costs 10x that of Thailand
  - Breaks the project financial feasibility
  - Trying to find import solution
- Logistics costs also high
- Limited local university support for lab analyses

EnerGaia

Identified potential project site locations

Honiara with KPSI

Munda

EnerGaia

Key Challenges

- Timing: EnerGaia joined in 2018 (year 4)
- Funding gap to business plan need
- Barriers to entry into a new country
  - Legal Entity Setup
  - Sourcing Nutrients cost effectively
  - Initial support for local data collection
  - Hiring
  - Logistics
  - Micro-finance solutions for smallholders
- Finding a good project site location

EnerGaia

Lessons Learned

- Everything takes much longer than hoped to solve or accomplish
- Need to have majority of project funding available ourselves, including micro-financing solution
- Must find a local contractor to help find local component and nutrients supply
- Having a good local partner from the beginning
- Must have enough time to solve issues in a financially sustainable manner for long-term project success

EnerGaia

Way forward

- We are preparing Baseline survey for long-term Monitoring & Evaluation
  - Include questions from dugong survey if applicable
- We will be in the community long-term as part of our company business model
  - Ensures sustainability of the project
  - Work with local partner from this project to ensure that some form of conservation activities are continued by the community

EnerGaia

Back-Up Material

EnerGaia

WHAT IF WE COULD HELP ADDRESS THE COMING FOOD CRISIS?

10bn

POPULATION
by 2050

4.5bn

MIDDLE CLASS*
by 2050

70%

FOOD DEMAND
by 2050

*Protein consumption increases 3x as person moves from low to middle income

EnerGaia

While using less water than other protein foods

Liters to produce 1kg of protein

SPIRULINA*
290

EGGS
29,000

MILK
31,000

CHICKEN
34,000

PORK
57,000

BEEF
112,000

NUTS
139,000

Source: Mekonnen and Hoekstra (2010)
**Based on EnerGaia Spirulina and using the same tank of water for 6 months*

EnerGaia

And producing more oxygen

0.7 trees produce the same amount of O2 as 1 EnerGaia tank

EnerGaia

While utilizing unused or infertile space

Downtown rooftop in Bangkok, Thailand

Rural village in Madurai, India

EnerGaia

Our Disruption: A proprietary close-circuit production system

- No airborne contamination
- Reduced water consumption
- Better productivity
- Easy to set-up and scale
- Optimizes non-useable land
- High quality and taste neutral spirulina produced




EnerGaia

Our Traction

6-year commercial track record

Winners of:
✓2016 Blue Economy Challenge (DFAT)
✓2017 Tech4Farmers Challenge (USAID)
✓2017 Fish 2.0 Southeast Asia Track

Global press coverage from: Al Jazeera, The Guardian, UK Channel 4 and many others

9 Farms Operating

THE BLUE ECONOMY CHALLENGE 2016 #BlueRevolution

Asean impact challenge

FEED THE FUTURE TECH4FARMERS INNOVATION CHALLENGE

DSM BRIGHT SCIENCE. BRIGHTER LIVING.

AFP AL JAZEERA Le Monde NHK WORLD REUTERS THE NATION TNN 24 VOA VTV2

EnerGaia

Types of Farms

INTERNAL	PRODUCTION	LICENSE ONLY	SMALLHOLDER
EnerGaia owned and operated farm	Privately owned, operated with EnerGaia's technology and spirulina produced is sold directly to EnerGaia	Privately owned, operated with EnerGaia's technology and sold to private buyers, paying a licensing fee to EnerGaia for all product sold	Small scale farms operated in low income communities in collaboration with a local organization and an EnerGaia internal farm

Production Farm

License Only Farm

EnerGaia

4 Internal Farms in Thailand

Rooftop farm at the Novotel

EnerGaia HQ and R&D

Farm at AIT University

Farm in Phuket (in partnership with GFood)

Internal Experience

- Having our own farms helps better equip us to support farmers that purchase our
- technology. EnerGaia has experience assisting with the development of new spirulina projects in: Thailand, Bangladesh, France, Singapore, India, Indonesia and Peru
- We have developed a due diligence process to access whether a self-sustaining spirulina project should be developed in a new region

Internal Rooftop Farm

Smallholder Farm

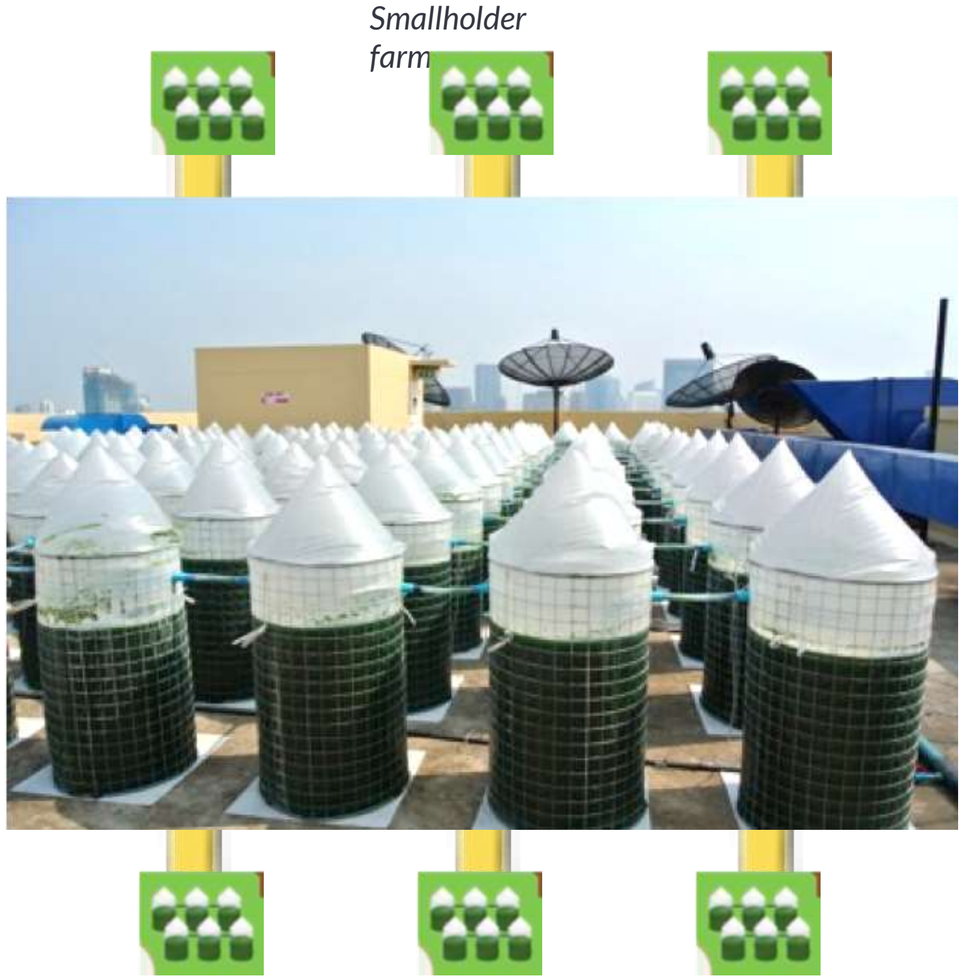
EnerGaia

Ensuring Quality Smallholder Partners

EnerGaia

Hub and Spoke Model

- Each smallholder farming program is paired with an EnerGaia owned and operated farm
- By having our own farm on the ground we can best offer technical support as we grow in the same conditions, require the same nutrients, have inoculum close by in case of a disaster and can use our farm for training new farmers
- Each program also partners with a local organization that is already established in the region to help identify participants, assist with a smooth integration and aid in locally sourcing supplies



EnerGaia

What it takes to Run a Spirulina Farm

Spirulina Farming skills required:

- Cleaning tanks
- Monitoring the tanks located at the home and adding the appropriate amount of nutrients as needed
- Harvesting and bringing the harvest to the collection center in town
- Approximately 9 hours of work per week
- Additional year round source of income

In the regions we work in, the women tend to have the skills that parallel with these best:

- House cleaning
- Spend time at the home looking after children and cooking (which often requires following a recipe)
- Make the weekly trip to the market (can bring the spirulina along)
- Hardworking
- Usually have many ways to make money (season dependent)

EnerGaia

Spirulina Smallholder Selection Process

1. Verification Steps

- Local organization partner helps identify
- candidates Candidate evaluation conducted

2. 2-month Training Program

30 Candidates - each candidate:

- Runs a system of tanks at the EnerGaia
- farm Earns money per kg of spirulina
- produced Learns the skills required
- Learns the benefits of consuming spirulina

3. Graduation from Training Program

4. 10% Downpayment for System and Loan Initiated

5. Tank installment and EnerGaia staff available for technical support

6. Weekly harvests are cleaned and tested at the processing center

- If quality does not meet standards EnerGaia staff will visit the farm site to offer assistance

EnerGaia

Spirulina local dish creations in Teluk Bogam

MEE GORENG AYAM

- Spirulina Rice Noodles
- Galangal
- Ginger
- Red onion
- Garlic
- Turmeric
- Kaffir leaves
- Bay leaf
- Purée candlenut
- Salt
- Pepper
- Palm oil
- Chicken

- Spirulina rice noodles
- Garlic and shallots- mixed together with palm oil and sautéd
- Sweet Indonesian soy sauce
- Tomato sauce
- Chicken bullion - one cube

EnerGaia