REPTILE LIGHTING GUIDE

A reference for UVI, visible light and near-infrared levels for commonly kept species.

SPECIES		FERGUSON ZONES UVI	LUX	BASKING SPOT TUNGSTEN LAMP POWER DENSITY (TLPD)
Scientific	English	UV Light 280-400nm	Visible Light 400-700nm	Near-Infrared Light (NIR) 700-2600nm
		Extreme Sunlight Levels UVI 8.0 - 10.0+ FZ Warning	60,000 - 140,000 Lux	**Warning. Power density over 450W/m²** This level can be a life/health threat
Cyclora cornuta *Sauromalus ater* *Uromastyx spp.* *Dipsosaurus dorsalis*	Rhinoceros Iguana Chuckwalla Uromastyx Desert Iguana	**Very High Sunlight Levels** Max. UVI: 7.0 - 8.0 FZ4 Range: 4.5 - 8.0 Target UVI in basking zone: 4.5 - 6.0	30,000 - 59,999 Lux Illuminance can be provided by LEDs or metal halide lamps. Light at this power will add heat to the basking spot.	**Basking Level A (375–449W/m²)** **Recommended level:** 400W/m² **Usage notes:** This level is at the highest intensity and is avoided for basking by most reptiles. Some animals are adapted to this extreme. Air temperatures may become excessive and animals will seek shelter. **Husbandry notes:** Shelter must be provided in a cool humid spot within the enclosure. Air often low in moisture.
Crotaphytus spp. *Pogona vitticeps* *Varanus acanthurus* *Iguana iguana* *Centrochelys sulcata* *Stigmochelys pardalis* *Varanus exanthematicus* *Testudo spp.*	Collared Lizard Bearded Dragon Ackie Monitor Green Iguana Sulcata Tortoise Leopard Tortoise Savannah Monitor Spur-thighed and Hermann's Tortoise	**High Sunlight Levels** Max. UVI: 7.0 FZ3 Range: 2.9 - 7.4 Target UVI in basking zone: 4.0 - 4.5		**Basking Level B (300–374W/m²)** **Recommended level:** 325W/m² **Usage notes:** This level is used by reptiles in the most open basking habitats. All of these animals can and do have the capability to survive the full sun for a period. Most hide by late morning. **Husbandry notes:** Shelter must be provided in a cool humid spot within their enclosure.
Salvator merianae *Furcifer pardalis* *Chamaeleo calyptratus* *Laudakia stellio* *Timon lepidus* *Lepidothyris fernandi* *Lacertid spp.* *Chelonoidis carbonaria* *Emydidae spp.*	Black and White Tegu Panther Chameleon Veiled Chameleon Painted Agama Jewelled Lizard Fire Skink Wall and Green Lizards Red-footed Tortoise European and North American Turtles			**Basking Level C (225–299W/m²)** **Recommended level:** 250W/m² **Usage notes:** This level is for temperate biome animals. Many of our species fall into this group. By late morning and with higher sun elevations, animals will have completed their warm up, and started their days activities. Mid-day is too hot for many. Cryptic basking often seen now. Local air temperatures now also at working metabolic levels. **Husbandry notes:** Shelter must be provided in a cool spot in their enclosure.
Thamnophis spp. *Pituophis melanoleucus* *Boa constrictor* *Lampropeltis spp.* *Pantherophis guttatus* *Python regius* *Terrapene spp.* *Heterodon nasicus* *Litoria caerulea*	Garter Snakes Northern Pine Snake Boas King Snakes Corn Snake Ball Python Box Turtles Western Hognose Snake Whites Tree Frog	**Medium Sunlight Levels** Max. UVI: 3.0 FZ2 Range: 1.1 - 3.0 Target UVI in basking zone: 2.0 - 2.5	10,000 - 29,999 Lux	**Basking Level D (150–224W/m²)** **Recommended level:** 175W/m² **Usage notes:** This level is for cooler biome animals. Many animals start basking early, and at this level there is sufficient energy to enable metabolic increase. This will coincide with local air temperatures rising to operating levels and is sufficient to kickstart the days activity. These levels can occur in large patches of sunlight in the forest.
Rhacodactylus auriculatus *Correlophus ciliatus* *Eublepharis macularius* *Gekko gecko* *Dendrobatidae* *Caudata* *Pleurodeles waltl* *Ambystoma mexicanum*	Gargoyle Gecko Crested Gecko Leopard Gecko Tokay Gecko Dart Frogs Salamanders and Newts Spanish Ribbed Newt Axolotl	**Lowest Sunlight Levels (Dawn/Dusk)** Max. UVI: 2.0 FZ1 Range: 0.7 - 1.4 Target UVI in basking zone: 1.0	5,000 - 9,999 Lux	**Basking Level E (50–149W/m²)** **Recommended level:** 125W/m² **Usage notes:** This level occurs when the first sunlight becomes effective for basking. Many of these animals enjoy gentle basking, but here the variability of the biome has a significant effect.
			1 - 4,999 Lux	**Basking Level F (0–49W/m²)** **Notes:** No practical basking occurs but a gentle thermal gradient across this range could be provided, along with good ambient lighting.

Solarmeter 6.5 UV Index Meter
Also sold as 6.5R and with several other brand labels.

WapoRich RQ-881D

RS PRO Solar Power Meter ISM400
This meter is also available under other names:
- PCE-SPM 1 Solar Radiation Meter
- TES-1333 Handheld Digital Solar Power Meter
- General Tools DTBU 1300 Solar Power BTU meter

They are all the same.

The measurement of the three lighting groups should be conducted with the instruments shown above. 1) There is no alternative for a Solarmeter 6.5. 2) The LUX meter shown is inexpensive and provides reliable readings. Apps available in phones for measuring Lux are considered unreliable and often have inadequate range. 3) Other power density meters should not be used as they may be calibrated differently.

IMPORTANT
When taking a measurement from a lamp ensure other light sources are extinguished and point the meter sensor directly at the centre of the lamp.

SCAN FOR INFO

AUTHOR NOTES

Statement of purpose:
This table is a guiding framework for providing *balanced* basking radiation to reptiles and amphibians living in captivity. Suggested values for each loose (!) grouping are purposefully *moderate* and adapted to use in vivaria. Many animals have extensive ranges and may well fit into more than one category.

Tropical canopy effects on sunlight:
Foliage modulates and creates photo-environments. Depending on foliage density, trees and tree canopies substantially reduce irradiation levels underneath. Gaps produce distinct shafts or patches of bright sunlight which many forest and tree-dwelling animals use, whose strength sometimes approaches out-in-the-open levels.

An overview of the guide

A print ready version of this Reptile Lighting Guide is available and posted in the link below and is the same as the QR code on the poster.

The Reptile Lighting Guide poster offers guidelines, not instructions. The philosophy has been to provide numbers that in the first instance are safe, those same numbers should fall into what is now described as a biomodulationary sweet spot. Every vivarium and species is different, this note cannot cover all cases and safety, yours and the animals' is your responsibility.

The species chosen are grouped in accordance with the intensity of sunlight. Starting with the sun at its strongest (at the top) through to its lowest intensity at the bottom. So for a Jewelled lizard you might offer somewhere between 3 and 4 UVi, over 30,000 Lux visible light and about 250W/m^2 PD from a tungsten lamp. As a keeper, you will know that they have a wide range of sunlight strength through the seasons and that they hibernate. You would provide lower irradiation values then, in the winter period. The values offered here are a good starting point.
When installed, the lamps should be arranged such that they all illuminate the basking spot to produce a "patch of sunlight"

This guide has been developed over the last 3 years, using data gathered by a small team from across the world and matching it against known solar irradiation models. In the process we were also validating our test methods and assumptions. The solar irradiation models and the results using our methods match well.

The challenge was finding a way of converting that collected data into something simple and presentable, It is hoped that this has been achieved. In the process we have revisited other data sources and reflected newer thinking.
More data is still being collected and eventually a paper(s) will be produced. It is certain that new information will emerge, new tools will enable us to review and reconsider what has been said, so do check for document updates.

The Excel spread that is used to produce the ISO charts, is always being improved. Many of the features don't work on line and it has to be down loaded for full functionality.

Link to
https://e.pcloud.link/publink/show?code=kZBmHNZTKz4z0IRXCLIC96LuvWjlFzc8Cdk
The link gives access to
Reptile Lighting and Husbandry; guide and documentation Notes,
Reptile Lighting Poster and user guide
Mapped ISO charts.

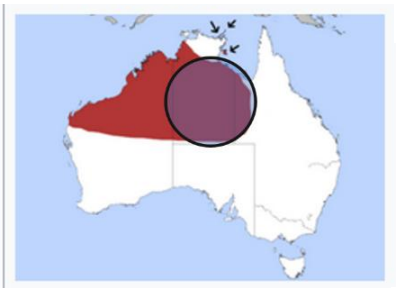
On the matter of the automated timing of lamps.
Technology allows us to set up complex ramp dimming and timing functions for our lighting systems. The complexity will add to the probability of systems failing or mis-operating, simplicity is best. The daily cycle of sunlight can be simulated sufficiently well by turning on the tungsten lamps first, then after 45 minutes turn on the visible light lamps, finally after another 45 minutes turn on the UVb lamp. The reverse is true at the end of the day.

A thermostat is still required as a safety feature should the temperature in the vivarium become too high for whatever reason. The thermostat should be monitoring the cool shaded area and must turn off all your heat generating sources in the event of danger.

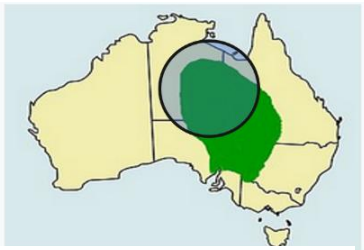
Lastly, the Reptile Lighting Guide graphic design was produced by Chris Hunt. He endured very many tedious modification, error corrections and simple cock-ups, all with good humour and we thank him for that.

How to use the poster

Let's say we have a Bearded Dragon or an Ackie monitor.



Varanus acanthurus



Pogona vitticeps

These two are really popular animals, yet not always understood. You will see that in places their range overlaps, so similar sunlight conditions would be a fair assumption.
When looking at the actual weather it turns out that the area also experiences monsoon-related effects and other seasonal patterns. When considering seasons and local biomes, the variability that the animal actually sees is considerable. Sunlight itself varies too, depending on the sun's apparent angle in the sky and the atmosphere. The suggestions for illuminance and irradiance in the poster are recommendations that take as many variables as possible into account. They assume that the general keeper will not be varying lighting through the year.

The two species are next to each other in the guide.
They both require high sunlight levels, starting with

- Tungsten Lamp Power Density (TLDP) positioned in the upper part of level B in the poster with a recommendation of 325W/m^2.
- Visible light; the Lux level should be high, certainly over 30,000 Lux which would be provided by a LED or maybe a Halide lamp. You will remember that both of those lamps will also add to the energy illuminating the basking spot and will increase heating of the surface.
- Lastly UVb needs to be added according to the Ferguson zone about 4.0 – 5.0.

Now we have numbers
UVb = 4.0 – 5.0.
Lux = 30,000+
Tungsten Lamp PD = 325W/m^2

Now to choose a lamp.

- Identify the distance from the lamp face and how much coverage you need for the basking spot.
- The LED and the tungsten halogen lamp should be directed onto the vicinity of the basking spot.
- The UV lamp irradiation should also be in close proximity.
- The location of the lamp matters and if it is fitted externally on a mesh then the mesh effect must be factored.
- For UVb the lamps available nearly all have UVi levels identified on the packaging.
- For tungsten lamps NIR (Near InfraRed) advice is not yet available on packaging. But lamps have been tested and ISO irradiance charts are available; many are available through following the **QR code** on the poster or the link in the introduction. When in the folder, select Mapped ISO Charts, then the voltage, USA = 120v and Europe = 220v. (some folder are currently empty)
- Then select the type of lamp you need, there may be a selector sheet to help.
- Let's look at Tungsten Lamp PD.
- Let's choose a lamp for a European 220v configuration and let's agree with a basking distance of 45cm, remembering that this is for a fairly low animal, a taller animal such as a Leopard Tortoise would need its height to be considered for basking distance choice. Choose a lamp from the list, its trial and error I'm afraid. In time there will be multi lamp selector guides.

PD 60w Rep Sys ECO G9 E27			Type	Tungsten		Watts	0060		Maker	Reptile Systems ECO		Fitting	E26/E27	
Scaling factor	1	Date	10/12/2025		Tester	Roman Muryn		Volts	240	Measured Power	62	Bulb Type	G9	
	Inches	-12	-10	-8	-6	-4	-2	0	2	4	6	8	10	12
Inches	cm	-30	-25	-20	-15	-10	-5		5	10	15	20	25	30
2	5					115	500	2000	1148	151	225			
4	10					141	600	2000	1253	181				
6	15					143	735	2000	1295	225				
8	20					162	643	1583	1260	255				
10	25					185	528	991	848	324				
12	30					211	558	971	652	333				
14	35					224	437	500	491	320				
16	40			50	111	210	363	391	391	291	137	70		
18	45			55	115	199	290	300	317	241	143	77		
20	50			62	101	179	230	243	155	215	141	84		
22	55			62	103	165	201	205	212	190	136	85		
24	60					146	173	174	183	161				
26	65					131	146	148	154	141				
28	70					115	130	126	135	128				
30	75					103	114	113	115	113				
32	80					91	101	100	103	96			Power Density	Level
34	85					81	87	91	91	86			450 - 1000	Warning
36	90					75	77	81	81	80			375 - 449	Level A
38	95					65	71	72	70	71			300 - 374	Level B
40	100					61	63	63	63	64			225 - 299	Level C
42	105												150 - 224	Level D
44	110												50 - 149	Level E
46	115												2 - 49	Level F
		Notes	Put notes here											

This one seems to fit; it provides 300W/m^2 at 45cm (that's the column below the little lamp) and a good spread of light either side, about 10cm either way. 20 cm would just cover the animal. But you could add additional lamps spaced 20cm apart and that would increase coverage significantly, because the beams overlap. Note that exactness is not so important, give space for them to choose the best spot.

Using this method requires no meter but it does need the supplier to provide the data on the box or someone else to have done the lamp testing. Reptile Lighting Facebook also has a ISO irradiation data sets logged in its files.

Finally the back of the human hand is quite good at sensing Tungsten Lamp PD, put your hand on the basking spot and it should never feel hot. As a guide 200W/m^2 is very, very gently warmth.

Repeat for the visible light lamp.
As a guide a lamp at the power recommended here (over 30,000 Lux) would be about 20 – 30 watts.