PREFACE

In 2020, Valaya Alongkorn Rajabhat University under the Royal Patronage, aims to be a “Green and Sustainable University. **VRU setting in Suburban ecology**: surrounded by industry, the rise in housing, the cause of the rapid expansion of the population, makes the utilities inadequate.

Vision

“Develop innovation

Focus on excellence

Take part in local development”

HISTORY OF VRU

Valaya Alongkorn Rajabhat University under the Royal Patronage was founded by Her Royal Highness Somdetch Phra Raja Pituchha Chao Fa Valaya Alongkorn, Krom Luang, the Princess of Phetchaburi. H.R.H. Princess Valaya Alongkorn was greatly concerned with the education of young Thai women.

June 4, 1932	Donated four rai (.64 hectare) of land to the Ministry of Education to establish Petchburiwittayalongkorn Teacher
October 1, 1970	The school was named Petchburiwittayalongkorn Teacher College.
1972	The college expanded to its present location at Pathumthani Province. It covers an area of 294 rai, 3 ngan, and 72 square wa (over 47 hectare).
November 14, 1974	His Majesty the King granted the royal patronage to Petchburiwittayalongkorn Teacher College and its alumni.
November 9, 1975	Their Majesties the King and Queen, along with the two princesses, made a royal visit to dedicate the statue of H.R.H Princess Somdetch Phra Raja Pituchha Chao Fa Valaya Alongkorn, Krom Luang, Princess of Petchaburi. On that occasion the King donated 100,000 baht from his personal funds to establish the Somdetch Phra Raja Pituchha Chao Fa Valaya Alongkorn Foundation
February 14, 1992	His Majesty the King granted the name “Rajabhat Institute” to all Teachers’ Colleges. The word “rajabhat” means “civil servant.”
June 14, 2004	This royal act upgraded the status of Rajabhat Institute Valaya Alongkorn to university level. Valaya Alongkorn Rajabhat University under the Royal Patronage

TABLE OF CONTENT

Chapter 1 Setting and Infrastructure

1.1 Type of higher education institution : Comprehensive
1.2 Climate : Tropical wet
1.3 Number of campus sites

Valaya Alongkorn Rajabhat University under the Royal Patronage, there are 3 campuses with learning and teaching management. VRU service area have 3 areas are the main campus, located in Pathum Thani province, the Bangkok campus and the Sa Kaeo campus.

Main campus

Sa Kaeo campus

Bangkok campus

1.4 Campus setting : Suburban

The location of the university is on Phaholyothin Road. The surrounding area has Nava Nakorn Industrial Estate in the south and west. Communities and agricultural areas to the north The east side of the university is a densely populated village.

1.5 Total campus area

Total campus area: 610,751.571 m^2 in main campus. The teaching and learning area is located at the front of the university with an area of 560,800 m^2, the interior area will be sports stadiums, student dormitories and personnel residences with an area of 49,951 m^2

1.6 Total campus ground floor area of buildings : 4,824 m^2

1.7 Total campus buildings area: 177,775 m^2

1.8 The ratio of open space area to total area:

Calculate by (560,800-4,824)*100/560,800 = 99.1%

1.9 Total area on campus covered in forest vegetation : 23,712 m^2

1.10 Total area on campus covered in planted vegetation (%):36.97%

1.11 Total area on campus for water absorption besides forest and planted vegetation (%) : Cal by = (398,627/610,751)*100% = 65.27%

The covered in planted vegetation area of the university can be divided into four areas: 1) the green area spread around 79,931 m^2, consisting of 39,965 m^2 of shrub and ground cover and 1,625 trees 2) Plant genetics conservation area 51,128 m^2 3) lotus pond area (natural forest) 23,712 m^2 and 4) lawn area 12,564 m2 total green area 207,300 m^2 (36.97%) of the area all. Total area on campus for water absorption besides forest and planted vegetation at 398,627 m^2 (65.27%)



Continuous improvement to developed areas

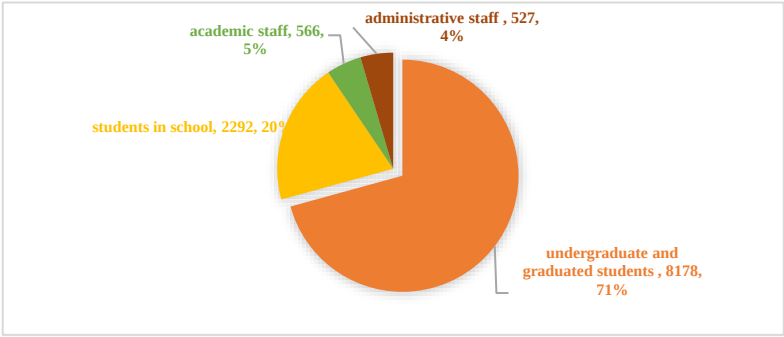
1.12 Total number of regular students (part time and full time): 8,178 students of undergraduate and graduated, and 2,292 students in school. Total 10,470 students.

1.13 Total number of online students (part time and full time) : 0

1.14 Total number of academic and administrative staff : 1,093 staffs

1.15 The total open space area divided by total campus population :

Cal by (555,976/11,563)*100% = 48.08%



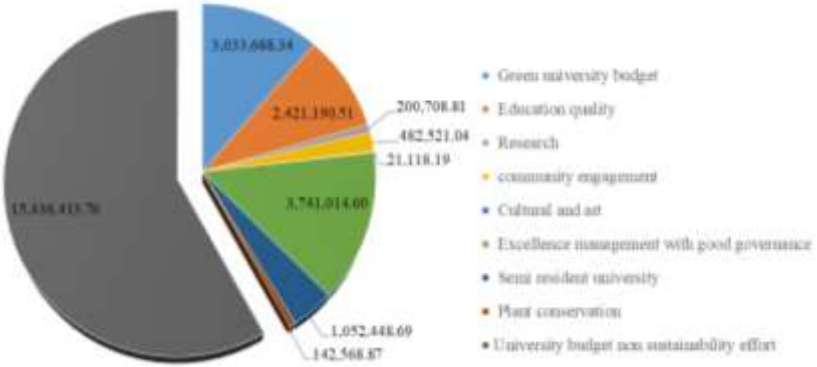
1.16 Total university budget : 26,531,672.81 US Dollars

1.17 University budget for sustainability effort 11,095,259.04 US Dollars)

1.18 Percentage of university budget for sustainability efforts within a year : 41.82%

University budget		Us dollar	%
	Green university budget	3,033,688.34	11.43

University budget		Us dollar	%
University budget for sustainability effort	Education quality	2,421,190.51	9.13
	Research	200,708.81	0.76
	community engagement	482,521.04	1.82
	Cultural and art	21,118.19	0.08
	Excellence management with good governance	3,741,014.60	14.10
	Semi resident university	1,052,448.69	43.47
	Plant conservation	142,568.87	5.89
Total University budget sustainability effort		11,095,259.04	41.82
Total University budget non sustainability effort		15,436,413.76	58.18



Chapter 2 Energy and climate change

2.1 Energy efficient appliances usage

In 2019-2020, 219 units of air condition have replaced more than 15 years old air conditioners with high efficiency air conditioners to inverter systems model. In order to increase the efficiency of air conditioners, a cleaning action plan is made at least once a year. Electric power consumption reduce with the energy conservation policy and uses electric appliance with energy saving label (energy saving label No.5). In addition, replacement of fluorescent lamp was conducted, which is a 12,000 LED bulbs.






2.2 Total campus smart building area m^2: 45,010 m^2

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">VRU Hospitality Training Center (960 m^2)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Science Learning Building (18,069 m^2)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Social Complex Building(16,090 m^2)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Office of Academic Resources (9,891 m^2)</td></tr>
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2.3 Smart building implementation

Smart building Element

1. There is a building that use natural air circulation and use sun light for lighting inside the building
2. There is a building that use solar cell for energy supplied
3. There is water conservation, such as using sanitary ware and water
4. Environmental Protection, such as waste management, odor and smoke disposal system, and waste water treatment plant.
5. There is quality control being utilized in the indoor environment, Such as filter film from sunlight and control air condition at 25 ^{o}C

Cal by = (Total smart building area) / (Total Building Area) × 100%
= (45,010/177,775) × 100%
= 25.32%

2.4 Number of renewable energy sources in campus: 3 sources

There are now renewable energy resources which includes solar panels mounted on the rooftop of the library building, Solar houses and 40 solar cell street lights on campus. In addition, the university produces biogas from food waste fermentation, approximately 10 cubic meters per day, equivalent to 4.6 kg of LPG. Wind power is the newest energy the university has to operate with a generating capacity of 500 watts.

Valaya Rajabhat University Under the Royal Patronage's have Energy Sustainability Environmental Action Plan in 2021, will include a project to establish a hybrid renewable energy innovation learning center to promote sustainable learning potential in Pathum Thani Province, and a project plan to establish a learning center Integrated waste management.

	
	
Solar cell in VRU	
	
Wind energy	Biogas from food waste

1) Solar power system for illuminating roads and pathways, total 35 pole, production capacity 90 watts / pole, 5 hours (average amount of sunlight per day), use 365 days / year.

= (90 * 35) watt * (5 * 365) hr

= 5,748.75 KWH

2) Solar power system, Academic Building (Library) 5 KW, 5 hours (average solar quantity in 1 day), use 365 days / year.

= 5 KW * (5 * 365) H

= 9,125.00 KWH

3) Solar power system, Plant genetic conservation building Capacity 1.5 KW, 5 hours (average solar quantity per day), use 365 days / year

= 1.5 KW * (5 * 365) H

= 2,737.50 KWH

4) Biogas production system Capacity 4.6 Kg of LPG/day, (1 Kw = 0.145 Kg of LPG), use 365 days / year

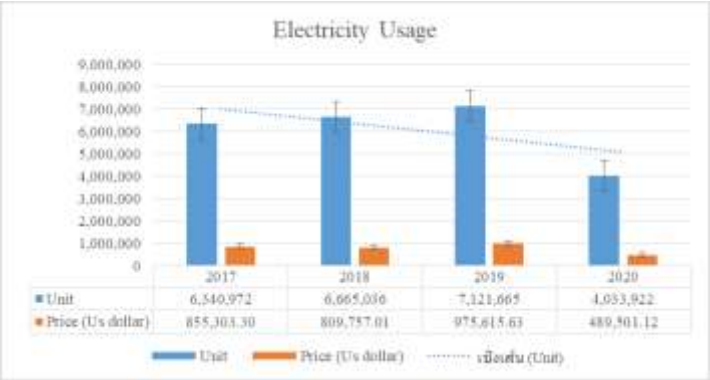
= 62.18 Kw/day * 365)

= 22,965 KWH

5) Wind power generation system

2.5 specify renewable energy sources in campus and provide capacity produced in kilowatt hour: 40,306.7 KWH

2.6 Electricity usage per year (in kilowatt hour): 4,033,922 kwh



2.7The total electricity usage divided by total campus population: 348.62 kWh per person

Cal by = 4,033,922 kwh/11571 person

348.62 kWh per person

2.8 The ratio of renewable energy production divided by total energy usage per year: 0.99%

Cal by = (40,306.7 kwh of renewable energy /4,033,922 kwh)*100%

= 0.99%

2.9 Elements of green building implementation as reflected in all construction and renovation policies

The university's activities to reduce the carbon footprint of the university have developed a policy to reduce greenhouse gas emissions. Each year, there are more than three elements:

1) The university has changed service cars over 15 years old with high carbon emissions to low emission cars, 5 cars.

2) The university has added green areas, trees are planted, and more than 500 tree saplings are distributed for planting in the university and neighboring communities.

3) All air conditioners in the university have been washed in order to increase the efficiency in order to reduce the consumption of electricity.

4) The university has a campaign to reduce the use of single use plastic, to use cloth bags, rice boxes, personal glasses, which can be reused.

5) Tram service within the university to reduce the use of private cars.

2.10 Greenhouse gas emission reduction program

2.11 The total carbon footprint (CO_2 emission in the last 12 months, in metric tons)

This year's calculation data may be inaccurate due to the COVID-19 situation this year. The internal operation of the university was disrupted by many sectors. Students are restricted from entering the university due to a lockdown.

CO_2 (Electricity) = (electricity usage per year (kWh)/1000) *0.84 = (4,033,922/1000) *0.84 = 3388.49 metric ton
CO_2 (Car) = ((Number of car entering *2 * t distance inside campus*240)/100) *0.02 = ((570 * 2 * 4.6 km * 240)/100) *0.02 = 251.71 metric ton

CO_2 (Bus) =((Number of shuttle bus * total trip each day * distance inside campus*240)/100) *0.02 = ((3 * 48 * 2.17 * 240)/100) *0.02 = 14.99 metric ton
CO_2 (Motorcycle) = ((Number of motorcycle entering *2 * t distance inside campus*240)/100) *0.02 = ((320 * 2 * 4.6 km * 240)/100) *0.01 = 70.66 metric ton
CO_2 (Total) = 3388.49 + 251.71 + 14.99 +70.66 = 3725.85 metric ton

2.12 The total carbon footprint divided by total campus population (metric ton per person)

Cal by (3725.85 /11,563) = 0.32 metric ton

Chapter 3 Waste

3.1 Recycling program for university waste

The university has a waste separation policy for all departments. The university supports trash that is classified into three types of waste: general waste, food waste, and recycled waste. In addition, in the residential area, food waste separation activities are organized to produce fertilizers.

The university supports trash that is classified into three types

Waste separation activities that can be recycled

Recycle waste is an invention used, such as bags, baskets, etc.

	
Stretchable plastic waste to be used to produce a monk's robe.	

3.2 Program to reduce the use of paper and plastic on campus

The university considers to reduce the occurrence of waste occurring within the university utilizing activities according to the project as follows;

1. A campaign to use cloth bags instead of plastic bags

2. A policy of that will discontinue the use of foam boxes for food and refraining from distributing plastic bags from stores throughout the university.3. Green meeting promoting by considering the use of resources are friendly environment.

- Invitations and public relations meetings
- Preparation of meeting documents with QR code scanning
- Giving water bottles to attendees by using a container to drink water throughout the meeting instead of using a glass of plastic water
- Use biodegradable and friendly environment natural materials for food such as banana leaves, paper.

4. Use public relations channels for internal departments via online systems or e-office to reduce the use of paper in the office.

A campaign to use cloth bags instead of plastic bags

An e-office to reduce the use of paper in the office.


Green meeting promoting by considering the use friendly environment

3.3 Organic waste treatment

By product of food waste disposers is cooking gas and bio-liquid fertilizers.

3.4 Inorganic waste treatment

Inorganic waste management has a systematic storage operation so that it can be recycled.

There are inorganic waste collection operations for inorganic waste treatment

3.5 Toxic waste treatment

Hazardous chemical management system

Hazardous waste collection

3.6 Sewage disposal

Sewage Disposal

Chapter 4 Water

4.1 Water conservation program implementation

The university has a policy, activities, and projects to reduce water using for saving water and conserving water.



Monitoring and analysis of water quality in surface water


4.2 Water recycling program implementation

The university has implemented wastewater treatment for water reuse. The treated water is reused, such as watering plants, pumping in the treated pond and cleaning the road surface. Database of wastewater for watering plants.

The water suction system is used in 1 year, using waste water, water truck, trees 108,000 * 365 = 39,420,000 liters and use wastewater for Average tree water car 39,420,000 + 5,760,000 = 45,180,000 liters.


Water recycling program implementation

4.3Water efficient appliances usage (hand washing taps, toilet flush, etc)

In 2020, the university has implemented to change sanitary ware to increase the efficiency of water use, thus saving water more.With the use of hand washing faucets, water-saving sensor systems. Because the water will flow only when it is used (1 time can be used for 30 seconds).




Change sanitary ware to increase the efficiency of water use

4.4 Treated water consumed

The university has been working to replace operational plumbing for more than 10 years and plans to build a water supply using retained water in the university catchment area. And more wastewater treatment systems have been implemented after operating at the university cafeteria and hotels.

Treated water consumed

Chapter 5 Transportation

5.1 Number of cars actively used and managed by university: 34 cars
5.2 Number of cars entering the university daily: 570 cars/day
5.3 Number of motorcycles entering the university daily: 320 mc/day
5.4 The total number of vehicles (cars and motorcycles) divided by total campus population:

1. Report of reservation of 34 central cars in 2020, has the same usage 1,358 times.

2. Number of cars entering the average of 684 cars entering the university / day or approximately 684 * 270 = 184,680 cars / year

During the holidays have an average of 50 cars to enter the university / day or about 50 * 90 = 4,500 cars year

3. Number of motorcycles entering the university (cars / year)

During the school term average of 319 motorcycles / day to university or approximately 319 * 270 = 86,130 vehicles / year

During the holidays have an average of 100 motorcycles / day or about 100 * 90 = 9,000 cars / year

Formula: (Number of cars actively used and managed by University + Number ofcars entering the university daily+Number of motorcycles entering the university daily)/(11,571person)

= (34+570+320)/11571

= 0.079

5.5 Shuttle services

The university has provided a shuttle bus service. Projects for arranging transportation within the university for substitute private vehicles. These are free service to avoid using private vehicles of staff, instructors and students. Shuttle/bus campus inside campus 3 shuttle bus, 9 electric car.

5.6 Number of shuttles operated in your university: 3 shuttle bus

5.7 Average number of passengers of each shuttle: 1,200 persons

5.8 Total trips of each shuttle services each day: 48 trips

5.9 Zero Emission Vehicles (ZEV) policy on campus

The university's policy is to reduce greenhouse gas emissions and reduce the use of private cars and reduce the use of cars that generate polluting the combustion engine. The university has provided more electric trains to serve students and staff, with a charting station available. The university also encourages students and staff to use bicycles, with 547 registered bicycles and 20 free borrowed bicycles. There are 9 more electric trains in free service.

5.10 Average number of Zero Emission on campus per day: 576

5.11 The total number of Zero Emission Vehicles (ZEV) divided by total campus population

Cal by = 576/11571

= 0.0497

5.12 Total parking area:

Total parking area has increased from 12,502 square meters (2019) to 13,200 square meters (2020). In 2020, additional parking spaces are symbolized in yellow.

5.13 Ratio of parking area to total campus area

Cal by (13,200 /610,764)*100% =2.16%

5.14 Transportation program designed to limit or decrease the parking area on campus for the last 3 years (from 2017 to 2019)

The university has limited parking spaces and is organized. Additionally, the university plans to propose a request for private mass transit to enter the area.

5.15 Number of transportation initiatives to decrease private vehicles on campus 2 initiative for decrease private vehicles on campus

The university is located on an area which is the boundary of 2 provinces are Phra Nakhon Si Ayutthaya and Pathum Thani. Causing the public transport service to be somewhat inconvenient. Therefore, the university's approach is to have volunteer traveling in the same way together and plans to expand the public transportation routes to increase travel channels for everyone at the university.

5.16 Pedestrian path policy on campus

1. Pedestrian is developed that can walk along the building.
2. Separator between road for vehicle and pedestrian path.
3. Street lamp for pedestrian in night use solar energy by focusing on safety and orderliness.

Pedestrian Path Policy on Campus

5.17 Approximate daily travel distance of a vehicle inside your campus only (in Kilometers): 2,093 km

Car 570*2 = 1140 km,
Shuttle bus 3*48*2.17= 312.48km
mc320*2 = 640km

Chapter 6 Education

6.1 Number of courses/subjects related to sustainability offered

Total number of course related to Sustainability offered in 2020 of 7 Program and 300 subjects

6.2 Total number of courses/subjects offered

Total number of course in 2020 of 64 Program and 1509 subjects

6.3 The ratio of sustainability courses to total courses/subjects

Cal by (300/1509)*100% = 19.88% of all subjects

6.4 Total research funds dedicated to sustainability research: 163,997 US Dollars

6.5 Total research funds: 200,708.81 US Dollars

6.6 The ratio of sustainability research funding to total research funding:

Cal by (163,997 /200,708.81)*100% = 81.71%

6.7 Number of scholarly publications on sustainability

No.	Title	Journal
1	Indoor AirQuality Improvement by Simple Ventilated Practice and Sansevieria Trifasciata	Atmosphere
2	The Variety of Local food diets in Lower Mekong sub-region Community of Thailand and Lao PDR	International Journal of Advanced Science and Technology
3	Impact of Training Facilitirs, Benefits and Compensation, and Performance Appraisal on the Employees' Retention: A Mediating Effect of Employees' Job Satisfaction	Systematic Reviews in Pharmacy
4	The Parsimonious and Accurate Characterization of an Energy Management System in Hybrid Vehicles Based on Statistical Estimation Methods	ICIC Express Letters
5	Optimization of fused filament fabrication system by response surface method	Internationaal journal of metrology and quality engineering
6	Similarities or Differences: The Exposure to Media Messages among Thai-So Women, Kusuman District, Sakon Nakhon Province, Thailand	Journal of Community Development

No.	Title	Journal
		Research (Humanities and Social Sciences)
7	An Improved Gravitational Coefficient Function for Enhancing Gravitational Search Algorithm's Performance	International Journal of Machine Learning and Computing
8	"Impact of Ecological Factors on the Distribution of Vanilla siamensis (Orchidaceae:Vanilloideae) in Tropical Forest at Khao Soi Dao Wildlife Sanctuary, Chantaburi, Thailand"	The Thailand Natural History Museum Journal
9	Convergence Analysis of Self-Adaptive Inertial Extra-Gradient Method for Solving a Family of Pseudomonotone Equilibrium Problems with Application	Symmetry
10	An Accelerated Extragradient Method for Solving Pseudomonotone Equilibrium Problems with Applications	Axioms
11	A Self-adaptive Popov's Extragradient Method for Solving Equilibrium Problems With Applications	JOURNAL OF MATHEMATICAL ANALYSIS
12	Floral morphology and Potential Pollinator of Vanilla siamensis Rolfe ex Downie (Orchidaceae: Vanilloideae) in Thailand	The Thailand Natural History Museum journal
13	Change in ground-dwelling arthropod communities in different agroecosystems in Wang Nam Khiao, Nakhon Ratchasima province, Thailand	Agriculture and Natural Resources
14	A General Inertial Projection-Type Algorithm for Solving Equilibrium Problem in Hilbert Spaces with Applications in Fixed-Point Problems	Axioms
15	Environmental Impact Assessment of Thai Banana Supply Chain	International Journal of Environmental Science and Development
16	Fixed Point Theorems for Multivalued Gerghaty Type Contractions via Generalized Simulation Functions	Thai Journal of Mathematics
17	Stability of a Generalization of Cauchy's and the Quadratic Functional Equations in Quasi-Banach Spaces	Thai Journal of Mathematics
18	Modified Explicit Self-Adaptive Two-Step Extragradient Method for Equilibrium Programming in a Real Hilbert Space	Thai Journal of Mathematics
19	On Solving Minimization Problem and Common Fixed Point Problem Over Geodesic Spaces With Curvature Bounded Above	Communications in Mathematics and Applications
20	Modified Viscosity Subgradient Extragradient-Like Algorithms for Solving Monotone Variational Inequalities Problems	Axioms
21	Strong Convergence of Extragradient-Type Method to Solve Pseudomonotone Variational Inequalities Problems	Axioms

6.8 Number of events related to sustainability :

1) Projects to tackle poverty and improve the quality of life of the people according to the strategy for local development in Pathum Thani and Sa Kaeo provinces, totaling 32 areas (32 Activities). The promotion of income generation for the public is cooking, raising animals, growing crops, handicrafts. Including a project to solve environmental problems such as wastewater and waste

2) Training to provide knowledge on environmental conservation, especially on solid waste management, both within the university and outside communities, totaling 15 activities.

3) Arrangement of projects / activities for caring for the environment within the university to have environmental quality within the standard, totaling 20 activities

6.9 Number of student organizations related to sustainability: 23 Student organizations related to sustainability from 30 Student organizations.

Activities that are organized to raise awareness and build environmentalists by the Love Us Green Society and environmental conservation, Valaya Alongkorn Rajabhat University. As a result of the club's ongoing activities, it received a gold medal award from the Department of Environmental Quality Promotion.Link for follow the activities of the student club at https://www.youtube.com/watch?v=qs2KgBv7JKk&feature=share&fbclid=IwAR380MAAzfT2bLqqNlSuusp9nuzfSqMrvBxqgw7jSCGw_yB5WuSJ_9oPNk





6.10 University-run sustainability website

www.vru.ac.th

6.11 Sustainability website address (URL) if available

http://green .arctech.in.th

6.12 Sustainability report

Organizers of sustainability report

Advisor :

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